[Wolfgang Ernst: NOTES ON TECHNICAL MEDIA]

NOTEBOOK "MEDIA ARCHAEOLOGY, AND 'CULTURAL TECHNIQUES"

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

Thematic blocks:
- *Media Archaeology*
- *"Cultural Techniques"*
- *Technological Analysis*

Detailled content of thematic blocks:

Media Archaeology:

NOTES ON MEDIA ARCHAEOLOGY
- Modelling electric circuit diagrams
- The non-human meaning of "media archaeology"
- Operational media archaeology

INSIDE MAF
- Media-archaeological "labs" / MAF
- Media-Archaeological (Impro-)Vis(it)ations
a) Inside Media-Archaeological Fundus
b) Inside Signal Laboratory

TRANSITIVE MEDIA-ARCHAEOLOGY. Technical Reasoning in the Presence of Operational Artefacts
a) MAF demonstration in the presence of technological artefacts:
"*transient media [philosophy]*"
- Hegel's Ghost
- MAF with Lessing
(Dis-)Locating the MAF in Hegel's House
Media of Inertia
b) Signal Laboratory:
- An alternative to digital computing: analog computing
- Artificial Intelligence as a challenge to Transitive media philosophy

LOGBOOK MEDIA ARCHAEOLOGY
- Technophysical aspects of "landline" telephony

"Cultural Techniques":

NOTES ON "CULTURAL TECHNIQUES"
"Cultural techniques" vs. techno-mathematical operations

Answers of Media Archaeology to Cultural Techniques Studies
Cultural techniques vs. technological idiochronicity
Technological media processes within / -out Cultural History
Media-temporal processes and their break from cultural history
The Autonomisation of Culture and History: The Micro-Time of Technical Media
Annales Sangallenses
Techno-culture studies and / or "cultural techniques"
- Huhtamo's precision in archival and artfactual research; engineering or programming dilettant trying to be precise when it comes to technological details, sometimes resulting in "total surrender"

Technological Analysis:

NOTES ON (TIME-)IMPLEMENTED TECHNOLOGY
Signal analysis and dis-embodiment
The cybernetic premise
Measuring "embodiment" with technological devices
Gaming with the Pin Ball machine
Man-machine complicity: punched cards, and genocide
Experimenting media-temporality
Against reduction to discursive effects
Looking *versus* listening at the monochord
Re-experiencing Baird's television
Sound and vision as radio and light waves (Heinrich Hertz)
Technological addressing of human being (in time)
The genealogy of mass media from measuring (experimental) media
The time-critical dimension as a genuine form of media experimentation
Media-eventuality
Beyond experimentation
Artistic experimentation as metaphor?
The media-ecological challenge
Operative diagrammatics: Symbolical notation as (re-)construction of a machine

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NOTES ON MEDIA ARCHAEOLOGY

- media archaeology a method for studying media close to technology, but with an epistemological bias, and closely related to the archive

Modelling electric circuit diagrams

- retrospectively from today's omnipresence of the "flipflop" in binary computing, "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 mixtures of iconic signs, indexical signs and symbols; interrelating 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. [...] 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. [...] 'Signals that are scarcely audible with the ordinary audion connection can be amplified to a point where they are too strong for, *and 'paralyze' the most stable audions*'. In the Eccles-Jordan trigger this pathological bias became the one and only purpose" = TS Siegert (IKKM discussion), referring to Edwin Armstrong, Patentschrift 1,113,149, Patent abstract, p. 2

- 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 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 techniques 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 harmonic system). Now imagine constructing a *separate* symbolic simulation of each 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

- Ihnatowicz' re-translation of digital data into analog computing, to increase the speed of his installation. "Fortunately, the circuit diagram for the predictor survives and was simulated using SPICE, a standard circuit simulation software package" = Paul Brown, Charlie Gere, Nicholas Lambert, and Catherine Mason (eds.), White Heat Cold Logic: British Computer Art 1960 - 1980, Cambridge, MA (MIT Press) 20xx, pdf 118

- Kittler's (phantom) Harmonizer necessarily embodying 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 on the computer, and analog simulations by the *simulation device itself* [...]" = Trenholme 1994: 120

- in the Kantean sense of an *archeology* of philosophy: "As the archaeology of our thought easily shows, man is an invention of recent date. And one perhaps nearing its end. If those arrangements were to disappear as they appeared, if some event of which we can at the moment do no more than sense the possibility – without knowing either what its form will be or what it promises – were to cause them to crumble, as the ground of Classical thought did, at the end of the eighteenth century, then one can certainly wager that man would be erased, like a face drawn in sand at the edge of the sea" = Michel Foucault, The Order of Things. An Archaeology of the Human Sciences [FO 1966], Oxford / New York (Routledge) 1989, final paragraph (p. 422) - like from silicon, which is literally the material basis of the Internet

The non-human meaning of "media archaeology"

- archaeology not reduced to search for a beginning, analysing the enunciative function that operates within technology, the general "archive" system to which it belongs - which is implemented algorithms today

- moments when media themselves, not exclusively humans any more, become "archaeologists" 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

- by necessity, any archaeology suspended from making cultural sense prematurely. Being confronted with the absence of humans in sites of material culture and with non-human artefacts, archaeology has been "posthumanistic" always already.

