["ON MEDIA ARCHAELOGY"]

Media Archaeology Lab / MAF

DIAGRAMMATICS OF DIGITAL MEMORY
Media Archaeology in Foucauldean terms
The non-human meaning of "media archaeology"
Displacing narrative media history: diagrammatic media archaeography
Operational media archaeology

CULTURAL TECHNIQUES AND / OR RADICAL MEDIA ARCHAEOLOGY

"Cultural techniques" vs. techno-mathematical operations

- beyond the nature / culture binary divide, a technical medium based on cultural knowledge, but still of a physical nature because there are electro- or even quantum-physical laws at work that are not solely dependent on the respective cultural discourse; media implement knowledge of physical and mathematical laws that transcend human culture; technology thus emerges *from* culture as an autonomous entity *beyond*

- "Mathematical symbols <...> have a particularity: they reveal structures"[1], in fact: they become media-archaeological operators themselves (*poiesis*)

- rescue "media archaeology" from its soft (the "dead media") versions. "Radical" media archaeology literally refers to the mathematical square root; techno-mathematical analysis is the cutting edge of rigid media archaeology (in accordance with Foucault's *Archaeology of Knowledge* which is much closer to propositional mathematics than most readers - apart from Martin Kusch - admit); mathematical approach, in combination with close electrotechnical analysis, is what differentiates "digital culture" analysis from previous media (studies)

- very term "technology" consists of two parameters. Athanasius Kircher, Phonurgia Nova, New York 1966 (Reprint edition Kempten 1673; German transl.: Hall- und Thon-Kunst, xxx; lat. *medium* there transl. with "Mittel" bzw. "Behülf"; difference between instrument and

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[1] Max Born, Symbol and Reality, in: Objectivité et réalité dans les différentes sciences, Archives de l'Institut International des Sciences Théoretiques, Brüssel 1966, 151f. See Charles Alunni, Gustave Juvet (1896-1936). Un Pionnier Oublié des Études Cliffordiennes, in: Advances in Applied Clifford Algebras, Basel (Birkhäuser) 2009, 14-38 (26)

techno-logical medium. Kircher p. 12: "Duplex hoc loco medium considerandum est, Physicum, & Mathematicum. Physicum medium est spatium illud aereum, per quod vox propagatur, diversaeque qualitatis & constritutionis est. Mathematicum medium est magnitudo, vel parvitas intervalli propagatae vocis durationem mentis [...]."[2] A second-order *medium* is knowledge-appropriated physics; the media condition for such appropriation is the construction of arbitrary, exact measuring device, such as tubes to measure acoustic reverberations: the interlacing of nature and culture, literarate techno-logy

- term *cultural techniques* might be applied to virtually any technique that establishes such a distinction: “Humans *as such* do not exist independently of cultural techniques of hominization, time as such does not exist independently of cultural techniques of time measurement, and space *as such* does not exist independently of cultural techniques of spatial control.”[3] The concept of “cultural techniques” thus provided a way for German media theorists to move away from the anti-humanist tendencies in Kittler’s work and to focus instead on cultural practices: “The culture-technical approach offers a viable alternative or escape route. To speak of operations and connections allows those inspired by the Kittler effect to speak of practices without saying society; to readmit human actors allows them to speak of agency without saying subjects.”[4] Kittler’s anti-hermeneutic stance thus transformed “into a less intransigent post-hermeneutic approach involving certain notions of praxis and limited human agency that Kittler was prone to eschew.”[5]

- concept of cultural techniques rooted in agricultural practices like alphabetic writing *boustrophedon*

- contemporary technological mediascape not simply progressive escalation or recursion of previous cultural techniques in Hegelean dialectics but new quality; rather delegation to the techno-logical *(auto-)poiesis*: pulling the Pythagorean string experimentally = direct human-instrument-coupling, while with VCO (voltage controlled oscillators) in electro-acoustic synthesizers a technological world inbetween unfolds; well-tempered tuning as non-Pythagorean sound (Johann Kroier) in current electro-acoustiv synthesizers is not coupled to the tuning human hand any more but "stammt aus einem Netz von zwölf ziemlich teuren Metallfilmwiderständen, die die Oktave als

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[2] Ambivalences in Kircher's use of both categories is discussed in Hoffmann 2002: 66 ff.

[3] Siegert, “Cultural Techniques,” 57

[4] Winthrop-Young, “Cultural Techniques,” 14.

[5] Ibid., 15.

Einheitspotential und ihre zwölf Halbtonschritte folglich als 2^-12 Volt <sic> behandeln."[6]

- cultural techniques *performative*, body-related action, "extensions of men" in McLuhan's sense, vs. media-technological *operations* which have escaped phenomenological reasoning since Maxwell's mathematical calculation of the electro-magnetic field, "withdrawn from any insight or introspection"[7] which only comes in again on a symbolical machine level, the non-opaque coding of computers

- nonlinear media-"historic" short cuts; Media Science does not start with the Pythagoren monochord, but abbreviates genealogy with electric spark (Aitken), generating oscillations; Hertz' Karlsruhe lecture room experimentation with electromagnetic waves / resonators: an inbetween acts, genuine media-event

- meaning of *realtime* actually not temporal fidelity (indexicality) but a tempo*real*. Norbert Wiener's "time on non-reality" for the binary switch; escalation of technologies from cultural techniques into the time-critical regime, the qualitative transformation from "performative" (body-and-cognition related) to "operative" (van Treeck)

On transmission as "bridging"

[referring to draft paper by Marcus Bastos, "On Transmission: bridging the 19th and 21st centuries", February 2018]

- for bridges as mechanical construct, term "cultural techniques" appropriate (such as doors as well, which you briefly mention). John Durham Peters, in *Marvellous Clouds*, makes a difference between cultural techniques and technologies; corresponds to the difference between material bridging and transmission by electro-magnetic waves

- core scene of Bertolt Brecht's Lindberghflug scenario, the true Media Theatre in 1929. Lindbergh's airplace is material transportation, whereas radio wave transmission is indeed "bridging" in terms of resonance. While the material bridge is stable, electro-magnetic

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[6] Friedrich Kittler, Phänomenologie versus Medienwissenschaft, online http://hydra.humanities.uci.edu/kittler/istambul.html, Abruf 22. Januar 2018

[7] Friedrich Kittler, Observations on Public Reception, in: Radio Rethink. Art, Sound and Transmission, ed. by Daine Augaitis / Dan Lander, Banff (Walter Phillips Gallery) 1994, 75-85 (80)

bridging is vibrating itself, a repetitive temporal process. While material transportation means delay in transmission (the actual flight time), immaterial radio transmission allows for "transmitted presence" or "mediated presence" indeed. For doors, the difference between technique and technologies is human opening / closing vs. the electro-magnetic relay for switching circuits and binary 0 / 1 decisions. A sharp techno-epistemic rupture occurs with net-based communication media (embodied in "packet switching" in Internet communication when the original unity is fragmented with individual addresses to find their way through parallel server routing): no *one* bridge any more, not one point-to-point connection, but a multiplicity of radically temporal, volatile, ephemeral bridges which exist only for the moment of partial signal transmission

Media, mathematics, archaeology

- epistemologically, the unvisibility (and silence) of numerical evidence reminds of the crisis of intuition in mathematics a century ago. Hilbert ´s meta-mathematical theory led to a non-referential use of mathematical signs: simply operative, thus engineerable, resulting in Turing's conceptual invention of a paper machine for calculating algorithms in 1936.

- no more humans that explore the deep Universe like Galilio Galilei with his telescope; instead, the cold gaze looks back from deep space itself. The eye is not the fastest channel of acquiring knowledge, as expressed by Goethe in *Dichtung und Wahrheit*, but the word: "Das Auge mag wohl der klarste Sinn genannt werden, durch den die leichteste Überlieferung möglich ist, Aber der innere Sinn ist noch klarer, und zu ihm gelangt die höchste und schnellste Überlieferung durchs Wort, denn dieses ist eigentlich fruchtbringend."[8]

Such words have excalated into data strings in algorithmically coded machines, in the programming of the computational executions which are the hidden agencies behind all apparent interface iconicity and metaphors.

Media archaeology analyzes the techno-logical negotiations and reciprocity between mathematization of machines and machinization of mathematics itself. Any archaeology of the computer and its programming practice oscillates between these two poles. Almost like a transistor itself, the materiality of mechanics and electronics at the

[8] Quote here after: Wolfgang Iskra, Die Darstellung des Sichtbaren in der dichterischen Prosa um 1900, Münster (Aschendorff) 1967, 41

same time enables and resists to pure *mathematical procedures* (Kurt Gödel).

"Simple mechanics may be able to implement simple calculating rules or algorithms, such as the four-species-machine which the young Leibniz presented to an astonished Royal Society, successfully translated the Indian-Arabic counting system by ciphers into a hardware of decadic cog-wheels, thus for the first time automating the primary counting modes. But this flow of numbers between mechanical wheels has simply be a calculation but noch yet a program which would be able to start, control and finish calculations on its own account. Historically programing only started - as opposed to calculability - at the time when technologies changed from tools to machines."[9]

The *logic of engineering* is one aspect of technology and another one *is the engineering of logic* such as the building of logical machines.[10] Such an approach might claim to integrate philological and historical aspects of computer archaeology on the one hand and scientific and engineering aspects on the other under the perspective of *cultural engineering*.

These techniques comprise not only texts and images, but numbers as well. Therefore a true media archaeology is close to mathematics, replacing the historicist quest for temporal origins by the mathematical quare root symbol (for *arché* itself).

Martin Kusch reads Foucault´s *Archeology of Knowledge* with its key terms like "series", "enunciation" etc. as the language of propositional logic; rendering these passages intelligible therefore is "to take the notion of a function at its mathematical face value" = Martin Kusch, Discursive formations and possible worlds. A reconstruction of Foucault ´s archeology, in: Science Studies 1/1989, 17-25 (17), which is radical media archaeology in its purest form. In the Pythagorean tradition, Friedrich Nietzsche once mused upon the relation between mathematics and nature; embodied in technological artifacts, numbers

[9] Friedrich Kittler, Hardware, das unbekannte Wesen, in: Lab. Jahrbuch 1996/97 für Künste und Apparate, edited by the Academy of Media Arts, Cologne 1997 (Walther König), 348-363 [transl. W. E.]. Related to this argument, see Peter Berz, 08/15. Ein Standard des 20. Jahrhunderts, Munich (Fink) 2001

[10] See the contribution by Gellius N. Povarov, Logic, automation and computing, to Georg Trogemann / Alexander Nitussov / W. E. (eds.), Computing in Russia. The history of computer devices and information technology revealed, Braunschweig (Vieweg) 2001

have indeed became autonomous.[11] With algorithmic computing comes true what Nietzsche has declared.

Answers of Media Archaeology to Cultural Techniques Studies

- counter-reading of the "hands on"-approach, accentuating the suspension of man from the "handy" relation to the world by technical machines, apparatuses and automata, beyond *Kulturtechniken*. Media archaeology keeps an ascetic analytic distance against the anthropological and discursive focus of Society and Technology Studies, concentrating rather on the non-discursive constellations which define the human-machine relation - at the expense of the “human technology which exists before a material technology” (Deleuze 34), the diagrammatical prefigurations of technologies by the diagrams of cultural engineering.

While transitive hand-machine relations might be subsumed under the field of studies called "cultural techniques" (German: "Kulturtechniken")[12] and remain somewhat anthropocentric, media archaeology with its focus on the non-discursive human-machine constellations keeps a more ascetic distance to the human agency in favor of the techno-mathematical field itself. For the purposes of such an analysis, the socio-cultural discourses that envelop technological processes must be momentarily suspended.

- hermeneutically distant look and “cold gaze” for media archaeology is para-human in terms of Walter Benjamin's comparison of the camera man (brilliantly expressed by Dziga Vertov's film *Man with a Camera*) with the operative gaze of the surgeon.[13]

- human culture does not loose, but win by non-semantic challenge, when suspended from subject-centered intepretations for a moment. Media archaeology exposes technicality of media not reducing culture to technology but revealing the techno-epistemological momentum in cultural artefacts itself

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[11] "Die Zahlen haben sich verselbständigt." Martin Stingelin, in: Kunstforum Internatnational, vol. 155 (2001), 166

[12] See Theory, Culture & Society, vol. 30, no. 6 (November 2013), Special Issue *Cultural Techniques*, edited by Jussi Parikka / Geoffrey Winthrop-Young

[13] See Walter Benjamin, Das Kunstwerk im Zeitalter seiner technischen Reproduzierbarkeit [1936], Zweite Fassung, in: ders., Gesammelte Schriften, hg. v. Hermann Schweppenhäuser / xxx Tiedmann, Frankfurt/M. xxx, Bd. xxx, 474- (496)

- Deleuzean concept of the machine as "organless body": "simultaneouly and inseparably a machinic assemblage and an assemblage of enunciation" = Gilles Deleuze / Félix Guattari, A Thousand Plateaus: Capitalism and Schizophrenia, trans. Brian Massumi, Minneapolis 1987, 504 / "a site at which a discursive formation intersects with material practices" = Jonathan Crary, Techniques of the Observer: on vision and modernity in the nineteenth century, 2nd printing, 1991, Massachusetts Institute of Technology 1990, 31

- all the difference between hand-writing and type-writing (Heidegger)

- phonetic alphabet (cultural technique) vs. phonograph (the actual acoustic signal) vs. spectral voice analysis / synthesis (re-entry of symbolic code, implemented and thereby temporalized in electro-physics)

- technical signal recording is not a cultural technique any more but physical event. The recording of the acoustically or optically "real" physical signal is opposed to symbolic notation by the alphabet not only in a technical but also in an epistemological way: the difference between physical signal as indexical and the arbitrary cultural symbol. With computing, dialectic opposition becomes synthesized; Digital Signal Processing (notably sampling of audio events) a function of discrete symbolization, a re-entry of the "alphabet" in numerical and logical form

- ancient Greek vowel alphabet, distinct to other writing systems, "invented" not only to write down Homer, but engendered operative mathematics, "thus, to science as such"; this very vowel alphabet of the Greeks has be/come (again) closer to new media than most of the other languages, such as roman scripts, since letters in the vowel alphabet could also be numbers and the codes of new media is now alpha-numeric, embodied in binary digits = 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)

- according to Walter Ong, electronic revolution in mass media communication devices like radio and television resulted in "secondary orality", communication based on the symbolic machine (computing) has led to a (hidden) secondary alphabetic revolution, with bits and bytes inheriting the typeset, but different from the printing culture in a dynamic way. The voice turns silent and still articulates - in implicity mathematical sonicity which is the ultimate shock to occidental

logocentrism

- a resonance circuit (the electronic basis of oscillators for electronic music synthesizers) is not a cultural technique but a physical event of second (culturally intelligent) order

- beyond the reach of "cultural techniques": When the inscribed phonographic traces on wax cylinders from Edison's days are opto-digitally retraced, inaccessible sound recording becomes audible again.[14] Frozen voices, once confined to analogue and techno-archivally secluded storage media, wait for their (digital) unfreezing. In that media-archaeological analysis, "media are the new capital-s subjects of media archaeology [...]"[15]

- physical and electromagnetic laws known to the designers of a *Volksempfänger* from pre-war Germany are still in operation in today's enduring AM radio infrastructure. "Mathematically encoded laws of nature, then, occupy the place once held by the place of the music of the spheres."[16]

- inductive rather than meta-discursive argumentation: media archaeology is radically rooted in the actual techno-logical event

- cultural techniques (such as writing and counting) as pre-condition for technological escalations; an escalation, though, is not simply an extension, but a new quality. Cultural techniques are related to the arbitrariness of the human hand / body / action, while technological implementation into electro-physics enables a techno-sphere below human "historical" (Vico) culture

- conceptually, cultural techniques remains within the time-field of cultural history: Vico's man-made temporality, while media archaeology claims that media, when in operation (instead of being simply material things), constitute their Eigenzeit.

- according to Giambattista Vico, history = temporality which humans understand for what their culture has produced itself, different from natural evolution. Autopoietic techno-mathematical time is an interlacing of both temporal regimes. Even if technologies are products of human culture, they generate non-historical figures of temporality (standardized clocking time) which irritate humans accustomed to / by

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[14] See Patrick Feaster, Pictures of Sound. One thousand years of educed audio: 980-1980, Atlante, GA (Dust-to-Digital) 2012

[15] Winthrop-Young, Siren Recursions, in: xxx

[16] Winthrop-Young, op. cit.

the narrative discourse of time-telling

- concept of cultural techniques for *Kulturwissenschaft* is what radical media archaeology is for *Medienwissenschaft* (both disciplines written in singular)

- technology as culturally, i. e. symbolically (re-)defined physical nature / (electro-)physics, mathematically folded upon itself (such as so-called "cognitive radio")

Modelling electric circuit diagrams

- only in historical discourse, retrospectively from today's omnipresence of the "flipflop" in binary computing, the "first" diagram of a digital switching circuit has been the Eccles-Jordan trigger; rather media-archaeological *ur-* (ongoing *arché*) than "original" in the historical sense: the trigger relay; cp. Bonch-Bujevich 1918 = "gleichursprünglich"

- discrete computing ultimately boils down “to signifiers of voltage differences” = Friedrich A. Kittler, There is No Software, in: same author, Literature, Media, Information Systems: Essays, ed. John Johnston, Amsterdam (G+B Arts International) 1997, 150

- circuit diagrams as mixtures of iconic signs, indexical signs and symbols; they interrelate switching and interpretation. "But [...] do you see a digital device? Do you see an analog device? Is it a matter of interpretation? A historian of electronic media would read this diagram in a way that would locate that diagram within the history of radio: After all, what we have here basically is a grid electrode which is modulated by a signal. What strikes at once is the similarity this circuit has to Edwin Armstrong’s Audion amplification circuit of 1913.[17] Armstrong himself described in his patent abstract this apparatus in terms of two coupled circuits: the grid circuit, connecting the aerial to the grid of the triode, and the wing (anode) circuit, connecting the anode of the tube, the battery, an autotransformer T and a telephone receiver. [...] The principle is that of a relay: the feeble input signal that is applied to the grid is amplified by a feedback of the strong oscillations in the anode circuit. A highly instable device, though: If the feedback became too strong the whole apparatus turned into a oscillator, i.e. a transmitter. Armstrong himself already noticed a pathological bias of his circuitry: 'Signals that are scarcely audible with

[17] And Eccles and Jordan are fully aware of it: "In a well-known method of using a triode for the amplification of wireless signals an inductive coil is placed in the filament-to-anode circuit, and another coil magnetically coupled with this is introduced into the filament-to-grid circuit."

the ordinary audion connection can be amplified to a point where they are too strong for, *and 'paralyze' the most stable audions*'.[18] In the Eccles-Jordan trigger this pathological bias became the one and only purpose."

- replacing the historicist quest for "beginning" by structural principles ("archi-tectural") *arché* which is operational timings rather than chronological origin; "if we take care to identify the digital as a condition that is made possible by the conceptual foundations of digital media and not necessarily by digital media itself, the boundaries of the digital moment—when it began and under what circumstances—become less clear" = announcement of book launch of Andrew Goodhouse (ed.), When is the Digital in Architecture?, at: Spike, Berlin, 15 June, 2017 = media archaeology in the Kantean / Foucauldean sense (*a priori* / *l'archive*); the pre-"digital media" conditions of "the digital" = rather cultural techniqus of counting and discrete numerical / measuring operations

- "Suppose the analog simulation is an electronic one, built out of resistors, capacitors, op-amps, VCOs, filters, and the like (simulation, perhaps, some complex mechanical <or musical>harmonic system). Now imagine constructing a *separate* symbolic simulation of earch of these components, attaching them all to the approporate anlog-digital and digital-analog converters, and then connecting the restuling 'black boxes' together with just the curcuit topology of the electronic simulator. <...> we have here 'isomorphism of causal structure'" = report by anonymous referee for *Philosophy of Science*, quoted in: Russel Trenholme, Analog Simulation, in: Philosophy of Science, 61 (1994), 115-131 (121); for such a component-by-component replacement of analog elements with symbolic subroutines "we must be able to provide a physical description of these subprocesses" = 121; claim for simulation (not just functionally emulating) the ENIAC computer with SIMULINK-based modelling the idiosyncrativ behaviour of single electronic tubes themselves

"It is highly misleading to characterize correspondences under analog simulation mappings as representations" <126>.

Inbetween is Kittler's (phantom) Harmonizer which necessarily must embody a digital (thus "symbolic") processor to calculate vocal frequencies in real-time - just like the first digital image processing was embodied in video recorders.

"Symbolic simulations are individuated by the *theory* that is modeled

[18] Edwin Armstrong, Patentschrift 1,113,149, Patent Abstract, p. 2. Meine Hervorhebung.

on the computer, and analog simulations by the *simulation device itself* <...>." <Trenholme 1994: 120>

Cultural techniques vs. technological idiochronicity

- rivalling with the concept of *Kulturtechnik* (cultural engineering), term "technicity" as defined by the Gilbert Simondon, to trace the force, effectivity and performativity of cultural transformation *intrinsic* and *prior* to tools, apparatuses, media technologies and other technical assemblages; Andrea Bardin and Giovanni Menegalle, Introduction to Simondon, in: Radical Philosophy 189 (Jan/Feb) (2015)

- technological media not completely subjected to an all-embracing cultural history, but tend to develop a temporality of their own; not just historical techniques but as well material "logic" which escapes historization; when nowadays Pythagorean experience reenacted at monochord, medium itself regenerates an equiprimoridal temporal position to such a time-invariant diagrammatic argument; implicit operative knowledge within media themselves waiting to be discovered by humans (different from performative, human body-bound "tacit knowledge" defined Polyani)

- different from historical hermeneutics (and within humanities as *Geisteswissenschaft*), replica of a material experiment in the past allows for its understanding by reenactment even if the replica is not the original materiality but a functional equivalent - which is different from the limits of understanding for knowledge coded in written documents; technological object is an operative "source" of past knowledge; Christian Sichau, Die Replikationsmethode: Zur Rekonstruktion historischer Experimente, in: P. Heering / F. Rieß / C. Sichau (eds.), Im Labor der Physikgeschichte. Zur Untersuchung historischer Experimentalpraxis, Oldenburg (Bibliotheks- und Infomrationssystem der Universität Oldenburg) 2000, 10-23 (10, note 3)

- November 2017, hint ("MAL / MAF fantasy") by Lori Emerson, Director of Media Archaeology Lab at Department of English and Intermedia Arts, Writing, and Performance, University of Colorado at Boulder, at Sotheby's auction object no. 61 "THE FIRST ELECTRIC SOUND SYNTHESIZER. A HELMHOLTZ SOUND SYNTHESIZER, MANUFACTURED IN CHEMNITZ BY MAX KOHL AFTER THE DESIGN BY HERMANN VON HELMHOLTZ, CA 1905 = http://www.sothebys.com/en/auctions/ecatalogue/2017/history-of-science-technology-n09686/lot.61.html; "History of Science and Technology" category on Sotheby's webpage a collector's dream

indeed; pragmatic answer from Berlin Media Archaeological Fundus: volunteer Ingolf Haedicke, a retired technician of electro-acoustics, builds replicas of such instrument with the students so that they make an active experience of media archaeological analysis by material synthesis - such as, in the Sotheby's catalogue, the next number 62, the legendary Theremin: TELETOUCH THEREMIN POSSIBLY BUILT BY LÉON THEREMIN, CIRCA 1937-1938; functional replica of its developed version Terpsiton; even carried further by software augmentation to turn it beyond a playful experience of intuitive interactive interface into a knowledge machine, coupling it with ancient Greek musical scales; raises the question of media-archaeological authenticity, and here MAL comes in: Computer preservation has enriched the discussion by introducing the concept of (functional) emulation, as an alternative to historicist simulation

- historic / ahistoric double-bind of techno/logy: time-invariant logical reasoning vs. radically "historicized" physical implementation. Donald F. McLean's paper "The Achievement of Television: The Quality and Features of John Logie Baird's System in 1926", in: The International Journal for the History of Engineering & Technology, Vol. 84 (2014), Issue 2, 227-247, inspired an engineer to build a version of the Baird Double-8 apparatus (uses a Nipkow disc with two spirals of 8 lenses, used by Baird in 1925 as a transportable demonstrator). McLean predicted it would be less quality than single-spiral Nipkow disc device. "It would seem from tests on the model that it was *significantly* poorer quality. Therein lie the benefits of 'hands-on' experimentation. The 'devil is in the detail' and building something forces the detail (and the devil!) out" (as expressed by Donald Mclean, September, 2017); M. Groth / S. Höltgen; Wissens-Appa/Repa/raturen. Ein epistemologisch-archäologischer Werkstattbericht von der Reparatur eines fruhen Mikrocomputers, in: Krebs, S. et al. (eds.), Kulturen des Reparierens. Dinge – Wissen – Praktiken, Bielefeld (transcript) 2018

- media archaeology critiqued "for being overly dramatic and focused on technological developments" = Report on *The Terms of Media II: Actions* conference, October 8 - 10, 2015, https://www.brown.edu/academics/humanities/events/conferences-and-symposia/terms-media-ii-actions (accessed June 26, 2017); insistively continues to address digital culture in terms of its *technological* media-specificity indeed: concrete platforms, constituting apparatuses, assemblages and protocols such as Internet infrastructures (cables and codes), rather than getting lost in more liberal terms of media ecology (or the "anthropocene") considering them in its "subjectivities, and atmospheres"[19]

[19] https://www.leuphana.de/en/research-centers/cdc/news/single-

- media innovations are culturally co-determined - a premise culminating in the *new historicist* view that affirms both the technicity of history and the historicity of technologies; chiastic model calls for a supplement: the assumption of an inner logic of media development that literally introduces a third element to the Promethean dichotomy of culture and nature

- almost anything associated with the term “media” or "technique" can be absorbed by discursive framework of cultural history. That inclusion, however, would jeopardize the accuracy of a term. Michel Serres distinguishes between techniques and technologies; distinction applies to the difference between cultural techniques and media technologies, between energetic / material machines and informational electronics / computing; Norbert Wiener contrasts the “hard” machinery of the Industrial Revolution, functioning on the basis of thermodynamics, with the “soft” negentropy of information technology - just like the difference between a steam engine and a thermionic tube: “I therefore reserve the term ‘technology’ for those types of artefacts that negotiate signs - and thus the logos - and contrast them with ‘techniques’, whose energetic scope is 10^{16} times higher"[20], just like German engineering since Heinrich Barkhausen (as pointed out by Norbert Wiener) differentiates "Starkstromtechnik" (current used as energy, like heating) from "Schwachstromtechnik" (low curreny) where subtle amount of electricity is used for communicational rather than energetic purpose - which equals the difference between electricity and electronics. The thermionic tube (triode) allows for technological intelligence. No more transitive cultural technique but "second machine" age (Gotthard Günther)

- concerning the frequent confusion between the stroboscope and the afterimage effect in the transmission of visual perception, Bernhard Siegert stresses “how fundamentally the media-theoretical discourse is in need of a media-historical framework of analysis to match media’s inherently high physical and mathematical standards.”[21] And, indeed, the history of knowledge and technology serves as a necessary test for all media theories. But media archaeology does not merely reconstruct

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view/date/2015/07/07/terms-of-media-conference-a-review.html, accessed 26 June, 2017): "Terms of Media Conference: A Review"

[20] Michel Serres, *Der Mensch ohne Fähigkeiten. Die neuen Technologien und die Ökonomie des Vergessens*, in: Transit 22 (Winter 2001/02), 193-206 (194f). [Transl. by GS]

[21] Bernhard Siegert, Good Vibrations. Faradays Experimente 1830/31, in: Kaleidoskopien Heft 1/1996, 6-16 (8). [Transl. by GS]

historical media practices; it also reflects on their time-building, chronopoetic processes – thereby raising a challenge to history.