- what it says about "human" communication if its effect can be achieved by intermediary transsubstantiation into binary data processing, storage, compression and transmission, like in smart phones; human cognition capable of dealing with mobile tele-presence without suffering from a choque of physical absence. 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 referring 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" = 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

- in order to become aware of such infrastructures, taking the point of view of the machines themselves, which is not anthropomorphizing technology, but rather mechanomorphic itself; procedures of signal measuring, A/D conversion, and data processing 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 operated by symbolic codes and streaming data; archeological gaze analytic rather than discursive, infra-structural rather than sociological, archaeographical rather than historiographical

- implicit technosonicity (analog signal transduction) and musicality / digital "algo/rhythm" (Miyazaki) of technological events. While sharing with classical archaeologists attention of the material artefact ("hardware") and its self-understanding as *science* (e. g. the special issue on "Archaeological Science", launched by *Archaeological Discovery* (AD), an international academic journal, for 2023), 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* by directly showing the artefacts in operative motion, that is: by "movies"; see https://www.youtube.com/watch?v=V37S95AE3Pc

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

Operational media archaeology

- 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" while 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

- in the technosonicistic sense, "music" modelling 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; logic of database replacing 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 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

- for media archeology, message of television is the 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 are 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 formulas unfolding only in their algorithmic execution
- technological media understood from the viewpoint of its channel capacity 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 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 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

- all software referring 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, in: Ctheory-journal, 10/18/1995, http://www.ctheory.net; at the end, nothing but voltage differences, techno-linguistically

INSIDE MAF

Media-archaeological "labs" / MAF

- media archaeological analysis gaining insights from the technological devices not as museum pieces, but while in operation ("in being"); core media-archaeological form of operative (material and logical) analysis: disassembling and re-assembling tools (both hard- and software); as well *symbolically* opening the "black box" to get insight into what media do; investigate program close to the machine like Assembly; Signal Laboratory focusing on operational media analysis; computer platforms in working condition; „hands on" approach is imperative; historicity vs. functional equivalence in retro-computing

- TESLA Televizor 4002A in MAF in two variations: its "consumer" appearance and its "analytic" presence (bare chassis), reflect upon the difference between media as interface and as technology; close analysis of 4002A clearly revealing 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, starting point for a theory of media time

- Media Archaeological Lab (University of Bolder, Colorado) concentrating on electronically generated literature, while Signal Laboratory (Humboldt University, Berlin) investigating the "literature" literally: (programming

and hardware circuits) of early computing (and other media); conceptual exchange between literature, digitality and electronics

- pandemically necessitated "virtual guided tour" through MAL / MAF, in 2020 / 21, a media-epistemic concern; instead of virtually emulating an experience of MAL or MAF (whose items are all about real presence), rather resist the YouTube live-stream or Zoom temptations; whole point of media archaeology its insistence on the material presence and actual (instead of recorded) operativity of media matter; once submitting to "digitization", the hardware argument already lost, and MAL / MAF have sold their souls to the virtual devil; turning this challenge into a productive argument: rather develop more media-archaeologically "genuine" (algorithmically born) forms of "navigation" of MAL (or MAF) from within the software-based space itself (Stefan Höltgen's experiment with Minecraft)

- Media Archaeological Fundus made up of "antique" techno-archaic artefacts that are anachronistically (in the media-archaeological understanding of technological temporality) highly relevant to our contemporary media culture

– MAF artefact assemblage 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

- function of MAF, at the same time, to actively dis-continue / contrast previous media memory, in order to face the different challenges of algorithmicized media culture; in Technical Museum Stockholm only one TV set left on display, one rather displaced film projector, a fossil-like steam engine; one operative "Amateur Radio Room"; classic media departments now rather dis- or even replaced by temporary exhibitions on robotics / AI / Machine Learning, and Computer Games

Media-Archaeological (Impro-)Vis(it)ations

a) Inside Media-Archaeological Fundus:

- copper commemoration plaque reminding of philosopher Hegel's ghost

- facing Pergamon Museum: "analog" media devices new "antiquity" of the present / flashing moments of "now" (Jetztzeit) in Walter Benjamin's sense (Theses on the Notion of History, XIV)

- media sculpture: cinema projector Ernemann not for documentation of

media cultural history, but media-archaeoloical "focus" (literally, for optical media), through glass window, on irruption of electronics into a mechanical image-projecting device: photocell for transduction of optical information into audible sound

- asymmetric dialogue (media-theatrical mise-en-scène): cinema projector (Ernemann) vs. MAF (Bosch)

- exciting moment: MAF in a state of transition, dissolution [Auflösung] or rather analysis: not closure, but de/construction

- sample artefacts: cigarette filter (magentophone "singing paper" Plaeumer); Kittler's soldering / wiring of synthesizer module; Korg MS-10 facing "analogue computer" patching: twin

- objects like Panasonic picture phone: princiüpally on the move, belong to different categories, as technical "individuals" (in Gilbert Simondon's sense "On the Existence of Technical Things"): TV / telephone

b) Inside Signal Laboratory:

- (dis?)continuous transition from MAF to Signal Laboratory (not "Lab" which mostly consist of computer workstations only in Digital Humanities)

- see "Lab book" by Parikka et al.