Technological media processes within/-out Cultural History

- *Kulturwissenschaft* prefers to read technologies as a function of historical processes; media archaeology takes the opposite perspective where the model of history itself appears as a function of cultural (symbolic and signal-based) operations

- cultural history emerged in the 19th century both as an academic practice and a research *dispositif*; it is vital to analyse its material and processual conditions. The postal system (transmission) and the archive (storage) became conjoined when Erich Moritz von Hornbostel ordered Edison cylinders with ehtno-musical recordings from all over the world for his Berlin phonographic archive, with the scope of developing the field of comparative ethnomusicology.[22] The notion of culture that governed the projects involved in collecting knowledge around 1900, had become identical to the storage media it generated. In its materiality, culture thus reveals itself as an object of research for the study of storage and transmission techniques. Chronology, diplomacy, epigraphy, genealogy, heraldry, numismatics, palaeography, sphragistics, historical cartography: these so-called ancillary disciplines of history, which identify and analyse their objects with regard to their usability as cultural data storage devices, acquire the status of media archaeology *avant la lettre* and are intimately connected with the category of *Kulturwissenschaft*. As a result, culture becomes calculable; it is a function of mnemonic strategies and transmission techniques, as well as their respective institutions.

- difference between *Kulturwissenschaft* and *Medienwissenschaft;* the former is primarily interested in discourses, while the latter places a much stronger focus on non-discursive aspects; media archaeology (much like Gaston Bachelard's epistemology) focuses on moments of contingency[23]

- discover the specific inner temporality [*Eigenzeit*] of technologies in a kind of reverse hermeneutical move. Writing, reading, counting, networking, and representing are symbolic techniques which generate

[22] See Sebastian Klotz (ed.), „Vom tönenden Wirbel menschlichen Tuns“: Erich M. von Hornbostel als Gestaltpsychologe, Archivar und Musikwissenschaftler, Berlin / Milow (Schibri) 1998, 116-131

[23] See also: Hans-Jörg Rheinberger, *Experimentalsysteme und epistemische Dinge*, Göttingen (Wallstein) 2001.

culture as a recurring and normative formation. They transform a priori concepts of space and time into an analysis of concrete spatial and temporal systems. Media archaeology does not conduct this analysis on the level of macro-cultural production, but rather on the level of micro-technical operativity; technological media systems can be understood primarily and conclusively on the basis of their elementary, sub-semantic procedures. Material, symbolic and signal-based operators are not just escalations of classical cultural techniques; they require a theory of genuine media-temporal processes.

- traditional media history and cultural history agreeing on how ‘organ projections’ and the *extensions of men* (Ernst Kapp, Marshall McLuhan) have developed into culture’s servomechanism

- man as codified (or even programmed) by cultural techniques and media technology. To paraphrase Günter Anders, media theory actively pursues the “antiquation” of man by distancing the subject-centred perspective through apparatus-based *theoría*

Media-temporal processes and their break from cultural history

[= rewriting of modules from W. E., From Media History to *Zeitkritik*, transl. Guido Schenkel, in: Theory, Culture & Society, vol. 30, no 6 (2013, Special Issue *Cultural Techniques*), 132-146]

- segment titled "Movement and Time" in Gustav Deutsch's film *Film ist* [Film Is] (Austria, 1998): medical X-ray footage of a speaking larynx. In this case, the medium speaks for itself, producing the same effect as the invention of the vocal alphabet in ancient Greece, which not only created the possibility to record – and thus store and transfer – oral poetry as a stream of phonetic utterances, but also allowed objects like drinking vessels and tombstones to speak to the reader in the first person via their inscriptions. The scientific observation of a speaking larynx in sets of 12 to 24 X-ray images per second is no longer conditioned by the human eye but by the eye of the camera or even that of the X-ray cathode. Only technical media are capable of manipulating, decelerating and accelerating moments such as this in a time-critical manner; *Film ist* announces the media–archaeological level in the existence of the apparatus, which – to paraphrase Foucault - corresponds to a monumental, discrete aesthetic, distinct from the documentary perspective of cultural history:

"[H]istory, in its traditional form, undertook to 'memorise' the *monuments* of the past, transform them into *documents,* and lend

speech to those traces which, in themselves, are / often not verbal, or which say in silence something other than what they actually say; in our time, history is that which transforms *documents into monuments.* In that area where, in the past, history deciphered the traces left by men, it now deploys a mass of elements that have to be grouped, made relevant, placed in relation to one another to form totalities. There was a time when archaeology, as a discipline devoted to silent monuments, inert traces, objects without context, and things left by the past, aspired to the condition of history, and attained meaning only through the restitution of a historical discourse; it might be said, to play on words a little, that in our time history aspires to the condition of archaeology, to the intrinsic description of the monument."[24]

As functions of a process of transmission, technologically generated signals are messengers of other things; at the same time, every electronic image, every electronically (re)produced sound always also a monument to itself, to its technology and – more radically – to the computer program which created it. This amounts to media self-reference. Media technology, while clearly emerging from human / cultural knowledge, results in an autonomous entity – a process that manifests itself via the technical feedback loop (the cybernetic paradigm of machine and mathematics). The development of feedback routes – as James Clerk Maxwell's *On Governors* (1868) had already shown prior to all explicit formulations of cybernetics – increasingly separates media systems from the discursive streams of culture. Thus, automation is defined precisely by the fact that "human controls have been disabled." [25] When the field of electronic media is accessed in terms of the electromagnetic field, this distinction places technological media in opposition to traditional culture-technical practices. To remain within the terminology of electromagnetism instead of cultural historiography: with media, there is only mutual induction. The discovery of electromagnetism – theoretically posited by Faraday, mathematically calculated by Maxwell and ultimately empirically proven by Hertz – overcame the search for a representation of humanity in nature, and instead defined it as a set of processes that open up a new field between physics and culture. "We must we therefore understand the knowledge of electrical phenomena and their application as an exclusive product of the human intellect."[26] By using

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

[25] Klaus Szameitat, Möglichkeiten und Grenzen der Automatisierung in der Statistik, in: Allgemeines Stastistisches Archiv 43 (1959), 316-(316). Translated by Guido Schenkel.

[26] Raphael Eduard Liesegangs Das Phototel. Beiträge zum Problem des

electricity, man has surpassed nature, and not simply performed an act of organ projection. “Once it is possible to animate an automaton that is better constructed than man himself, the world has reached its ultimate purpose.”[27] The media processes that are thereby set in motion no longer exclusively belong to either nature or culture. The Greek term *nómos* already implies a departure from *physis*, from nature itself.[28] Faraday taught us to understand this field as a form of independent reality with an intrinsic dynamic, detached from the corporeal realm[29], opening up a space for temporal and spatial free play; facing techno-mathematics by its rules, it derives not from cultural history, rather from Riemann spaces, where time and space become conflated. Michelson-Morley experiment from 1887 gloriously failed to prove the existence of "ether wind"; followed by the provocative Lorentz contraction theorem: instruments of measurement expand or contract along with the ether. Although this explanation considered obsolete today, it still holds the appeal of an alternate model of conceptualizing non-historical time in what is called culture

- culture no longer operates with primary natural “media” (air, water) alone and also posits no imaginary substances (“ether”), but rather – as in the case of electromagnetic carrier waves – forms its own media channels that can be both artistically and artificially *modulated*, the combination of media produced by cultural techniques and human speech acts generates the uncanny, siren-like attraction of media technology. Precisely because “the Sirens, who were only animals […], could sing as men sing, they made the song so strange that they gave birth in anyone who heard it to a suspicion of the inhumanity of every human song.” [30] The temporality of media transmissions induces a similar discomfort. We know that Hitchcock’s *Psycho* is a historical film document every time it airs over television channels. But in the technical moment of transmission, it is actively present (unlike a painting in a museum) as an electromagnetically-induced process that shoots through our sense of time like an electric surge. The result is

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electrischen Fernsehens, Düsseldorf 1891, x. Liesegang refers to an entry in: Electricitäts-Zeitung No. 24 (1890). Translated by Guido Schenkel.

[27] Liesegang ebd. Translated by Guido Schenkel.

[28] Anm. des Herausgebers zu Buch II (§ 371b) von Platon, Der Staat (Politeia), übers. u. hg. v. Karl Vretska, Stuttgart (Reclam) 2001, 503

[29] Carl Friedrich von Weizsäcker, Die Einheit der Natur, München (dtv) 1974, 147

[30] Maurice Blanchot, Der Gesang der Sirenen, in: ders., Der Gesang der Sirenen. Essays zur modernen Literatur, München (Hanser) 1962, 9-40 (11). [„The Song of the Sirens“, in Blanchot. *The Book to Come.* Stanford U Press, 2003, transl. Charlotte Mandell, p.3]

cognitive dissonance: the subliminal perception of the present, but with the cognitive awareness of an alternate perspective, namely that of the past.

What happens when waves are no longer oceanic matter (as in the *Odyssey*), but rather a matter of high-frequency technology? A study launched at Berlin's Humboldt University in April 2004 proposed to examine Homer's siren motif from the perspective of acoustic media archaeology.[31] Only through the technological act of measuring can the sonic element, as the most fleeting of all cultural goods, re-enter cultural memory. But by the same token, historical recollection is de-historicized and the cultural-historical model is replaced with technical parameters of measurement. On the one hand, media archaeology is an ancillary discipline of cultural memory; yet, on the other hand, in terms of its media-epistemological focus, it is a technology capable of training the visual and acoustic senses for non-cultural objects. Technology is thus no longer an organ projection of nature. Cultural knowledge effectively results in negentropic re-configuring products of nature into technological artefacts = argument Gernot Böhme, Natürlich Natur. Über Natur im Zeitalter ihrer technischen Reproduzierbarkeit, Frankfurt/M. (Suhrkamp) 1992, 118; when musing about the nightingale's song, Kant points out that, in the absence of a bird, men knew to produce such sounding exactly like nature in *dissimulatio artis* (hiding acousmatically in a bush) = Böhme 1992: 119. Once analytical media measure the frequencies of sounds, they are able to synthetically subvert the sonic difference between humans and machines; a radio broadcast of a singing nightingale results in uncertainty wheter recorded in nature or synthetically produced by electronic circuitry; Eduard Rhein, Wunder der Wellen. Rundfunk und Fernsehen dargestellt für jedermann, Berlin (Deutscher Verlag) 1935 (4th ed. 1939). When nature itself becomes reproducible, it is technically legible. The age of the baroque cabinets of curiosities had an impartial view on these matters. Pre-electroic cultural techniques still oriented at nature as " an infinite resource for artificial machines that surpass all human inventions" = Johann Gottlieb Sulzer, Versuch einiger moralischer Betrachtungen über die Werke der Natur, Berlin 1750, 39 (transl. into English by Guido Schenkel). See Horst Bredekamp, Antikensehnsucht und Maschinenglaube, Berlin (Wagenbach) 1993. Radio waves not unnatural (*para physin* – according to Aristotle's *Physics*), rather reproduce the secret of their

[31] See W. E., Lokaltermin Sirenen oder Der Anfang eines gewissen Gesangs in Europa, in: Phonorama. Eine Kulturgeschichte der STIMME als Medium, ed. Brigitte Felderer, Berlin (Matthes & Seitz) 2004, 256-266

own wave movement in a generative kind of *mimesis*.[32] Artificial nature is baroque machine culture but becomes obsolete with algorithmic computing; see Böhme 1992: 196. Media-archaeological perspective of the trans-classical machine; culture defined by creating un-natural meaning functions (Flusser); operational logic of algorithmic machines, even if 100 % product of cultural engineering, neither reproduces natural, nor subjective objects; its *artefacts* are of a techno-logical kind.[33] Culture has not only created epistemology, but indeed also signal-processing machines, which are - in the operative moment - then by definition dialectically autonomous from culture. Computers and communication technology do not count (with) semantic aspects; they do not view images as icons; they do not perceive music as sound; they read texts with the aesthetics of a scanner (OCR)[34]

The Autonomisation of Culture and History: The Micro-Time of Technical Media

- autonomisation of technological processes of media temporality illustrated by the emancipation of mechanical time from astronomical time in the early modern age. Mechanical clocks were more than just that: due to the micro-mechanism of escapement hey became oscillators, bringing the previously celestially-oriented time down to earth. The chronologically discrete clock, in contrast to the category of time as flow, opens up an *éclat* between cultural meaning and operative media; see Ernst Jünger, Das Sanduhrbuch, 2nd ed., Frankfurt/M. (Vittorio Klostermann) 1954. When Nicole d'Oresme compared the movements of the celestial bodies to the rhythms of the mechanical escapement device of a clock in *Le livre du ciel et du monde*, he modelled nature on technical mechanisms instead of modelling technology on organic archetypes. Quarz-driven clockworks finally define time units than the natural cycles (ellipses) in astronomy[35] the mechanical media of time measurement dictate their non-discursive internal temporality to culture and turn the observer himself into their own medium. Galileo suggested that Christiaan Huygens should not to use the human heartbeat, but rather

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[32] See H. Koller, Die Mimesis in der Antike. Nachahmung, Darstellung, Ausdruck, Berlin 1954

[33] See Eggert Holling / Peter Kempin, in: Identität, Geist und Maschine. Auf dem Weg zur technologischen Gesellschaft, Hamburg (Rowohlt) 1989, 138

[34] See Claus Pias (ed.), Kulturfreie Bilder. Erfindungen der Voraussetzungslosigkeit, Berlin (Kulturverlag Kadmos), forthcoming

[35] See Rudolf Taschner, Der Zahlen gigantische Schatten. Mathematik im Zeichen der Zeit, Wiesbaden (Vieweg) 3rd ed. 2005, 56

mechanical oscillations in order to measure time. The end result is the atomic clock, which is based on the oscillations of a Caesium isotope. “Atomic clocks are so precise that they are the ones defining chronological units now, rather than celestial phenomena" = Ibid., translated by Guido Schenkel. This moment marks the emancipation of the media of measurement from nature within the medium of nature. If time is that which is measured with a clock (the Aristotelian definition of time), then that is media time. Yet the historical temporality of chronology and calendars is nothing but a scaled clock and thus becomes a function of the media of measurement. From this perspective, the category of media history is turned inside out: it becomes a temporal fold.

- autonomisation of the technological media sphere from traditional cultural techniques; detachment of *engineering* from classical *techné* by mathematization; beyond simple "extensions of man", communication engineering as complete detachment of technical constructions natural or organic modes of operation; Wolfgang Krohn, preface to: Edgar Zisel, Die sozialen Ursprünge der neuzeitlichen Wissenschaft, Frankfurt/M. 1976, 25. Mathematical instruments and clockworks no longer extensions of human organs, rather *organon* in the Aristotelian sense, as “machines whose operation is only guaranteed by their compliance with their own internal laws and rules that can be verified and controlled" = Serge Moscovici, Essai sur l ´histoire humaine de la nature, Paris 1969, 220 (transl. into English by Guido Schenkel); see Eleonore Kalisch, Konfigurationen der Renaissance. Zur Emanzipationsgeschichte der ars theatrica, Berlin (Vistas) 2002, 194 f.

- in computational theory, algorithm = ordered progression of step-wise problem solving equals the machine itself. Even if both (logical and material) machines are 100 % a product of human knowledge, they develop an intrinsic *Eigenzeit* as media technology where the real message is not the cultural content which is processed but as well something within the non-human world. With the "escapement" in mechanical clock, periodic oscillations have become a non-human processual object (emancipating from heart beat) as a function of such techno-logics

- historical discourse a narrative order of imposing symbolic "time" on spatially coexisting records (the archive); 19th century grounded concept of unidirectional time’s arrow in actual physical evidence: thermodynamic theorem of entropy

- temporarily, media archaeology gets suspended from the supremacy of historical discourse, which – disguised, e. g., as a history of science,

tends to absorb all of its epistemological alternatives. The premature inclusion of the analysis of technological media processes in the category of cultural studies robs it of its explosive potential. Media archaeology deals with artefacts, particularly with those that are created only in the process of technological execution

- when a radio receives a broadcast. Regardless of whether this radio is an old or a recent model, the broadcast always takes place in the present. In contrast to media history – that is, the human vantage point (Vico) – media archaeology tentatively adopts the temporal perspective of the apparatus itself – the aesthetics of micro-temporal processes. A different kind of temporality is represented here. The oscillating string of an instrument still forces its sound – and with it its (intrinsic media) temporality – upon our ears. But these ears hear different harmonies in the same sound; they are culturally predetermined; differentiation of the acoustic (physics), the sonic (cultural conditioning), and the musical (cultural semantics) = freely adapted from Peter Wicke. Does the vibrating string sound the history of being to us? Any discovery of string-based octaves always short-circuits historical time.[36] This also means that the human senses do not only conform to a seemingly immediate history of being, but also to the instrumental medium itself. These instruments are products of cultural techniques; that is, of a negentropic desire, such as the repeated acoustic experiment. This, in turn, is inscribed with a “historical” index (to paraphrase Walter Bejamin), which combines with our perception into a fulgurous constellation – media time, not history, is at work here. What is the relationship between the verisimilitude of a lab experiment and the contingency of discovery? The contingencies in the success of technical discoveries defy narrative logic. The relationship cannot be plausibly described within a classical causal model of history. Oerstedt came upon the effect of electromagnetic induction rather by accident during a lecture in which the magnetic needle began to twitch in the vicinity of an electrified wire. Here, a micro-temporal process forms the foundation for a media-technological event and thus produces a new form of temporality in competition to the historical event. Sparks produce waves. Heinrich Hertz, a student of Helmholtz, realized accidentally that parallel to a spark, another one forms – a remote effect of electric beams. Hertz describes this phenomenon with the very mathematical theory of electromagnetic waves which Maxwell contributed to epistemology. Maxwell arrived at the theory of light as electromagnetic waves through pure mathematics; heuristically, however, his very concrete starting point has been Faraday's experimental discovery of electro-magnetic

[36] See Friedrich Kittler, Aphrodite (Musik und Mathematik Bd. 1.1), Paderborn (Fink) 2006, 282

induction. From that epistemological constallation derives the media of electromagnetic waves (television, radio, mobile phones): a realm within its own, no longer simply cultural, laws.

- category of resonance between two temporal objects merely taken from acoustics as a metaphor or is it modelled on it directly? Resonance is produced when two tuning forks oscillate in perfect harmony. The vibrations of one excited fork – even if interrupted – cause the second to vibrate as well – a kind of wireless information transfer.[37] Does something similar occur in the actual reading of a "historical" text? If it resonates in the moment of reading, it is no longer historical. Does the ear hear this type oscillating event? "What kind of reality is produced in the act of listening to a loudspeaker is a question of cognition." [38] From the perspective of biological computing, Heinz von Foerster describes cognition – analogous to the neurobiological category of memory – as the "calculation of reality"; results in contractions of (cultural-)historical time

How Not to Write Media History?

- media time may be written as cultural historiography but not identical to it. Media also demand another mode of representation of their occurrence in time. An ex-historian has a sense of this, even if the positive formulation of this concern remains a provisional stammer. For cultural and media history, the pressing revolution of knowledge that unsettled the Newtonian world view around 1900, in the form of the physics of Max Planck and Albert Einstein, is yet to come. When historiography is no longer viewed as the simple relationship between an object and its perception, but rather as mathematically mediated (statistics) and – in terms of a concise media archaeology – as a combination of measured object, measuring apparatus and perception, then historical time will be transformed into an observable in the sense of quantum physics. It is the act of registration (recording) that inscribes this time with an irreversibility. The act of writing – that is, the transition between the continual flow of signals and their discrete recording – thus becomes comprehensible as a strictly media-archaeological moment, based not on its semantics, but on its operative execution which induces distinction between factuality (past) and potentiality (future)

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[37] See Eva Küllmer, Mitschwingende Saiten. Musikinstrumente und Resonanzsaiten. Bonn 1986

[38] Martin Supper, Elektroakustische Musik und Computermusik. Geschichte - Ästhetik - Methoden - Systeme, Darmstadt (Wiss. Buchges.) 1997, 32. Translated by Guido Schenkel.

- nothing in Foucault on radio or on television or on vinyl as such, just a passage on the typewriter

- media which do not merely refer to the axis of time (time-based media), but are capable of manipulating it (time-critical media), represent a new type of temporal statements. In contrast to historiography and historical monuments, for which time is the object but just symbolically represented, technical configurations are capable of operating (as) time itself; techno-intrinsic temporality demands another kind of media philosophy of time, such as "the temporality of ergodic art" = Espen Aarseth, Aporia of Epiphany in Doom and The Speaking Clock. The Temporality of Ergodic Art, in: Marie-Laure Ryan (ed.), Cyberspace Textuality. Computer Technology and Literary Theory, Bloomington / Indianapolis 1999, 31-42; Aarseth does not consider it in accordance with the probability mathematics of Norbert Wiener; Frank Furtwängler, Human Practice. How the problem of ergodicity demands a re-animation of anthropological perspectives in game studies, in: The Aesthetics of Net Literature. Writing, Reading and Playing in Programmable Media, ed. Peter Gendolla / Jörgen Schäfer, Bielefeld (transcript) 2006. Media archaeology constitutes an attempt to account for this alternate temporality of media. The linear prediction code – developed in the context of antiaircraft defence and fire control during World War II, but used today as a probability indicator in all aspects of life – is the model here. It represents the calculations that form the basis of Wiener's time-critical research; analogy to current micro-temporal economies – such as computer games – insofar as their operativity is equally as time-critical as it is (seemingly) infinite in its combinatorics. In essence, this question was already raised by Leibniz in his fantasy "Apokatastasis panton," an early version of Poincaré's return on the basis of the combinatorics of all letters in a library. The difference between this and the infinite, but static space of *The Library of Babel* (Jorge Luis Borges), is the coupling of this thought experiment with media-operative and thus time-critical processes.

- engagement with time-critical media processes leads to reluctance to write the modes of execution of media in time simply as media *history*. It provides a convenient model that can be practised with ease by trained scholars of the Humanities, Cultural Studies and Media Studies. But here, as well, an epistemological turn is coming, analogous in its ambiguity and uncertainty to the one quantum physics represented for classical mechanics. Because, on the level of a technologically-induced media temporality that can neither be written as cultural nor as media history, media time has long reigned on its own terms. Again: Written as History, media history and cultural history are connected. But wherever non-preconceivable media time processes are concerned – that is, processes which themselves subvert this historical model – the

past of media must be written differently, as well. It is not history, but at most the incidental nature of cultural existence as affected by the temporal modes of technology. It holds true, in allusion to a concept from Heidegger's "Kehre" (turn), that no historical existence (*Dasein*) could have invented the radio, but that – conversely – technological media, such as the radio, determine historical ways of being (*dazusein*). In contrast to Heidegger, however, media archaeology tentatively shrugs off the confines of the historical; not for the sake of a postmodern questioning of temporal processes as such, but in order to approach them from the vantage point of the media operations themselves, rather than allowing itself to be entrapped by musings on origins and metaphysics. Let us try for a moment to suspend the voluntary self-restriction of the human temporal horizon by means of the category of history. In this way, the face of the historical human does not disappear like a figure on the beach in the breaking waves, but rather like the sand in an hourglass

Annales Sangallenses

- Where does cultural techniques end and technological media begin?

- medieval annals not equal to syntactical word listings in Weizenbaum's KI program ELIZA

- Present digital (media) culture triggers a new kind of awareness of past cultural practices, "retro-actively" in Freud´s sense ("somehow always known, but never thought of" = "Eigentlich immer gewußt, nur nicht daran gedacht": Sigmund Freud, Erinnern, Wiederholen und Durcharbeiten [1914], in: S. F., Gesammelte Werke, vol. X, Frankfurt/Main 1946, 126-136 (128): not from the past derive memories, but memories relating to the past

- early Medieval Annals perform the discrete time sequence of a "sampled" continuous function called reality; translation from analogue perception to digital registration (technically: A/D conversion)

- Different from the Annals of Saint Gall is the micro-temporality in operativity of data processing (synchronization) which replaces the traditional macro-time of the "historical" archive, of emphatic historical consciousness - a change in aggregation, a literal "quantization"

- the Annals of Saint Gall, a record of annual events referring to early 8th century Europe. Neither *discours* nor *histoire*; the disorder implied by some of the events is stabilized only by the regular, unbroken procession of years, a cultural technology of formalization (counting)

instead of narrative:

709. Hard winter. Duke Gottfried died.
710. Hard year and deficient in crops.
711.
712. Flood everywhere.
713.
714. Pippin, Mayor of the Palace, died.[39]

In McLuhan´s terms, this "cold" list requires a reading technique different from "hot" historical (or historiographical) imagination. Remarkably, there can be (no) entries as well for the absence of events. Annals offer their readers „one thing after the other“, corresponding with the very nature of the von-Neumann-architecture of computers which operate strictly sequential, one bit / cycling unit after another -, while proper narratives provide their readers with „one thing because of the other“[40]

- "sequence of operations required to perform a specific task is known as an *algorithm*"[41] - the alternative to story-telling, a digital aesthetics of writing a mere sequence of events in serial, sequential order

- time now is being organized by technology itself, Paul Virilio declares[42] - just like the story-teller can be replaced by the cold camera eye (Dsiga Vertov); cinema still has a dramatic concept unfolding in time[43], vs. non-linear hypertextuality

- algorithms displace classical story-board; script is not a screen-play any more (story-telling), but code lines; programmer is not interested in stories any more; rather he writes discontinuous jump adresses to Hot Spots. Designing a Computer Game today means 95 % of digital

[39] Annales Sangallenses Maiores, dicti Hepidanni, ed. Ildefonsus ab Arx, in MGH, series Scriptores, ed. Georg Heinrich Pertz, vol. 1 (Hannover, 1826; Reprint Stuttgart 1963), 72f. Translation quoted from: White 1980: 11

[40] Robert F. Berkofer (Jr.), Beyond the Great Story. History as Text and Discourse, Cambridge, Mass. 1995, 117, unter Bezug auf: White, Value of Narrativity, in: Contentof the Form, 1987, 42ff, und Aristoteles.

[41] J. D. Richards / N. S. Ryan (eds.), Data Processing in Archaeology, Cambridge U. P. 1985, 1f

[42] Paul Virilio, Technik und Fragmentierung, in: Karlheinz Barck u. a. (eds.), Aisthesis. Wahrnehmung heute, Leipzig (Reclam) 1990, 71-82 (71)

[43] Monika Halkort, Datenbankbasiertes Broadcasting - Neue Erzählgenres im Netz, in: do it yourself! Kunst und digitale Medien: Software - Partizipaton - Distribution, hg. v. Andreas Broeckmann / Susanne Jaschko, Berlin (transmediale.01) 2001, 155-159 (155)

administration (setting links), and requireas just 5 % "authorship". This programming practice is deconstructing narrative scenes into its most elementary morphological units. Linearity (which in the case of film is based on the irreducable material linearity of celluloid already) has articifially to be introduced on CD-ROMs for guide-lines

Archaeology (proper) *versus* history

- opposed to figurative, narrative (hi)story-telling, modular processing of past data concentrates on antiquarian modes of "archaeographical" representation under the auspices of digital computing techniques; René Ginouvès / Anne-Marie Guimer-Sorbets, La Constitution des Donnés en archéologie classique. Recherches et expériences en vue de la préparation de bases de donnés, Paris (Éditions du CNRS) 1978

- archaeology as close to the sciences as it is (usually) to the "humanities"; now Digital Humanities

- archaology as a form of art which uses scientific methods = pre-historical archaeologist O. G. S. Crawford, as quoted in Franz Georg Maier, Neue Wege in die alte Welt. Methoden der modernen Archäologie, Hamburg (Hoffmann und Campe) 1977, 27

- Riederer / von Rohr (eds.) 1973: Kunst unter Mikroskop und Sonde. Naturwissenschaftliche Untersuchungen an kulturhistorischen Objekten

- Maier calls the new technological methods in archaeology a second "pioneer age" in archaeology - in fact from the material (digging / material excavation) to the data-processing epistemology <Maier 1977: 27>.

- contributors to a publication by F. R. Hodson / D. G. Kendall / P. Tautu (eds.) *Mathematics in the Archaeological and Historican Sciences* (Edinburgh / Chicago: Edinburgh University Press / Aldine Atherton, 1971) point out that the statistical methods, quantification and computer processing of data does not relieve the technically registered data from the need to be interpreted but human evaluation. Mathematics can - in a circular argument reminiscent of Alan Turing's statement on "computable numbers" (1936/37) - only be helpful in sharpening aspects of analysis which *can* be made pure mathematical (Kendall), not establishing certainty but reducing the level of uncertainty <front flap>.