- point to media-archaeological objects inside Signal Laboratory, continuing cross-relation to MAF: analog computers as twins to electronic synthesizer Korg (patchable); *sounding* mathematics / ratio (the hard-edged meaning of Media Archaeology, different from "obsolete media"); "patched" first video game (not on digital computer!) Tennis for Two; relic from ex-nuclear education TU Berlin: reactor simulation; paradigm of simulation

- forthcoming: new patch on MEDA analogue computer an artificial neural net; AI the new challenge to platform-oriented (hardware) and Assembly-oriented (software) Signal Laboratory, where there is still "no software" in Kittler's sense, since all AI operations still run on (quasi parallel) extended von Neumann computer architectures, but the (principal! Turing 1937) undecidability of algorithms, when confronted with massive "big data", make the difference

- contemporary media (even AI / Machine Learning) still techno-logical: hardware / software; actualize / revision / modification Kittler theorem? "there is no 'deep' machine learning"

- error-detection TV for educational use: in fact operative diagrammatics; insight from the backside revealing the "two bodies" / techno*lógos*: of contemporary electronics: logical design (circuitry) on the one hand / becoming flesh (electro-technique) on the other

- reverse engineering / insight: opening "black box" as core media-archaeological imperative

- is the symbolic (with Lacan), the circuit diagram, implemented in / as the real in different topologies: not logics, but rather idiosyncrativ connectivity; core TL question: the actual embodiment (physical) or implementation (software) of electronic media not subsequent to techno-logical reasoning, but co-originary

- at Berlin Medien Science (not: "studies") BA / MA educational unit "Historiograpy *versus* Media Archaeology"

- notion of "cultural techniques" denying the destinction between "media" and "culture" from the beginning; practically though:

- failed unification between Kulturwissenschaft and Medienwissenschaft; continuing Institute for M & M: media science "with ears", against 90 % visual orientationof film, television, computer imaging media studies

TRANSITIVE MEDIA-ARCHAEOLOGY. Technical Reasoning in the Presence of Operational Artefacts

a) MAF demonstration in the presence of technological artefacts: "*transient media [philosophy]*"

- in fact: *daimon*stration; technological idiosyncrasies unfolding only with media in operation / being

- lecture *daimon*stration different from "lecture performance"; notion of performativity still focused on human body, white media-archaeological attention shifting to media *operations*

- MAF's most obvious (De-)Monstration: The Ernemann Cinema Projector in its "dramatic" asymmetry posed against the Bosch "MAZ" TV recorder

- Revealing the "Bit": The Flipflop Demonstrator

- Media-Epistemic "Toys": the KYBERNET

- How a Cigarette finds its Way into a Technical Collection: not simply a reference to Kittler (the heavy intellectual smoker) but to the occasional invention of the magnetic tape

Hegel's Ghost

- *entry*: Hegel commemoration plaque at MAF address Am Kupfergraben 4b; Hegel no ideal philosopher of technology exactly because of his logocentric philosophical idealism; like Schelling's (vain) defence of "natural philosophy" vs. scientific technical experimentation concerning, e. g., electro-magnetism: contemporary to Michael Faraday (analog media) and Charles Babbage (digital computing)

- lecture series *Fundus fundamentalis* (e. g. Benjamin Heidersberger on / with modular analog synthesizer EMS); different mode of lecture-demonstration *in the presence of artefacts*; Hegel / Marx / Lukacz: *reification*; "house ghost" Hegel would not mind more "abstraction", but Media *Science* department indeed appreciating argumentation that is closer to the technical medium

Dialectically opposed to media theory which is spatially and temporally distanced observation, media archaeology opens the black boxes of technology (both hard- and software) for a close reading of its operative elements. That leads to the concept of a "transitive media philosophy" that undermines the familiar notion of "media theory" itself.

MAF with Lessing

- "functional" spaces: Lessing's *Laocoon* 1766; Reclam edition (Studienausgabe) Stuttgart 2012

- precursor of aesthetics as media semiotics: room- vs. time-based "arts" / *technai*; techno-logical artefacts existing as material artefacts or surfaces (analogue to "sculpture" and "painting" in the fine arts), but becoming "media states" only when driven / enacted by time signals (mechanics, electricity, code); thereby Lessing's dichotomy collapsing

- Lessing, though, missing autopsy / the "close reading" of technological artefacts both a) as electric circuitry on material level - media archaeology, b) as code for "digital" media - media philology; "Protestant" Lessing focussing on *sola scriptura* (as reminded by Umberto Eco, IBM vs. MacIntosh computer interface aesthetics)

Media of Inertia

- theme proposal (Pias) for Stanford-Leuphana School (June 2024): Latin *acedia*, engl. inertia, latency; later smoothed to »Art, Technlogy, and the Problem of Acceleration«

- "media of *de*celeration" in fact concrete artefacts: real resistors and condensers as basic electronic elements on MAF workbench

- workbench actually in analogy to dissection table (German *Seziertzisch*) in anatomical theatres for academic teaching of medical science / technical anatomy as the main "stage" of *media theatre*

- the condenser serving as smallest energy "battery" device: not emphatically for long-time storage from the past, but rather as buffering in the extended time-window of the present

- resistor: deceleration of electron flow in closed electric circuits

- delay lines: materially delayed signal; spiral spring as reverb device (German *Verzögerungshall*) from ex-Eminent-electroacoustic organ

- book cover image of publication Christoph Borbach, *Delay*

- magnetic tape echo (sonic signal) delayer "COPICAT (WEM Watkins Electric Music, London), 1970s" / Mickey mouse effect in magnetic tape vs. Springer "Tempophon"; media-archaeological momentum: time axis manipulation (*delay*) achieved by material circuit of tape heads in series; Kittler 1993. "Time (sound) converts into space (tape), and then space (tape) converts back into time (echo sound)" = Amit Pinchevski, Echo, Camrbidge, Mass. / London (MIT Press) 2022, 156; COPICAT moving between reverb (extended acoustic present) and echo (sonic signal from the "past"); significantly works better with discrete impulses than with continuous voice: resulting techno-epistemic spark from transitive operational artefact experience