- structural affinity between archaeology as material-orientated science (as opposed to philology - as long as its hermeneutic method is

bot being replaced by statistical analysis[44]) and computing, in a auxiliary and a methodological sense. Inbetween the material monument and the philological text record stands the inscription.[45] Furthermore, the pratice of constructing genealogical filiation of manuscript tradition in the diagramatic form of *stemma* applies a mathematical method; monks copying an ancient manuscript for tradition "made mistakes, either involuntary (carelessness) or voluntary (the desire to correct the source)" = Sorin Cristian Nita, Establishing the linkage of different variants of a Romanian chronicle, in: ibid., 401- 410 (402)

- distinguish "*descriptive 'archaeography'* " of material findings "from more *interpretative archaeology* in a narrower sense"[46]

- Anthony Grafton, Bring out your dead. The past as revelation, 2001, 338 (notes to pp.193-196), note 63: "*Jacques Spon*, Recherches curieuses d'antiquite, Lyons 1683, Preface, sig. a3r: '*Archaeographia* est declaratio sive notitia antiquorum monumentorum'"

- not by coincidence one of the first sciences in the humanities department applying maschine computation has been archaeology; publication by J. D. Richards / N. S. Ryan, *Data Processing in Archaeology* (Cambridge / New York / Melbourne: Cambridge University Press, 1985). At the same time, data processing a s archaeology (for that reason the book mentioned is, for its most part, an introduction into computer programming). Media archaeology is not just a way of remembering "dead media", but rather a mathematical aesthetics; modelling, statistics and especially cluster analysis (e. g. for the distribution of objects in a grave field) one the fields where archaeology made use of data processing with electronic computers

- mathematization of archaeology: "In my view the contribution of IT and statistical techniques have a central role to play in supporting archaeological interpretation. The archaeological judgment must take precedence yet making that judgment is frequently not straightforward. Even the beneficial contribution of such 'hard' science such as radio carbon determinations of date or ground penetrating radar to archaeological interpretation, rely on operators having a close empathy with archaeological material, the context of discovery and the role of post-depositional processes. If the post-processional reaction to

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[44] See Liliana I. Boneva, A new approach to a problem of chronological seriation associated with the works of Plato, in: Hodson et al. (eds.) 1971, 173-186

[45] See Alexandra Stefan, Applications of mathematical methods to epigraphy, in: ibid., 267-275

[46] C. A. Moberg, Archaeological context and mathematical methods, in: ibid., 551-562 (533)

the scientific inductivism of the 'New archaeology' of the 1960's shows us anything it is that we need to be aware of the contexts in which we may apply our tools, be they computers or trowels" (communication Peter Rauxloh, Information Strategy Manager, Museum of London, July 2002)

- avantguarde among academic disciplines (within "Humanities") to apply electronic computing has been Archaeology, not by chance but reveals as structural affinity. Archaeology, esp. (appropriately so-called) pre-historisch archaeology, deals with pure (material) data, no narratives (textual tradition) like classics (Greek and Roman philology). In many ways, archaeology is close to mathematics. Epistemologically, this becomes clear with Michel Foucault's propositional *archéologie* = Martin Kusch, xxx

J. D. Richards / N. S. Ryan, Data Processing in Archaeology, Cambridge / New York / Melbourne (Cambridge University Press) 1985

Techno-culture studies and/or "cultural techniques"

- German term *Kulturtechniken* names practices like agriculture, mathematical symbol calculation or body movement such as rhythmic; dancing a kind of automatization or extension of the human; Kapp's notion of 1877 "organ projections"; these practices still essentially depend on the human body or mind to be *performed* - different from truly automated processes which are *operated* by (and inbetween) machines

"Left" vs. "Right Hegelians"

- Bernhard Siegert, Cultural Techniques. Grids, Filters, Doors, and Other Articulations of the Real, transl. by Geoffrey Winthrop-Young, New York (Fordham University Press) 2015

- split into "left-Kittlerians" and "right-Kittlerians"; "Sybille Krämer's and Bernhard Siegert's explorations of 'cultural techniques' expand notions of the kinds of operation that might constitute mediality, which allows the human to reenter the discussion. One cornerstone of “cultural techniques” is an ontological reversal whereby activities such as counting *precede* the associated concepts such as number, normally thought to come first" = Winthrop-Young, Geoffrey, Cultural Techniques: Preliminary Remarks, in: Theory, Culture and Society 30, no. 6 (2013): 3–19 (15)

- door as cultural technique media-epistemologically differs from circuit switching / Thyratron vauum tube: "The access protocol of telematics replaces that of the doorway. The revolving door is succeeded by 'data banks', by new rites of passage of a technical culture masked by the immateriality of its components" = Paul Virilio, The Overexposed City, in: Zone 1-2 (1986), 545

- Guidonian hand as the embodiment of a long-standing cultural technique = Horst Wenzel, Von der Gotteshand zum Datenhandschuh: zur Medialität des Begreifens, in: Krämer / Bredekamp (eds.), Bild—Schrift—Zahl, xxx, 25–56

- "Kittler's media became practices in the hands of the proponents of cultural techniques, whereas the media archaeologists homed in on object-centered epistemologies. [...] From a media-theoretical perspective, the question of whether sounds are stored in the magnetic charges of a cassette tape, binary code, a music box, or indeed the muscle memory of a pianist is of central significance. Media archaeology argues that the medium is not merely a vehicle that is somehow external to music but is rather inextricably connected with it: the sounds exist only in and by virtue of the medium. And the study of cultural techniques explores seemingly mundane activities - pointing, flattening, grid-making - from the perspective of their medial import. According to either of these approaches, textual, analog, and digital forms of inscription constitute entirely different worlds" = Alexander Rehding, Introduction, in: Journal of the American Musicological Society, vol. 70 No. 1, Spring 2017, thematic issue "Discrete / Continuous: Music and Media Theory after Kittler", 221-256; http://jams.ucpress.edu/content/70/1/221

TECHNOMATHEMATICAL IMPLEMENTATIONS: TECHNOLOGICAL LIBERATION FROM THE HAND AND NON-HUMAN FORMS OF EMBODIMENT

Signal analysis and dis-embodiment

- relevant time structure for understanding technical media not its historicity but the time structure of the signal event itself, in technical layers like tuning systems (resonant circuit), techniques to build and to en-act (bias) hardware, principles of parameter setting. Knowledge of media history has its legitimation when the question is how technologies are embedded in broader cultural textures. But this can only be the secondary step; the first has to be a reconstruction of the specific time structures unfolded by signal processing in technology itself, its temporal relations

- Micro-tempor(e)alities; time-critical signal processing in humans and machines; either analogue (continuous) or discrete time; electronic synthesizer: "Attack" and "Decay"; notion of "transients" in signal processing; discrete time signal processing for signals defined only at discrete points in time (quantized in time, but not in magnitude), such as telegraphy (Morse code)

- Media as agents of signal analysis: biological data (from the human body) are retrieved (and transformed) by time-varying measure media (such as sonography, electrocariograms); signals being defined as "time-varying or spatial-varying physical quantities". "In the context of signal processing, arbitrary binary data streams and on-off-signals are not considered as signals, but only analog and digital signals that are representations of analog physical quantities" = entry "Signal Processing", http://en.wikipedia, accessed on 25 November 2010

- media-archaeological levels: "In communication systems, signal processing may occur at OSI layer 1, the Physical Layer (modulation, equalization, multiplexing, etc) <...>, as well as at OSI layer 6, the Presentation Layer (source coding, including analog-to-digital conversion and data compression)" = en.wikipedia

- Operative diagrammatics = physical "embodiment" of symbolic languages; computational mathematics, implemented in the physical world, means being-in-time; Warren S. McCulloch applies term "embodiment" of logical (Boolean) algebra in neurons

- J. C. R. Licklider researched the essentials of what constitutes "hearing" in humans and animals (auditory analysis): "Is there, built into the auditory nervous system, a *mechanism* <W. E.> [...] that supplements the cochlear frequency analysis?"[47] His very use of terms stems rather from electronic engineering, thus dis-embodying the analysis of human hearing

- businessman becomes a servomechanism of his clock, and explicitely "the cyberneticists - and soon the entire world - of his computer2 = Marshall McLuhan, The Playboy Interview: Marshall McLuhan, in: Playboy Magazine, März 1969 (*online* www.columbia.edu/~log2/mediablogs/McLuhanPBinterview.htm), as

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[47] J. C. R. Licklider, Auditory Frequency Analysis, in: Colin Cherry (Hg.), Information Theory. Papers read at a Symposium on 'Information Theory' held at the Royal Institution, London, September 12th to 16th 1955, London (Butterworths Scientific Publications) 1956, 253-268 (254)

quoted here from: Martina Leeker, Camouflagen des Computers. McLuhan und die Neo-Avantgarden der 1960er Jahre, in: Derrick de Kerckhove / Martina Leeker / Kerstin Schmidt (eds.), McLuhan neu lesen. Kritische Analysen zu Medien und Kultur im 21. Jahrhundert, Bielefeld (transcript) 2008, 345-374 (350)

- Licklider, Man machine symbiosis, 1960

Implementations

- in computer science, implementation refers to realization of a technical specification or algorithm *as a* program (software) = http://en.wikipedia.org, entry "Implementation". When a piece of computer hardware can interpret a programming language *directly* (in a transitive way), that language is called *machine code*. A so-called *native code compiler* is one that compiles a program into machine code.

- the "instance" refers generally to any *running* process, specifically to an object as an instanciation of a class; the sister concept to "embodiment" from a media-archaeological point of view. the Smalltalk programming language e. g. is conventionally implemented by compilation into bytecode, which is then either interpreted or compiled by a virtual machine

Measuring "embodiment" with technological devices

- critique of neuro-scientific laboratory equipment als *dispositif*: "Neuroimaging techniques requiring the test participant to lie in a scanner, however, are inappropriate to investigating the process of music-making: the confines of the scanner make for unnatural bodily posture and limited movement; the noise in the scanner would prevent the participant from concentrating on musical-auditory events. Electroencephalography (EEG) does not allow the musician to move their heads freely, as it is difficult to remove motor artifacts from EEG signals. Functional near-infrared spectroscopy (fNIRS) technology, as explored in a pilot study carried out by the author and colleagues using NIRScout, a portable NIRS system, imposes minimal physical constraints on the participant (when playing piano or a string instrument); nonetheless, current neuroimaging techniques require many more improvements to be reliable tools for investigating the process of music-making. On the whole, the question of what the dynamic processes of kinaesthetic simulation underlying the process of musical shaping towards fulfillment (and the co-shaping process taking

place in music perception as well) look like can be most efficiently addressed by investigating the neurodynamic processes involved in music-making and music perception; such an approach does more justice to the temporal process of (co)shaping a piece of music than current structure- or function-oriented neuroscientific methods."[48]

- In neurophenomenological (vs. media-archaeological) investigation of the aesthetic experience of music (Helmholtz 1863); temporal structures from neuroimaging data can be analyzed most efficiently when using a neuro*dynamic* approach, whereas at present structure- and function-oriented neuroscientific approaches are dominant = 168

- embodiment as (not only loose, but tight in Heider's sense) integration of the human into the (time-based) machine (Jan Claas van Treeck); the human becomes a chrono-prosthesis of the machine, analogous to Turing's insight from 1936 that, when calculating, man is in the "machine state"

- "Implementation" of the symbolic (algorithms) into the real; "embodiment" extends (beyond the biological body) to what media archaeologists call "implementation" (from informatics), being essentially a (diagrammatical) question of being-in-operativity as comparable - yet disctinct - to human performativity; common denomiator: "music" and (neo-logically) "algorhythm"

Gaming with the Pin Ball machine

- "liberation" of the painterly hand by photography (Henry Fox Talbot, *Pencil of Nature*, 1844)

- just as human hand is coupled (in the cybernetic sense) to the Pin Ball game machine as known from public houses, as described in a typescript entitled "Flipper" by Friedrich Kittler from the 1960s or 70s which immediately anticipates the first generation of computer games (in the sense of Pias 2002); published in Kittler, Bagersee (2015)

- "Wenn der Mensch nur dort ganz Mensch ist, wo er spielt, so wird auch er, wenn sein Mitspieler Automat ist, zum Unmenschen" (Kittler ibid.); counts for the temporal realm as well; when discretely (not analog / diagramatically) calculating either in his mind of coupled to

[48] Jin Hyun Kim, Shaping and Co-Shaping Forms of Vitality in Music: Beyond Cognitivist and Emotivist Approaches to Musical Expressiveness, in: Empirical Musicology Review, Vol. 8, No. 3-4, 2013, 162-172 (167)

pen / quare paper, man is in (Turing-)Machine state (Lacan)

- "attack" in the keys of the electronic synthesizer; "Spiele, die ins rasche Reagieren einübten" (Kittler), since 19th century table tennis (finally resulting in "Tennis for two" game on analog computer)

- Wilhelm Wundt's psycho-physical laboratory established at Leipzig University (to be continued by Hugo Münsterberg in the Harvard Lab version later)

- challenge in anti-aircraft prediction in World War II from the point of view of the artillery, as confronted by Norbert Wiener - explicitely giving rise to *Cybernetics* itself (Wiener 1948, Introduction) - and by Claude Shannon in a different approach separating the physical laws of the machine (airplane) from the idiosyncratic (counter-)reactions of the human pilot.

- human Pin Ball machine player with his hand(s) as interface to the automaton has to adopt to the tempor(e)ality of the machine; the equivalent to tactics in the temporal field is time-criticality; that moment, he turns into a cyborg, a true cybernetic organism: part of a closed circuit (German *Regelkreis*) in terms of systems theory, becoming nothing more or less than one (analog) element within an system circuitry

- intransitive automatic regulation (literally: "cybernetics", government) replaces manual transitive control; even the gesture of directing a cup of tea to the lips (in Wiener's example, 1948), in close motion-tracking analysis, is revealed as an ongoing, in the worst case oscillating (tremor) feed-back between the motoric and the visual.

- function of the Serbean and Bosnean one-string instrument *gusle* in the oral poetry. They are not meant primarily to entertain the audience but they serve as servo-motoric feedback for the poet in the performance and re-genration of "formulaic" (Milman Parry), thus: rhythmicized epic songs.

"Hands-on-time": time axis manipulation

- notion of hand-based instrument control extends to the term time-axis-"manipulation" as well (as known from kinematographic operations like the film cut and slow or fast motion).

- "Thumb movies" (German "Daumenkino") produces the kinematographic effect of movement by hand; hand-driven

phonograph / gramophone

- ears as (supplementary) "time sense" organ in human perception much more time-critically sensitive to variances in speed resp. frequency of acoustic waves ("music", sound) than in the reproduction (and transmission) visual movement

- Talbot points out the non-human temporal efficiency of the photographic shot in *The Pencil of Nature* (referring to plate III „Articles of China“), that "the whole cabinet of a Virtuoso and collector of old China might be depicted on paper in little more time than it would take him to make a written inventory describing it in the usual way. The more strange and fantastic the forms of his old teapots, the more advantage in having their pictures given instead of their descriptions."

The phantasm of self-recording nature

- *Kymograph* as self-writing nature ("Selbstschreiber"); deriving from that: phonographic cylinder which is not score notation of musical performances by the human hand but immediate acoustic recording. But academic culture lags behind; see Bela Bartok's manual transcription of Hungarian folk song recordings

- coupling human hand - tool vs. alphabetical writing: symbolic notation. In music: score notation = without "hand on instruments", vs. instrumental play = Jens Gerrit Papenburg, Der Synthesizer als Apriori. Körper und Maschinen in der Popmusik, in: Paragrana 14 (2005) 2, 91-104 (94)

EXPERIMENTING MEDIA-TEMPORALITY

Introducing "Experimenting media-temporality" (Pythagoras, Hertz, Turing)

- "Circular Causal and Feedback Mechanisms in Biological and Social Systems"[49]

- one level of temporality which is in a flash-like manner revealed in the "experimental event" is the micro-temporal behaviour of the media in question; the second one is what it does to (or with) the "temporal

[49] The original title of the so-called Macy-Conferences in New York, ed. by Heinz von Foerster 1949, and subsequently by v. Foerster / Mead / Teuber 1950, 1951, 1953, 1955

sense" of the human experimentator, and c) what are the consequences for the historiography of such experimental settings: On the one hand, they clearly belong to what we call and describe as cultural history (or "history of knowledge" in more Latourean terms), but on the other hand (from the point of view of the media themselves, that is: the media-archaeological perspective) there is something at work which is indifferent to historical change, the "time-invariant event"

Against reduction to discursive effects

- "Experiment as event" reformlated as "experiencing eventuality"

- a media-experimental setting is an artificial configuration based on cultural knowledge - but still it is nature, since there are electro- or even quantum-physical laws at work which are not completely dependend on the respective cultural discourse. The media-experimental event cannot be reduced to discoursive effects. Just like the historian Reinhart Koselleck insisted - againt the relativity of historical interpretation - that there is always the "Veto-Recht der Quellen", there is an eqivalent in media-technischal experimentation.

Applying the media-archaeological method

- media-archaeological method is close to the experimental. In media-experimental setttings, not static ontological objects, but micro-momentary processes are being unrevealed (a kind of Heideggerian *aletheia*, "Lichtung" / electric lightning). The figure/ground dichotomy, so prominent since early *Gestalttheorie* (Edgar Rubin 1915, Max Wertheimer xxx) and returning in Marshall McLuhans model of "tetrads" in media-historical configurations (*The Global Village*), here transforms into a dynamic essence: "Die Gestaltpsychologie in dieser Form ist nur vor dem Hintergrund der Erkenntnisse der Elektrodynamik von Maxell, Faraday, Helmholtz und Hertz über das elektrische Feld denkbar. <...> Die Weise, wie sich potentielle Figuren innerhalb eines Grundes (Feldes) verhalten, ist dem elektrischen Feld analog."[50]

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[50] Kathrin Kadelbach, Der Versuch einer Zeitfigur der Fotografie, Hausarbeit (2009) zum Seminar *Irriationen und neue Formen der Zeitwahrnehmung durch Medien* (Sommersemester 2008) am Seminar für Medienwissenschaft der Humboldt-Universität zu Berlin, 32 (unter Bezug auf ein Argument in: Richard Zakia, Perception, Evidence, Truth and Seeing, in: The Concise Focal Encyclopaedia of Photography, Elsevier (Focal Press) 2008, 239-250 (242)

- epistemological focus: media temporality in a flash-like manner revealed in the "experimental event"; the micro-temporal behaviour of the technological media in question (that is: "under experiment"); secondary (derived) phenomenological aspect = what it does to (or with) the "temporal sense" of the human experimentator; audio-visual and computing media address humans at the existential essence of their sensation of being-in-time. While media historiography concentrates on the figurative phenomena, electronic media archaeology reveals the ground or rather: field

Looking *versus* listening at the monochord

- Charles Sanders Peirce on *diagrammatic reasoning*: "Similar experiments performed upon any diagram constructed to the same precept would have the same result."[51]

- reenacting procedure which Pythgoras experimented with the monochord in the 6th century B.C. today, that is: when pulling such a string, actually reenacted is the techno-physical insight of the relation between integer numbers and harmonic musical intervalls which once led Greek natural philosophers to muse about the mathematical beauty of cosmic order in general (including the experience and fear of deviation of this aesthetic ideology resulting in the "Pythagorean *komma*", that is: irrational number relations). Admittedly, when we pull the string, we are certainly not in the same historical situation like Pythagoras, since the circumstances, even the ways of listening and the psycho-physical tuning of our ears, is different. But still the monochord is a time-machine in a different sense: It lets us share, participate at the original discovery of musicolgical knowledge, since - in an almost Derridean sense (expressed in his *Grammatology*) - the original experience is repeatable; the experiment allows for com/munication across the temporal gap (bridging a temporal, not spatial distance like mass media do).

- Peter Heering / Falk Rieß / Christian Sichau (eds.), Im Labor der Physikgeschichte. Zur Untersuchung historischer Experimentalpraxis, Oldenburg (Bibliotheks- und Informationssytsem) 2000, esp. 9-23 (on textual vs. artifactual evidence), and 142 (on the ideosyncracies of the experimental setting ("Eigendynamik"), and *eigenzeit*

- Vincenzo Galilei undertook a number of experiments with a lute to

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[51] Charles Sanders Peirce, Collected Papers, Bd. II: Elements of Logic, Cambridge, Mass. (Harvard UP) 1932, 350 <prüfen!>

investigate the nature of musical harmonics" = As described in: Vincenzo Galilei, A Special Discourse Converning the Unison, trans. in Claude V. Palisca, The Florentine Camerata. Documentary Studies and Translations, New Haven / London (Yale University Press) 1988, 203-205; kind of media-based archaeology of the acoustic: "Galilei employed the lute here not as a musical instrument but as a piece of laboratory equipment [...]." Once within experimentation time, it can be re-enacted.

- reproducing nature with cultural means; *physis* is here both agency (measuring instruments, subject to physical and mathematical laws) and object of experimentation, in a co-originary way

On the diagrammatical level, the re-enactment is time-invariant; on the operative level of implementation, the materiality of the medium itself seems to impose certain vetoes rooted in the historicity of the instrument, but in fact, the epistmological operation remains intact in principle (*archaeo*logically): "I [...] set out to replicate this experiment using a lute built in the 17th century by an unknown maker [...]. The present condition of the instrument required the use of some substitutions for the mateirals oroginally used by Galilei in his experiment; however, these did not affect the basis tenets of the experiment."[52]

Once human senses are coupled with technological settings (media setttings), man is within an autopoietic temporal field, a chrono-regime of its own dynamics (or mathematics, when data are registered digitally). Such couplings create moments of literal ex-ception: Man is taken out of the man-made cultural world (Giambattista Vico's definition of "history") and confronts naked physics.

- another "instanciation": the pendulum; Christian Kassung, Das Pendel. Eine Wissensgeschichte, München (Fink) 2008

- experimenting media-time as media-temporal experience

The media-electronic equivalent to the vibrations of the monochord string is, of course, the electromagnetic wave. On experimenting media time, let us refer to the archaeology of television in John Logie Baird's system.

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[52] Claude V. Palisca, Was Galileo's Father an Experimental Scientist?, in: Paolo Gozza (ed.), Number to Sound. The musical way to the scientific revolution, Dordrecht / Boston / London (Kluwer) 2000, 191-199 (195)

Intermezzo: Re-experiencing Baird's television

- once human senses are coupled with technological settings (media settings), man is within an autopoietic temporal field, a chrono-regime of its own dynamics (or mathematics, when data are registered digitally). Such couplings create moments of literal ex-ception: Man is taken out of the man-made cultural world (Giambattista Vico's definition of "history") and confronts naked physics. Another "instanciation" of my argument would the pendulum (as experimented by Galilo Galilei and Christiaan Huyghens)

- media-electronic equivalent to the vibrations of the monochord string: the electromagnetic wave; refer to the archaeology of television in John Logie Baird's system; best method for *understanding media* is their re-engineering and putting into function; in this case: an operative modell of Baird's *Televisor*. Nowadays in England, the Narrow Bandwidth Television Association (www.nbtv.org) since 1975 takes care of such early electromechanic, low-definition television. "The Association continues to extend its achievements, including the spanning of the Atlantic in January and February 2003 in emulation of J. L. Baird's 1928 exploit."[53] *Nota bene* the use of the term "emulation", which signifies a kind of re-enacting which is co-temporal to the original itself. There is an experimental Televisor kit offered by the Middlesex University as a "teaching resource" (www.mutr.co.uk); accompanying brochure brings out that media time is about functional equivalence, an in fact: repeatability, functional re-enactment (to take a notion developed by the historian Collingwood) in experiencing hight-tech media time is closer to the criteria of an experiment in natural sciences than to historicist idea of history: "The *televisor* you have just purchased works in exactly the same way as the original, but uses modern components such as an LED instead of a neon lamp for pucture illumination." And more specifically: What difference is between a functionally equivalent electronic component and its actual embodiment (such as the electronic vacuum tube and its functional replacement by the transistor)?

"It is about one third of the size of the commercial televisor - but the performance is as good" <ibid.> - a transformation of original to model (in simulation respectively emulation). The central a-historical criterium remains: "performance" as *gleichursprüngiches* re-enactment.

Sound and vision as radio and light waves (Heinrich Hertz)

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[53] Quoted from the brochure accompanying the Televisor kit offered by the Middlesex University as "teaching resource"; see www.mutr.co.uk

- Wolfgang Hagen, Technische Medien und Experimente der Physik. Skizzen zu einer medialen Genealogie der Elektrizität, in: Rudolf Maresch / Niels Werber (eds.), Kommunikation, Medien, Macht, Frankfurt/M. (Suhrkamp) 1998, 133-173 (*online* www.whagen.de)

In 1879 Hermann von Helmholtz initiated a prize (Berlin Academy of Sciences) to answer the dispute which was the true theory of electricity: Weber / Neumann (no wave-like transmission, broken through an intermediary medium, but rather immediate re/action, in the tradition of Newtonean physics), or James Clerk Maxwell: Electromagnetic waves are part of an encompassing electromagnetic spectrum like light, thus subject to temporality, a limited speed.[54] Radio waves, on the very media-archaeological level (that is, before becoming part of a mass-medium called "radio"), in other words, have a *sense of ending*.

- electric sparks known since pieces of amber rubbed with textile, named after Greek *elektron* since Thales of Milet; such sparks already behaved like "radio" - but missing detector, both mentally (in humans) and technocally (no "detector" until Eduard Branly's "Coherer" since 1890, invented as a laboratory device, further developed by Oliver Lodge in 1894). Radio as such "found" but not invented in the laboratory; rather put together by entrepreneurs like Giulielmo Marconi who combined the Hertzean apparatus with Brandly's device and Popov's antenna to a functional tool for transmitting wireless Morse code); still, the experimental system "knew" it already: Douglas Kahn, Radio Was Discovered Before it Was Invented, in: Golo Föllmer / Sven Thiermann (eds.), Relating Radio. Communities, Aesthetics, Accesss. Beiträge zur Zukunft des Radios, Leipzig (Spector) 2006, 24-32. Such alreadyness as index of a non-historical media temporality which is equally original each time ("gleichursprünglich")

- media archaeology concerned not with inventions but dis-coveries

- experimenting vibrations: electro-magnetic wave propagation, that is: the media-archaeological experience of technological media, is not (merely) prehistory, but alternative appraoch to what has become the mass medium called "Radio"; Heinrich Hertz' discovery that electromagnetic waves propagate by means of high-frequency excitation of an open oscillating circuit, the result of a research query. Radio meant at first specifically not language and music but rather radio waves for wireless telegraphy, particularly radio telegraphy in marine radio after 1900. Term "radio" accordingly meant literally, in order to emphasize the specific properties of electromagnetic fields,

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[54] See Wolfgang Hagen, Das Radio, Munich (Fink) 2005, 30

namely the radial effect of the waves, broad-casting on the physical plane. It is therefore not enough to characterize radio simply as a device for receiving radio broadcasts, referring primarily to their content. Based on radius, that is, ray, the message is above all the medium: electromagnetic waves and high-frequency electrical signals, transmission, and sound, enunciated in latency

- electrotechnical transformation of speech into signals, of signals into waves, into recording and radiation

- Marconi took coherer as thunderstorm detector, combined it with the idea of a transmitting antenna. Marconi practicing wireless telegraphy; in 1901, communication bridged the Atlantic using electromagnetic waves for the transport of coded signals; "wireless" not always been synonymous with radio; patent registered in1904 by Marconi's engineer John Ambrose Fleming, further developed an effect detected by Edison in light bulbs, by which electricity can flow from filaments to an additional enclosed electrode, even if no direct contact exists. In his patent manuscript of 1884, *A Manifestation of the Edison Lamp*, Edison explicitly describes electricity flowing through the vacuum «without wires»—literally «wireless,» radio inside the evacuated, etherless tube itself]

- spark gap transmitters generate pulse-shaped waves; why Heinrich Hertz did not already consider radio as acoustic content in his experiments; early radio was closer to Morse Code than to what we know as radio today, or, to put it differently: it was literally digital before it became, through speech and music modulation, an analog medium. The digital managed its reentry through pulse code modulation—with which radio in fact finds its way back to its original potential as broadcast medium; 1906, when the International Wireless Conference in Berlin regulated the handling of wireless communication; only with the introduction of tube technology that the human voice or music lastingly replaced Morse Code. Radio as function of a technological escalation: the vacuum tube; opposite of such electronics based on low-voltage current the Telefunken high-frequency machine transmitter of 1912 with a frequency of 10 kHz, which could be transformed up to 170 kHz, making telephony attempts from Königs Wusterhausen to Vienna possible in 1913; mechanical limits of such wave generation forced the paradigm change to the field of nearly inertialess electronics, the realm of the modulatable electron stream in a vacuum / electron tube transmitter