- ferromagnetic delay unit from Manchester computer: electronic speed / Turing, temporary storage; Turing on "mercury delay line", vulnerable to thermodynamic entropy (temperature) as irritation / subversion of the symbolic order ("digital" signal processing) by the physically real (in Lacan's terms, as applied to technical media by Friedrich Kittler, GFT 1999): *nickel* Runtime Memory (German *Laufzeitspeicher*) where the binary information is hardware-"coded" (not symbolically, but in the real) as torsion shaft (German *Torsionswelle*) into the wire, to be "received" and "decoded", in the end, after a defined duration

- VFO (Variable Frequency Oscillator) at Kork synthesizer MS10

- challenge for MAF: how can "coded" delay in actual computing be displayed - no longer as material aratefact? not in archival shelves; question arises how this "scripture" is related to the electronic machine; remains the techno-mathematical *gap* in terms of demonstration / *daimon*stration

- insistence on techno-mathematical embodiment of code in order to really (and not simply symbolically) exist in the world, that is: in time; can "code" only be exposed *in action*, not by the sheer material presence of a computer device as such; Lessing 1766: "sculpture" vs. "poetry"; media drama unfolds only *in being*, not as *computer*, but in *computing*; as "demo"(nstration) / can the *daimon* of technológos only be revealed processually

b) Signal Laboratory:

- dealing here with signals rather than abstract symbols, even if superficially represented as alphanumeric code; see Kittler, "There is No Software": every bit, essentially, coming down (media-archaeologically) an electric voltage value

An alternative to digital computing: analog computing

demonstration object in MAF: Telefunken analog computer with installed first computer game "tennis for two" (see Pias, Computerspielwelten)

- exCOMPUTEC-READY / The media-archaeological alternatives to the familiar linear, narrative and progressive concepts of a techno-historical timeline are media-temporal foldings and recursions in the sense of McLuhan's *Laws of Media*. His model of "Tetrads" (as operative diagrammatics) states that a current medium, once it has been displaced by a new technology, first becomes displaced and dysfunctional, but will not disappear. "Obsolete" media unexpectedly recur in a new context. As such, the "undead" analog computer ("the anlog thing", as coined by Bernd Ulmann) returns: if not in its historical form, but in related principles such as quantum computing, "unconventional computing" (Andrew Adamatzky) and artificial neural nets for AI and "Deep" Machine Learning.

- a challenge remaining to the "materialism" of hardware-oriented media science with its MAF: how to expose / display the mathematical aspect of the / theory-born Turing machine (1937) as a model answer to the metamathematical question of "computable numbers"? answer: media archaeology insisting on computing as "embodied" mathematics, connected to the crucial question (German *Gretchenfrage*): computer mechanized mathematics (Turing 1937) or a mathematization of the machine?

- "drama" of MAF the encounter of matter and code (the real / the symbolical); how can such techno-mathematical entanglements be put on (material) display?

- even terms like "embodied" mathematics and "embodied cognition" (Chalmers / Clark) still logocentric; should rather be reformulated to something like mathematization of matter / concept of "structurally programmable" matter (Conrad) different from "matters of activity" resp. "active matter" concept in HUB Cluster of Excellence research

Artificial Intelligence as a challenge to Transitive media philosophy

In the classical media-archaeological approach, *analysis* literally means "elementarizing" - an epistemic consequence of the (phonetic) alphabetization of spoken language (*parole*) into discrete letters (thesis McLuhan). But such a signal- and "beating" *waveform*-oriented micro analysis of neuronal "communication" in concrete and simple steps is challeged, in "Deep" Machine Learning, by the complex mathematical modelling and processing of "big" training data.

- how "deep" is machine learning? the *unfathomable* (German "unergründlich") challenging the *arché* in media-archaeological analysis of technical devices; can human neural communication be modelled / simulated (but not: emulated) by electric circuits indeed and thereby be investigated, but not their "emergent" complexity in combination of circuitry and algorithm with "big" training data

- see "AIsthetics" *(Glowing Globe* conference title, Rijeka, October 17, 2024); challenge of MAF philosophy by complex / *inscrutable* (German "undurchschaubar") AIsthetics

which brings us back to "deceleration" (German *Entschleunigung*):

- deceleration (technical time-stretching such as in the AKAI real-time sampler for musical events) as temporal *archaisation*, for technical comprehension [German "Nachvollziehbarkeit"]

- the intentional slowing down of complex subsymbolical processing in "deep" neural nets" as step-by-step calculation (in discrete states) leading to a better "understanding" of AI?

- Donald Knuth one invited to analyze what a program does in one second / PhD thesis Gauthier

- adaption to human sense of time an anthropocentric mis-understanding of techno*chrónos*?

- un/explainable emergent (that is, less metaphysically expressed: "complex") patterns in AI / ML as challenge for analytic method of media

archaeology

- in terms of Lessing 1766: "reduce to the max" a) in spatial terms: locating the computing core of artificial neural nets in / as massively parallel GPUs; b) in time-critical terms as digital signal *processing*

- chrono-photographical method of "slow motion" immediately accessible to human "time sense"

- with high-frequency computing, though, the perception of time undergoing "a radical shift between the human scale and the nanoscale" = Andrea Rassell, On perceiving molecular time: computational chemical simulations and the moving image, submitted article for publication; currently under review, *Abstract*

- computational simulations providing a feeling of micro-"neural" time "by smearing an extremely short duration across a longer perceptible duration" while at the same time irritating the human "chronoception" (perception of time), while unexpectedly, the screen becoming "complicit in the expert temporal understanding of scientists" = Rassell ibid., chronopoietically speaking

- the reactivity of artificial neural nets *themselves* being "isomorphic" computational models already

LOGBOOK MEDIA ARCHAEOLOGY

Technophysical aspects of "landline" telephony

- Benjaminesque "aura" of the landline voice (always reminding of a distance, even if affectively close): "Somehow my landline is still kept, quietly it became a kind of secret availability of mine and the end-point of funny or irritating miscalls. With all these, or in spite of these haunting miscalls together I feel, or I would feel it more intimate" = e-communication M. P., December 31, 2023, vs. "radio theory" (Brecht): all of the sudden with the availability of an inviting (new) communication medium: but what to say?