- invention of the electronic vacuum tube by Robert von Lieben in Vienna and Lee de Forest in the USA at the same time and independently in 1906 as the decisive technohistrical mark of co-

originality; 2006 therefore "one century of radio"? even antique radio, when successfully transducing signals, never in a historical state, rather in a present state; technological medium does not conform to the historicism of linear epochal concepts but infrastructual *durée* as *epoché*; in actuality, it undermines this logic and sets a different temporal economy

- an original recording resonating today from an old tube radio, provided it is still run on 220 volts, hardly makes history audible. A tube-based radio thus practices compressed time as respects sensory perception, as long as this is not overlaid with «historical meaning,» which cognitively does not correspond to the actual media workings of radio but rather to the logic of inscribed historiography

Technological addressing of human being (in time)

- experimental means of investigating eventality, temporality, duration, and becoming; primary level of temporality in a flash-like manner revealed in the "experimental event"; the micro-temporal behaviour of the technological media in question (that is: "under experiment"); the second one is what it does to (or with) the "temporal sense" of the human experimentator; AV media address us at the existential essence of our sensation of being which is the temporal sense

- AV media address human senses at the existential sensation of being temporal phenomenology. They re-generate temporal experience, thus adressing the human on the sensory (aisthetical, physiological) level as radically present, while our cognition puts it into a "historical" context: here, a dissonance takes place, a gap opens, a *différent* in Jean-François Lyotard's sense (referring back to Kant)

The genealogy of mass media from measuring (experimental) media

- "No analysis of natural science, whether it be physics of biology, is complete unless we possess a proper analysis of its appropriate time-concept2 = Norbert Wiener, Time, Communication, and the Nervous System, in: Annals of the New York Academy of Sciences, Bd. 50, 1948/50, 197-219 (197)

- "In experimental settings nature tells us something which does not exist somewhere in the natural world" (Haley)

- electro-physical measuring / recording of cultural articulation

(digitally by "sampling") subjects the signal event to experimentation, thus enabling a non-hemeneutic analysis of cultural articulation on the sub-philological, even sub-alphabetic level

- media-archaelogical context which led to what later became mass-media like the phonograph, kinematography, electronic television; such media have first been develped for experimental research, for analytic, not projective purposes (even the genuinely theory-born computer). To put it roughly: Any listening to music on records or to radio programs therefore is essentially experimental, a kind of reverse experimentation. The well-known television tube has developed out of a mesuring device, Ferdinand Braun's electronic oscilloscope, like the Edison phonograph has been preceeded by Léon Scott's "Phonautograph" to register the frequencies of the human voice for analytic purposes. Tuning (analog) radio is experimenting with radio waves and their electromagnetic resonances. The public use of "synthetic" mass media is *reverse experimentation* of analytic media (a term alluding to the media-archaeological practice of "reverse engineering").

The time-critical dimension as a genuine form of media experimentation

- both in humans and machines where micro-temporal events are crucial for the whole process to succeed at all - as an epistemological object of knowledge not only relatively new in occidental culture but one which came into focus only my hight-precision time-measuring media itself. The time-critical dimension is a genuine form of active media knowledge and archaeology. Only with such instruments as Christiaan Huyghens' pendulum clock, leading to the introduction of minutes and even seconds on the clock skale, and more specific with elecro-mechanic measuring devices as developed by Hermann von Helmholtz to cope with the speed of communication within nerves, and finally with electronics, the micro-temporal delays (Delta-t) which happen within brain functions could be analyzed; Adrian's electro-physiology with its technological *a priori* = the thermionic tube

Experimental time *versus* history of knowledge

- technological eventuality is time signal vs. history; the experimental diagram vs. historiography which is the act of symbol registering, both by measuring media or humans, in the laboratory

- Edgar Wind, Das Experiment und die Metaphysik [habilitation thesis

1929], Frankfurt/M. (Suhrkamp) 2001, esp. chap. "Theorie des Experiments", 70 ff.

- experimental settings, being unnatural / artificial, clearly belong to what we call and describe as cultural history (or "history of knowledge" in Latourean terms); on the other hand, from the point of view of the media themselves, that is: the media-archaeological perspective, there is something at work which is indifferent to historical change, the "time-invariant event"

Media-eventuality

- Heinz von Foerster's relational definition of *object* and *event*: "Eine mögliche graphische Metapher für die Komplementarität von 'Ereignis' und 'Objekt' ist ein rechtwinkliges Gitter, das von beiden gebildet wird" = Heinz von Foerster, Bemerkungen zu einer Epistemologie des Lebendigen, in: idem, Sicht und Einsicht. Versuche zu einer operativen Erkenntnistheorie, authorized version in German by Wolfram K. Köck, Braunschweig / Wiesbaden (Vieweg) 1985, 81-93 (87); AO: Notes on an Epistemology for Living Things, in: Biological Computer Laboratory Report No. 9.3, University of Illinois, Urbana 1972

- diagrammatic laboratory, where objects and relations meet

- in software engineering, so-called "event" is meant to govern a momentary use of the computer program in non-linear ways (often user-orientation at interfaces); the "interrupt", f. e., makes the mechanism wait for signal input from outside, and in modelling an arbitrary input leads to related events in the simulation.

- "time" and "event": concept of event-orientated programming

- In philosophical phenomenology, the "event" a singular and instant act which can not be subsumed unter general terms but is still constitutively at work for being, acting, knowing. In Martin Heidegger's late philosophical work, the fundamental notions of being (Sein) and time (Zeit) konverge in the event (Ereignis) = Martin Heidegger, Beiträge zur Philosophie (Vom Ereignis) [Gesamtausgabe III. Abt. Unveröffentliche Abhandlungen Vorträge - Gedachtes, vol. 65], Frankfurt/M. (Klostermann), 3rd edition 2003

- analytic ontology (Alfred North Whitehead) focuses on the processual "event"

- processual ontology is close to the essence of media technologies

itself (since only when being in operation a medium is in its medium state). Media archaeology (different from the apparant archaeological metaphor) does not uncover artefacts but events.

- use of the term "operational"; employment of scientists in WKII (esp. British) operational research with the impact of mathematical-statistical methods, OR opens a temporal horizon ("future in the past", the anticipatory prediction of enemy aircraft behaviour), a truly experimental *eventuality*

Beyond experimentation

- in historical research, experimentation does not give access to historic knowledge, since past events can not be experimentally re-enacted (except in experimental archaeology, maybe); argument of historians usually applied to differentiate their hermeneutic discipline from the natural sciences; media-archaeological experimentation (as opposed to historicism) gives access to the invariants of knowledge in time Hermann von Helmholtz declares at the climax of historicism

- "How should an experimenter proceed when faced with a Black Box?" = Wilhelm Ross Ashby, *An Introduction to Cybernetics*, London 1956, 87. Cybernetic replaces experimentation with modelling, culminating in simulation, f. e. of nuclear reactions, by electronic analog computers first (and stored-program digital computing later)

- "referential" writing (as transitive *mimesis*) itself becomes operative: In science, "mathematical symbols <...> have a particularity: they reveal structures"[55], in fact: they become media-archaeological operators themselves (*poiesis*).

Mathematics is diagrammatical in the sense of Charles Sanders Peirce's "diagrammatic reasoning": "Mathematics is just the detection and investigation of structures of thinking which lie hidden in the mathematical symbols."[56]

- distinction between referential and operative writing correlates with

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[55] Max Born, Symbol and Reality, in: Objectivité et réalité dans les différentes sciences, Archives de l'Institut International des Sciences Théoretiques, Brüssel 1966, 151f. See Charles Alunni, Gustave Juvet (1896-1936). Un Pionnier Oublié des Études Cliffordiennes, in: Advances in Applied Clifford Algebras, Basel (Birkhäuser) 2009, 14-38 (26)

[56] Born ibid.

the distinction between semiotic and signal-processing systems

Artistic experimentation as metaphor?

- artist group *Ohio* produced video movies from experimental settings, such as the behaviour of a model rocket in a wind tunnel = video edition *Ohio* # 13 (2004) = www.ohiomagazine.de. "Nicht das Ge- oder Misslingen dieser Experimente ist für die Künstlergruppe Ohio von Interesse, sondern die Bilder sind es, die von ihnen gemacht worden sind."[57] Diagrammatically, media recording has a transitive, techno-aisthetic relation to the experimental event, being a form of kinematographic analysis of the kinetic event, while its media-artistic re-play has an intransitive, esthetical value. Film essayist Harun Farocki, made such cinematographic reflection another form of media theory itself: *Auge / Maschine*

- media artists Jan-Peter Sonntag, in his "Son:arc project", re-stages historical experiments on electricity as "research art"; a similar "experimentation as *art* event" takes place in his investigation of the Polar Light (Performance at the Alfred Wegner Institut Bremerhaven, October 30, 2009), tracing the so-called "Warden Sprites". There is a kind of electro-magnetic Tsunami caused by solar turbulences, as seen in September 1859 as emantation of "Nordlichter" around the globe. Nineteenth century electric telegraphy was disturbed by such "natural radio" even before radio as cultural broadcasting had been invented - a kind of retro-media archaeology. SPRITES are ultra-short appearances of light between the troposphere and the ionosphere (the reflecting medium for short wave radio) which cause echoes in (natural) ELF waves (Etrem Low Frequency). Such "events" are used by Jan-Peter Sonntag to modulate fluorescent tubes fill with lightning gas (causing "TESLA-light") and to cause perceivable sound out of these ultra- and infra-sonic waves. "Sferics" is the technical term for atmospheric long-wave radio signals caused by thunderstorms et al.

- Beam Forming: "acoustic camera", based on a microphone array, makes acoustic events in space visible in ways which locate the source of sound. Thereby one sees what is heard synaesthetically, based on time itself as a channel: signal runtime differences (Delta-*t*). What looks like a spatial operation, takes place in the time domain and thus turns space into an event. The experience of space by temporalization is known in its crudest form by binaural hearing in humans, and as echo location. But such mechanical evidence in Newtonean space

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[57] Ohio (Uschi Huber / Jörg Paul Janka), in: Zeitschrift für Medienwissenschaft 1/2009, 104-113 (104)

failes within the electromagnetic field.[58] The Siemens Studio for Electronic Music, as preserved and displayed in the Deutsches Museum at Munich, demonstrates how the very existence of electro-acoustic as art form is a direct function of measuring media. Only electronic devices develop an "ear" for the EM

Media-archaeological experimentation

- contrasting the chrono-photographical experimental setting of Eadweard Muybridge to answer the question if horses in the course of galopping at one moment lift all four legs above ground (which it too fast to be noticed by human eyes, such as the painterly gaze), laboratory setting constructed by Ernst Mach and xxx Salcher to measure the speed of a bullet by electro-photographical short-circuits made use of the electric spark as subject and object of photography itself. In both cases, the camera time-critically recognizes events which the human eye does not see at all.

- In her installation *Blow up TV* the media artist Angela Bulloch uses a key visual, a sequence from Michelangelo Antonioni´s film *Blow Up* (1966): the protagonist, a photographer, hiding behind a tree taking photos to discover a murder; but in trying to identify the spot, the closer the camera looks, the less is the apparent murder an evidence [siehe Karl Krauss? "Je näher man ein Wort anschaut, desto ferner schaut es zurück"]. The artist extends this process of identification by yet another magnification, enlarging the digital scan of this scene in great blocks of its single pixels. Thus the image *implodes* by slowing down the cinematographic motion to one digit per second (thus undermining the copyright which is based on the recognizability of the motive for the spectator), and on the other hand the original image *explodes* within a sequential modular system of purpose-build so-called *pixel boxes*, where one pixel is represented in a 50 x 50 cm monitor which are attached to complex RGB lighting systems which can be generated and programmed with any digital information[59] - a desillusion of the image betrayal of the human eye, reavealing the scanner-gaze of the computer which is "looking" at a different kind of evidence, not looking for letters any more. The pixel modules - which also point at the fact that digital images are hyper-indexically composed by pure information, as opposed to the referential image like

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[58] See Johannes Gfeller, Der Referenzgerätepool von *AktiveArchive* an der Hochschule der Künste Bern, in: Schubiger (ed.) 2009, 212-221 (215)

[59] Such is the installation *BLOW_UP T.V.* of Angela Bulloch in the gallery Schipper & Krome, Berlin, September to November 2000

the classical photography which still suggest a pre-discursive real - were developed by Angela Bulloch and Holger Friese, indicating that multi-media archaeology requires high-technical skills.

- pixel = smallest conceivable picture element, which makes sense in a semantic way only when appearing within a group. When the square of light made by a single pixel is 50 x 50 cm, the distance between the viewer and the group of pixels must be large in order to discern the image; the closer the media-archaeological look, the more distant the "image" becomes

- in addition to spatial distance, a temporal extension. In order to perceive a "movie" (moving images composed here by pixels), the momentary glance does not reveal the temporality. It takes time (like David Gordon's *24 Hours psycho*) to see a movie this way.