"*Cultural Techniques*":

NOTES ON "CULTURAL TECHNIQUES"

- cultural techniques basic cultural operations, against operative and media-epistemic escalation "from" cultural techniques "to" technologies

"Cultural techniques" vs. techno-mathematical operations

- a technical medium based on cultural knowledge, but still of a physical nature; electro-physical laws at work that are not solely dependent on the respective cultural discourse; media implement knowledge of physical and mathematical laws that both result from and transcend cultural knowledge; technology emerging *from* culture as an autonomous entity *beyond*

- analytic *reductio ad technologiam*; media charged with peaks of materially embodied, highly condensed, time-accumulated (not cultural-"historical") techno-logical knowledge (operative diagram, "Wissensakt"); therefore demanding to be epistemologically unfolded in its accidental (frictions), synthetic self-knowledge; even if rooted in cultural techniques, flipping into autonomous individuation (Simondon)

- "Mathematical symbols [...] have a particularity: they reveal structures" = Max Born, Symbol and Reality, in: Objectivité et réalité dans les différentes sciences, Archives de l'Institut International des Sciences Théoretiques, Brüssel 1966, 151 f.; in fact: they become media-archaeological operators themselves (*poiesis*)

- very term "technology" consisting 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 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 & constitutionis est. Mathematicum medium est magnitudo, vel parvitas intervalli propagatae vocis durationem mentis" = quoted after Hoffmann 2002: 66 ff.; second-order *medium* 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

- "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" = Siegert, Cultural Techniques: 57; concept of "cultural techniques" providing 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" = Winthrop-Young, Cultural Techniques: 14; Kittler's anti-hermeneutic

stance transformed "into a less intransigent post-hermeneutic approach involving certain notions of praxis and limited human agency that Kittler was prone to eschew" = 15

- 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 a 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 Einheitspotential und ihre zwölf Halbtonschritte folglich als 2^{-12} Volt <sic> behandeln" = Friedrich Kittler, Phänomenologie versus Medienwissenschaft, online http://hydra.humanities.uci.edu/kittler/istambul.html, accessed January 22 2018

- 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" = 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) - which only comes in again on a symbolical machine level, the non-opaque coding of computers

- electromagnetic "field" - accidentally discovered by Oersted in a lecture on physics in 1819, systematically experimented by Faraday later, mathematically calculated by Maxwell and finally identified as "radio" event by Hertz, as the core agency in electrified media culture since; this elementary, media-archaeological event undermining even the "analog" / "digital" distinction: the inductive magnetization effect providing memorization both with the tape recorder and in a hard disk drive

- nonlinear media-"historic" short cuts; Media Science not starting 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)

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.

- transitive hand-machine relations subsumed under the field of studies called "cultural techniques" (German "Kulturtechniken") remaining somewhat anthropocentric; media archaeology with its focus on the non-discursive human-machine constellations keeping 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 momentarily suspended

- hermeneutically distant look and "cold gaze" for media archaeology 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 = 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, vol. xx, 474-xxx (496)

- human culture not losing, but winning 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

- 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 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)

- Sylvia Pinheiro et al., The History of Writing Reflects the Effects of Education on Discourse Structure: Implications for Literacy, Orality, Psychosis and the Axial Age, in: Trends in Neuroscience and Education 21 (2020), 100-142 (https://www.sciencedirect.com/science/article/pii/S2211949320300181?via%3Dihub), on "the eras in which people heard sounds, before writing changed our cultures towards focuses on vision" = Marcus Bastos, electronic mail November 18, 2020; fascinating case study of "cognitive archaeology" and a diagrammatic analytics of ancient literature in the Digital Humanities style (as opposed to cultural historiography); truly media-archaeological in its mathematical (computable) approach; text explicitly confirming Platon's critique of the alphabetic impact on human memory; somewhat missing the special "musical" character of the Greek vocal alphabet as opposed to the syllabic writing systems in Oriental cultures; only with single characters for single vowels AEIOU writing becoming literally "phono-graphic"; scientific (rather than "hermeneutic") approach to ancient texts

- according to Walter Ong, electronic revolution in mass media communication devices like radio and television resulting 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) 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; frozen voices, once confined to analogue and techno-archivally secluded storage media, waiting for their (digital) unfreezing. In that media-archaeological analysis, "media are the new capital-s subjects of media archaeology" = Winthrop-Young, Siren Recursions, in: xxx

- physical and electromagnetic laws known to the designers of a *Volksempfänger* from pre-war Germany still in operation in today's enduring AM radio infrastructure; technological encodings "occupy the place once held by the place of the music of the spheres" = Winthrop-Young, Siren recursions

- cultural techniques (such as writing and counting) as pre-condition for technological escalations; an escalation 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 still 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 as 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 the narrative discourse of time-telling

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

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 allowing 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)

- Sotheby's auction object no. 61, heading "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; replicas of such instrument for an active experience of media archaeological analysis by material synthesis

- Sotheby's catalogue, 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; computer preservation has enriched the discussion by introducing the concept of (functional) emulation, as an alternative to historicist simulation

- 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" = 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

- Michel Serres distinguishing 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" = Michel Serres, Der Mensch ohne Fähigkeiten. Die neuen Technologien und die Ökonomie des Vergessens, in: Transit 22 (Winter 2001/02), 193-206 (194 f., transl. by GS; 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; 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 insisting "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" = Bernhard

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

- media archaeology not merely reconstructing historical media practices, also reflects on their time-building, chronopoetic processes

Technological media processes within / -out cultural history

- postal system (transmission) and the archive (storage) 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

- chronology, diplomacy, epigraphy, genealogy, heraldry, numismatics, palaeography, sphragistics, historical cartography: 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*; culture a function of mnemonic strategies and transmission techniques

- discover the specific inner temporality [*Eigenzeit*] of technologies; media archaeology conducting analysis not on the level of macro-cultural production, but rather on the level of micro-technical operativity; 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

- "organ projections" and the *extensions of men* (Ernst Kapp, McLuhan) have developed into cultural servomechanism

- man as codified (or even programmed) by cultural techniques and media technology; media theory actively pursuing the "antiquation" of man (Günter Anders) by distancing the subject-centred perspective through apparatus-based *theoría*

Media-temporal processes and their break from cultural history

- segment titled "Movement and Time" in Gustav Deutsch's film *Film ist* [Film Is] (Austria, 1998): medical X-ray footage of a speaking larynx; 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; scientific observation of a speaking larynx in sets of 12 to 24 X-ray images per second 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* announcing the media–archaeological level in the existence of the apparatus

- "There was a time when archaeology, as a discipline devoted to silent monuments, inert traces, objects without context, and things left by the past, [...] attained meaning only through the restitution of a historical discourse; [...] in our time history aspires to the condition of archaeology, to the intrinsic description of the monument" = Michel Foucault, Archaeology of Knowledge, transl. A. M. Sheridan Smith [*1972], London / New York (Routledge Classics) 2002, Introduction, 3-19 (7 f.); as functions of a process of transmission, technologically generated signals 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 recentlyy – to the computer program which created it, amounting to media self-reference; media technology, while clearly emerging from human / cultural knowledge, resulting 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" = Klaus Szameitat, Möglichkeiten und Grenzen der Automatisierung in der Statistik, in: Allgemeines Stastistisches Archiv 43 (1959), 316- (316), translated by Guido Schenkel. 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; remaining 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" = Raphael Eduard Liesegang, Das Phototel. Beiträge zum Problem des electrischen Fernsehens, Düsseldorf 1891, x (transl. Guido Schenkel); Liesegang referring to entry in: Electricitäts-Zeitung No. 24 (1890). By using 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" = Liesegang op. cit. (transl. Guido Schenkel)The media processes that are thereby set in motion no longer exclusively belong to either nature or culture; Greek term *nómos* already implies a departure

from *physis*, from nature itselt; Faraday understand this field as a form of independent reality with an intrinsic dynamic, detached from the corporeal realm = Carl Friedrich von Weizsäcker, Die Einheit der Natur, München (dtv) 1974, 147 - 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 operating 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" = Maurice Blanchot, The Song of the Sirens, in: idem., The Book to Come, Stanford University Press 2003, transl. Charlotte Mandell, 3; temporality of media transmissions inducing a similar discomfort: Hitchcock's *Psycho* 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; cognitive dissonance: the subliminal perception of the present, but with the cognitive awareness of an alternate perspective, namely that of the past

- technology no longer an organ projection of nature; cultural knowledge negentropic re-configuring products of nature into technological artefacts = 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; radio waves not unnatural (*para physin* – according to Aristotle's *Physics*), rather reproduce the secret of their own wave movement in a generative kind of *mimesis*; artificial nature 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 = Eggert Holling / Peter Kempin, in: Identität, Geist und Maschine. Auf dem Weg zur technologischen Gesellschaft, Hamburg (Rowohlt) 1989, 138; culture not only created 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)

The autonomisation of culture and history: 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 better define time units than the natural cycles (ellipses) in astronomy = Rudolf Taschner, Der Zahlen gigantische Schatten. Mathematik im Zeichen der Zeit, Wiesbaden (Vieweg) 3rd ed. 2005, 56; mechanical media of time measurement dictate their non-discursive internal temporality to culture and turn the observer himself into their own medium; Galileo suggesting that Christiaan Huygens should not to use the human heartbeat, but rather mechanical oscillations in order to measure time; end result is the atomic clock, which is based on the oscillations of a Caesium isotope; atomic clocks defining chronological units now; emancipation of the media of measurement from nature within physics itself. If time is that which is measured with a clock (the Aristotelian definition of time), then it is media time; category of media history is turned inside out, becoming a temporal fold; time itself not computable - unless Aritoteles' definition of

chronos as a function of numerically measuring movement is extended to the extreme

- 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 an ordered progression of step-wise problem solving equals the machine itself. Even if both (logical and material) machines 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 becoming a non-human processual object (emancipating from heart beat) as a function of such techno-logics

- a radio receiving a broadcast, regardless of whether this radio is an old or a recent model, the broadcast always taking 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 represented here. The oscillating string of an instrument still forces its sound – and with it its (intrinsic media) temporality – upon human ears, even if culturally predetermined; differentiation of the acoustic (physics), and the sonic (cultural conditioning); string-based octaves always short-circuiting historical time; human senses do not only conform to a seemingly immediate history of being, but also to the instrumental medium itself; such instruments products of cultural techniques; that is, of a negentropic desire, such as the repeated acoustic experiment, in turn inscribed with a "historical" index which combines with human perception – media time, not history, at work here; contingencies in the success of technical discoveries defying narrative logic; Oerstedt coming 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 induction. From that epistemological constallation derives the media of electromagnetic waves (television, radio, mobile phones): a realm within its own, no longer simply cultural