- media experimentation basically experimentation of temporal figures

- Swiss video artist Jean Otth manipulated the line deflection electronics of a TV set in order to create a simple horizontal line on the screen which is pulsed by the intented, but not realized line transfer rhythm. He called this 1974 piece *Exercice IV de l'abécédaire télévisuel*; reconstruktion of this video installation in Kunstmuseum Luzern (2008), catalogue: Irene Schubiger (ed.), Schweizer Videokunst der 1970er und 1980er Jahre. Eine Rekonstruktion, Zürich (ringier Verlag) 2009, 92. A measuring test of the signal flow on the oszillocope proves that this has been a conscious manipulation and not just a defect of the apparatus.[60]

- media archaeological analysis gains insights from the technological devices in operation. Disassembling and re-assembling devices; as well *symbolically* opening the "black box" to get insight into what media do; investigate program close to the machine like Assembly; Signal Laboratory focuses on operational media analysis; computer platforms are in working condition; „hands on“ approach is imperative; historicity vs. functional equivalence in Retro-Computing

Transatlantic alliance: Media Archaeological Lab / MAF

- Lori Emerson's Media Archaeological Lab (University of Bolder, Colorado); MAL and Media Archaeological Fundus (Media Studies, Humboldt University, Berlin) somewhat complementary (with "Signal

[60] Johannes Gfeller, Anmerkungen zum restauratorischen Hintergrund der Ausstellung, in: Schubiger (ed.) 2009, 124-135 (125, figs. A and B)

Laboratory" inbeween, keeping alive computer game platforms). MAL concentrates on electronic literature, while MAF investigates the "literature" (programming and hardware circuits) of early computing (and other media); conceptual exchange between literature, digitality and electronics

- TESLA Televizor 4002A in MAF in two variations: its "consumer" appearence and its "analytic" presence (bare chassis) to make students reflect upon the difference between media as interface and as technology (the close analysis of 4002A clearly reveals the continuity of that TV set to pre-Second World War developments of electronic television, thus bridging the historical/political discontinuity by media-technological continuity. This is a starting point to develop a theory of media time); museological challenge of technical objects (from hard- to software) in museums

- Media Archaeology Lab run by Lori Emerson at University of Colorado at Boulder; active purpose in preservation of "obsolete" computer platforms, to provide access, for scholarly analysis, to re-enactment of media-cultural past: works of digital literature, mostly from before the era of the WWW, along with the platforms they were created on and for Internet reading (which is "reading" by the machines at the same time); computer hardware and software such as Apple Macintosh and Hypercard; the lab's underlying philosophy "driven by several different strands of media archaeology" (communication Lori Emerson, November 2012); http://loriemerson.net/media-archaeology-lab

- Lynn Hershman-Leeson's film *Conceiving Ada*; by code the present time can be in touch with the past - a media-archaeological rather than media-historical short-circuiting of (media) times; reminds that media archaeology is not just about the digging metaphor, but about mathematical clearness as well.

- the mathematical layer of media-archaeologial research and teaching; http://blogs.loc.gov/digitalpreservation/2013/02/archives-materiality-and-agency-of-the-machine-an-interview-with-wolfgang-ernst

- MAF (Media Artefact Pool) as teaching collection made up of "antique" / techno-archaic artefacts that are (anachronistically in the media-archaeologica understanding of technological temporality) highly relevant to our contemporary media culture – ranging from an electron-ray indicator tube to a temperature sensor used as a periphery device on an early Commodore 64 computer; oriented around the concept of an operational Media Theatre; objects not presented as examples of design; instead, focus primarily on the objects’ function and internal

aspects / functionality

DIAGRAMMATICS OF DIGITAL MEMORY

Media Archaeology in Foucauldean terms

Archaeology, in Michel Foucault's notorious definition, does not imply the search for a beginning; it does not relate analysis to a geological excavation; it rather questions the already-said at the level of its existence: the enunciative function that operates within it, the discursive formation, and the general "archive" system to which it belongs - which is implemented algorithms today.

Positioned between archeology as academic discipline of analyzing material culture and the Foucauldean notion of the *archive* as the set of rules governing the range of what can be verbally or audiovisually expressed at all, media archeology is an awareness of moments when media themselves, not exclusively humans any more, themselves become "archeologists" of epistemic objects (imaged-based image retrieval); beyond Marshall McLuhan, media are not just extensions of men any more, but have become autonomous, creating a chrono-poetics of their own.

The non-human meaning of "media archaeology"

By necessity, any archaeology is - at least in its initial approach - suspended from making cultural sense prematurely (classical hermeneutics). Being confronted with the absence of humans in sites of material culture and with non-human artefacts, archaeology has been "posthumanistic" always already.

What does it say about "human" communication if its effect can be achieved by intermediary transsubstantiation into binary data processing, storage, compression and transmission, like in smart phones? Even human communication itself is signal transduction first of all (acoustically), and already coded (articulated language / alphabetic writing). When the "most human" in cybernetic and communication engineering analysis turns out to be the most symbolic, the with*in-human* is revealed (*aletheia*). When Hermann Helmholtz published his seminal *Lehre von den Tonempfindungen* in 1863, the subtitle declares a kind of sonic *arché*: the "physiologische Grundlage", as almost literal "foundation" for the theory of music

Media Archaeology refers to nonhuman procedures by not

concentrating on media on the level of their surface effect on humans (phenomenal interfaces), but rather uncovers the hidden agenda of technomathematical artefacts, their artefactuality. Nicole Starosielski's research on the undersea cables of international communication is "reminding readers about the materiality of the virtual. Circulation takes place not in the ethereal clouds, she writes, but in cables underwater"[61].

In order to become aware of such infrastructures, Media Archaeology takes the point of view of the machines themselves, which is not anthropomorphizing technology, but rather mechanomorphic itself. The procedures of signal measuring, A/D conversion, and data processing are kind of "inhuman hermeneutics", knows things which are hidden from human sensual perception. At the same time, technologies as materialized knowledge are product of theoretical reasoning and cultural engineering , therefore not alien to human perception but in alliance with procedures within the human itself, like the language machine and cognitive calculation. Instead of defining technologies as "nonhuman" agencies (Latour), discover signal events within the human machinery itself such as voice-as-frequencies below logocentrism (the cybernetic "communication" assumption). Shannon's "Mathematical Theory of Communication" temporarily relieves "information" from all semantic references; a transmitter of radio waves "communicates" with the radio receiver; computers communicate within the in-between *alias* Internet

Media as physical channels of communication and as technical artefacts are operated by symbolic codes and streaming data. This asks for analysis in ways different from textual studies; the archeological gaze is enumerative rather than narrative, descriptive rather than discursive, infra-structural rather than sociological, archaeographical rather than historiographical.

The difference between Media Archaeology and Classical Archaeology is the implicit sonicity (analog signal transduction) and musicality (digital algo/rhythm) of technological events. While sharing with classical archaeologists attention of the material artefact ("hardware"), the essence of media archaeology comprises the *operative*, processual mode of technologies, since any technical artefacts is in a *media* state only when actually transducing signals or processing data. Otherwise, it is just a piece of material furniture. In terms of media-archaological description, this leads to replacing verbal techno-symbolical *ekphrasis*

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[61] Niko Higgins, in: Twentieth-Century Music 14/1 (2017), 153–158: 157, referring to Nicole Starosielski, The Undersea Network (Durham, NC (Duke University Press) 2015

by directly showing the artefacts in operative motion, that is: by "movies"; see https://www.youtube.com/watch?v=V37S95AE3Pc

The media-theatrical scence is the confrontation between the "operative" machine and the "performative" human, investigating the delicate human / apparative coupling of such things called media.

Displacing narrative media history: diagrammatic media archaeography

Media archaeological analysis is diagrammatic, in the sense of the "rôle intermédiaire du diagramme entre le geste et le symbole".[62] Operative diagrammatics is not restricted to the electric circuitry of analog media, but aims at understanding how digital media put mathematical algorithms into operation, how it technically transforms algebraic formulas into commands, and how engineering routes and automates functions that humans have mistaken as exculisvely human before.

In digital media communication, counting, algorithmics etc. preceded discursive narration; still Media Archaeology does not want to relegate Media Studies as part of the Sciences Faculty (mathematics, engineering) exklusively; it is as well rooted in the philosophical faculty ("Humanities") since its ultimate target of technological knowledge is to make explicit the epistemological insights which are implicit in the technical commands, executions and operations.

The temporal aesthetics of Media Archaeology is a-historical; it is not about contextual information about past media, but creating situations where getting into contact with media in its radical operability and temporality. When studying the papers of the Turing estate in the archives of King's College, Cambridge, this does not result in a historian's contextualization of past discourses but in sharing the mathematical situation in its non-historical presentness - which applies to the turingmachine (*alias* computer) itself; its operational functions are the media archaeological momentum which is, at its core, un-historical.

The "radical" media-archaeological approach to media temporality is mathematical by nature. Fourier-Analysis transforms the time axis of wave form signals such as acoustic vibrations or electronic image scan

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[62] Guerino Mazzola, La Véritè du Beau dans la Musique, Paris (Delatour France) 2007, 153, referring to Jean Cavaillès, Gilles Deleuze, Gilles Châtelet und Charles Alunni

lines into the frequency domain

["Eine Archäologie dieser Frequenzen wäre in dem Moment gewährleistet, in dem "es gelingt, einen Zeitbereich ganz ohne Metaphysik und Geschichtsphilosophie in den Frequenzbereich zu transformieren"[63]]

- a geometrization which, according to Bernhard Vief, has been prefigured by the spatialization of oral speech as vocal alphabetic notation already. On the infrastructual level of cultural discourse, this has severe consequences for the cultural technique of narrative which is transformed into matrix, topology, diagram.

The gap widens between epistemologically oriented history of knowledge and techno-epistemological media archaeology; the latter rather looks at operativity of circuit diagrams which transduce electric signals

- technical devices become "media" only in instanciation; such operativity embodies a different temporal logic compared to "historical time"

- in McLuhan´s terms, "cold" listening to technologies differs from "hot" historical (or historiographical) imagination

- cybernetic epistemology implied by the "digital retro-action" idea of a feedback-loop between analogous past and digital present addresses the "archival", discrete paradigm of past-as-databank(s) as opposed to analogue, narrative historiography in linking past to the present

- digital retro-action in a techno-active sense takes place, actually, by the digitization of analogue source material from the audio-visual (broadcast media) archives and in the present: translating analogous world into a digital matrix; referring to the past, digitization of records from the past affects paper with new options of accessablity by intelligent search algorithms, as well images and sound; micro-temporality in the operativity of data processing

- computers "retro-actively" transform narrative aesthetics into non-discursive, algorithmic configuration of events

Operational media archaeology

[63] Friedrich Kittler, Draculas Vermächtnis. Technische Schriften, Leipzig 1993, 200

- January 2014, by chance discovery of a waste TV, half covered by years of dust, grass and leaves: an old tube-based television set in the woods north of Berlin; careful "excavation" happens with reflecting in parallel about the multiple tempor(e)alities of decay / entropy which are involved in such a device - from the almost indestructable vacuum tubes down to the electric circuits which partly dissolve into something like abstract geometry; re-enacting TV set from reading its electronic circuitry as operative media diagrammatics

- storage as crystallization of temporal objects resp. recycling; endurance of storage becoming increasingly more short-term. ROM (long-term read-only memory) challenged by RAM, by random access. Final storage transforms into interim signal buffering; still, storage does not disappear; "cloud computing" emblematic of the other kind of distancing that takes place when a range of storage is outsourced and increasingly calculation is externally performed ("apps"); proprietary servers with implications for data retrieval (and reuse). Such data whether from the fleeting messaging patterns of mobile cultures or data saved on external servers retrievable in computer forensics applied now to digital cultural heritage practices; Matthew G. Kirschenbaum, Ovenden, Richard; Redwine, Gabriela (2010) Digital Forensics and Born-Digital Content in Cultural Heritage Collections Council on Library and Information Resources (CLIR) publication 149, http://www.clir.org Washington; question of who legally has access raises a different set of questions not touched upon by the more technologically focused approache

- link between technological frameworks and aesthetics; in the sonicistic sense, "music" models media time. The sonic and the rhythmic as exemplary cases in understanding of algorithmic media: how are instructions executed, how the executive operationality of data takes precedence to interpretation or semantics. Manovich claimed that the logicof database replaces that of the narrative in digital media = Lev Manovich, The Language of New Media (Cambridge, MA: The MIT Press, 2001), appl a similar idea from the point of view of temporality. Referring to Vilém Flusser, model of historical time was deeply intertwined with alphabetic writing which reduced the multidimensionality of architecture and images to linear, sequential lines

- television as a specific regime of the image that is not static but continuously regenerated in cycles of scanning of the cathode tube ray – line by line, which implies a different linearity to that of the narrative. Digital networks incorporate the temporality of “pings” of the ICMP protocol: echo request, echo reply are the basic communication

rhythms that sustain the transfer of information over the net. (cf Pias 2011). This brand of media studies starts from the signal as the basic unit for analysis – and as Wendy Chun has noted, “signal” affords itself both towards “physical events and symbolic values” = Wendy Hui Kyong Chun, Programmed Visions. Software and Memory (Cambridge, MA: The MIT Press, 2011): 156; signal processing capacities of technological devices dependent / aimed at / communicate with sense-specific human perception physiology; online streaming, especially with slightly slower Internet connection that halts at times to load the content; this reliance on the signal as a time based process in earlier mass media; technological signal processes addressed / oriented at human perception; the signal-to-noise ratio is governed by complex diagrams familiar to engineers and mathematicians: the statistics inherent in transmission, or the specific colour worlds this has related to

- TV broadcast of any football game, on the monitor surface, displays the signal-to-noise ratio between players on the field and amorphous shots of the spectators in the stadium, statistically

- archeology of media researches configurations of hardware for what can be interpreted as circuitry (electronics) resp. a program (computing)

- for media archeology, the only message of television is this signal: no semantics; in electronic television (video), color blue has a veto in chroma key resolution; same goes for the blue screen, and for manipulations of resolution and color filters

- technologies of *aisthesis*; Claude Shannon's engineering perspective on the primacy of channels and signals that temporally processed in channels as grounding (McLuhan) on which data, information and hence cultural forms are being sustained and distributed in technical media culture; mathematical codes and in their algorithmic execution, processes defined by patterns of signals unfolding in time; *dynamic ontology*: frequencies instead of beings, quantities instead of qualities and functions instead of attributes, to paraphrase Bernhard Siegert (referring to Max Bense) = "Cacography or Communication? Cultural Techniques in German Media Studies", 40: "Like physics, aesthetics is a science whose primary object is signals, the physical materiality of signs."

- technological media is to be understood from the viewpoint of its channel capactiy which counts with time (bits/sec.). It is less about the objects of/in those channels than about the operations which introduce the patterns, pulsations and intervals through which information

becomes a reality of the channels before becoming a reality for the phenomenological viewers/listeners/readers of media

- a techological medium is defined as the physical passage which mediates something codified, and gets decodified at the other end; emphasis on the primacy of the channel for the tool box of the media theorist: the blunt existence of a channel as a physical reality is where media starts, literally "metaphorical"

- underlying processes of signal processing, operating, executing, and synchronization form media microtemporality and time-criticality as the road for media archaeology; distinguish the uniqueness of media studies from "cultural studies"

- all software refers back to operating systems; further back (as its condition of possibility / *apriori*) to the BIOS (basic input/output system), and so forth – tracking a “kind of descent from software to hardware, from higher to lower levels of observation” = Friedrich Kittler, ”There is no Software” Ctheory-journal, 10/18/1995, http://www.ctheory.net; at the end, nothing but voltage differences, techno-linguistically