- category of resonance between two temporal objects merely taken from acoustics as model; resonance 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 – kind of wireless information transfer; something similar occurring in the actual reading of a "historical" text? If it resonates in the moment of reading, it is no longer historical

Annales Sangallenses

- where cultural techniques end and technological media begin; medieval annals not equal to syntactical word listings in Weizenbaum's KI program ELIZA; early Medieval Annals performing the discrete time sequence of a "sampled" continuous function called reality; translation from analogue perception to digital registration (technically: A/D conversion); micro-temporality in operativity of data processing (synchronization) replacing the traditional macro-time, a literal "quantization"

- cinema still adhering to a narrative drama unfolding in time; time now being organized by technology itself = Paul Virilio, Technik und Fragmentierung, in: Karlheinz Barck u. a. (eds.), Aisthesis. Wahrnehmung heute, Leipzig (Reclam) 1990, 71-82 (71)

- Susan A. Crane, *Nothing Happened. A history* (2021); resist to write non-event as narrative, or "history"; Brian Rotman's *Signifying Nothing* (1989), a media archaeology of the cipher "zero" - down to current computing; Ina Blom's *Autobiography of Video*, with a chapter on "boredom" as a major aesthetics of early video art (Bill Viola et al.)

- narratives no longer the sole sense-giving form, not least in current entanglement with (digital) technologies; media archaeological critique of narratives as a sense-giving form; demythologize the notion of collective or social memory for the technological realm of communication media; dichotomy between technical storage and human / "social"

memory; inspiration from the Turing machine in the sense of living, or existing, in discrete states, in non-linear branching

- algorithms displacing 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 95 % of digital administration (setting links), just 5 % "authorship"; programming practice deconstructing "narrative" scenes into most elementary morphological units. Linearity (which in the case of film is based on the irreducable material linearity of celluloid already) has to be introduced articifially on CD-ROMs for guide-lines

Techno-culture studies and / or "cultural techniques"

- German term *Kulturtechniken* naming practices like agriculture, mathematical symbol calculation by haqnd or body movement such as rhythmic dancing as kind of automatization; Kapp's notion of 1877 "organ projections"; such practices still essentially depending on the human body or mind to be *performed* - different from truly automated processes which are *operated* by (and inbetween) machines; Bernhard Siegert, Cultural Techniques. Grids, Filters, Doors, and Other Articulations of the Real, transl. by Geoffrey Winthrop-Young, New York (Fordham University Press) 2015

- 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: Sybille Krämer / Horst Bredekamp (eds.), Bild - Schrift - Zahl, Munich (Fink) 2003, 25–56; differentiate "embodiment" from "implementation"; cultural techniques still body-dependent / humanly embodied (with all its environ*mental* / cognitive "deep" learning contextualizations), therefore always becoming *performative*, but as cultural operations articulating a non-human knowledge which, once implemented as / in technologies as kind of second-order "embodiment", develops into enunciations of its own proper material / energetic *lógos*

Huhtamo's version of media archaeology

- Huhtamo's precision in archival and artfactual research; engineering or programming dilettant trying to be precise when it comes to technological details, sometimes resulting in "total surrender"

- "materiality of media machines" an important element in Erkki Huhtamo's research on early optical media, and the moving panorama, and the mechanical theatre in the Baroque, and forthcoming book on "screenology, or archaeology of the screen"; different shift of focus from technological to visual *tópoi*, cultural memory of man-machine visions such as the "cyborgean imaginary" which, in variations, recur as "pathos formula" (in Warburg's sense) in the cultural imaginary; tradition of E. R. Curtius' studies on literary motive transmission different kind of "topology" than networked graphs; Malraux' *musée imaginaire*, et al.; Warburg, for his Mnemosyne project, in Germany referred to as the founder of Kulturwissenschaft, rather than Media Studies

- recycling of visual clichés and commonplaces in media culture different from techno-logical "memes" (Dawkins) and the bio-technical "cyborg"; Donna J. Harroway 1995 *Manifesto for the Cyborg* on "body modification"; discovering the new / old in the old / new; non-linear time machine; different from Foucault's knowledge-archaeological accent on discontinuities in order to confront new kind of challenges in computational media epoch; resist the metaphor of "excavating" / "revealing" cultural *tópoi*

- re-discursivation of media archaeology (*Verkulturwissenschaftlichung*) a variation of media archaeology, or not at all? rather pre-media archaeology / "unearthing" precursors / "ancestors" in terms of visual *tópoi* missing the technological escalation; one-eyed hybrid of human body with photocamera head not linear derivation of ancient Greek *cyclops*

- machine learners in current AI (autoencoding) able to automatically identify visual *tópoi*; *Suchbilder* project and Legrady's media-artistic installation Pockets full of Memories based on Kohonen SOM algorithm

Technological Analysis:

NOTES ON (TIME-)IMPLEMENTED TECHNOLOGY

- familiarity with most recent technologies necessary for a precise media-archaeological analysis; cannot simply be reduced to "past" practices (even though for archaic "simplification" as reduction to basics)

- "tempoReal" / "mateReal" somewhat idiosyncratic, but intended neographism

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; first step 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 retrieved (and transformed) by time-varying measure media (such as sonography, electrocariograms); signals 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

The cybernetic premise

- "operant conditioning chamber" (aka "Skinner Box") in experimental psychology

- J. C. R. Licklider researching the essentials of what constitutes "hearing" in humans and animals (auditory analysis): "Is there, built into the auditory nervous system, a mechanism [...] that supplements the cochlear frequency analysis?" = J. C. R. Licklider, Auditory Frequency Analysis, in: Colin Cherry (ed.), 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); such a usage of terms derived rather

from electronic engineering, thus dis-embodying the analysis of human hearing

- Licklider, Man machine symbiosis, 1960; businessman becoming a servomechanism of his clock, and explicitely "the cyberneticists - and soon the entire world - of his computer" = Marshall McLuhan, The Playboy Interview: Marshall McLuhan, in: Playboy Magazine, März 1969; www.columbia.edu/~log2/mediablogs/McLuhanPBinterview.htm

- "All Systems Go!" Flux + Cybernetics = Art Machines; vs. Kittler's last remark: "switch off all systems", which at the same time says: do not treat me as a bodily person any more, but as an archival *corpus*, as data persona

Measuring "embodiment" with technological devices

- critique of neuro-scientific laboratory equipment as *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) not allowing for the musician to move freely, "as it is difficult to remove motor artifacts from EEG signals. Functional near-infrared spectroscopy (fNIRS) technology [...] 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. [...] 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" = 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)

- neurophenomenological vs. media archaeological investigation of the aesthetic experience of music (Helmholtz 1863); temporal structures from neuroimaging data 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); 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 denominator "music", and (neo-logically) "algorhythm"

Gaming with the Pin Ball machine

- human hand coupled (in the cybernetic sense) to the Pin Ball game machine, 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, Baggersee (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 / diagrammatically) calculating either in his mind of coupled to 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 - explicitly 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 here; that moment, human 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", replacing manual transitive control

Man-machine complicity: punched cards, and genocide

- antithesis to techno*lógos* hypothesis: "So if we are always already complicit with the machine, what are we to do?" = Tara McPherson, Why Are the Digital Humanities So White? or Thinking the Histories of Race and Computation, in: Debates in the Digital Humanities, ed. Matthew K. Gold (Minneapolis: University of Minnesota Press, 2012), 139-160 (152); ethical (discursive) vs. machine-oriented (media-archaeological) concern with punched card machines involved in genocide "program"; in parallel with scholarly debates circling around two paradigms: "intentionalism" which is human-centered, and structuralism/functionalism" - focus on mechanism / machinery; see Wulf Kantsteiner / Todd Presner, The Field of Holocaust Studies and the Emergence of Global Holocaust Culture, in: Notes from Probing the Ethics of Holocaust Culture, eds. Claudio Fogu, Wulf Kansteiner, and Todd Presner (Cambridge: Harvard University Press, 2016), 8

Experimenting media-temporality

- "Thumb movies" ("Daumenkino") producing the cinematographic effect of movement by hand; hand-driven phonograph / gramophone

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

- Talbot on 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."

- *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; academic culture insisting on symbolic regime: Bela Bartok's manual transcription of Hungarian folk song recordings

- "Circular Causal and Feedback Mechanisms in Biological and Social Systems" = original title of so-called Macy-Conferences in New York, ed. by Heinz von Foerster 1949, and subsequently by v. Foerster / Mead / Teuber 1950, 1951, 1953, 1955

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

- media-experimental setting as an artificial configuration based on cultural knowledge; 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; media-experimental event can not be reduced to discoursive effects; like historian Reinhart Koselleck insisted - againt the relativity of historical interpretation - on "Veto-Recht der Quellen", an eqivalent in media-technical experimentation

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" = Charles Sanders Peirce, Collected Papers, Bd. II: Elements of Logic, Cambridge, Mass. (Harvard UP) 1932, 350

- reenacting procedure which Pythgoras experimented with the monochord in the 6th century B.C. today; actually reenacted is the techno-physical insight of the relation between integer numbers and harmonic musical intervals; certainly not in the same historical situation like Pythagoras, since the circumstances, even the ways of listening and the psycho-physical tuning of 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; in an almost Derridean sense (expressed in his *Grammatology*), the original techical experience is repeatable; 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*

- reproducing nature with cultural means; *physis* both agency (measuring instruments, subject to physical and mathematical laws) and object of experimentation, in a co-originary way; Christian Kassung, *Das Pendel. Eine Wissensgeschichte*, München (Fink) 2008

Re-experiencing Baird's television

- "archaeology" of television in John Logie Baird's system; best method for *understanding media* 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" = quoted from the brochure accompanying the Televisor kit offered by the Middlesex University as "teaching resource"; see www.mutr.co.uk; *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 high 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)?

- "about one third of the size of the commercial televisor - but the performance is as good" = ibid. - a transformation of original to model; central a-historical criterium remains: "performance" as *gleichursprüngliches* re-enactment

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

- 1879 Hermann von Helmholtz initiating 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 part of an encompassing electromagnetic spectrum like light, thus subject to temporality, a limited speed. Radio waves, on the very media-

archaeological level (that is, before becoming part of a mass-medium called "radio") have a *sense of ending*; 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

- 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, not (merely) prehistory, but alternative approach 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" at first not language and music broadcast 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, 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

- for Marconi, 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 describing electricity flowing through the vacuum "without wires", literally wireless; radio inside the evacuated, etherless tube itself

- spark gap transmitters generating 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 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 epoque; 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 making "history" audible; tube-based radio practicing 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 "phenomenotechnical" (Gaston Bachelard) 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 addressing human senses at the existential level of temporal beings (phenomenological "inner sense of time", with Husserl); re-generating temporal experience, thus addressing the human on the aisthetic (physiological) level as radically present, while cognition puts it into a "historical" context: a dissonance taking place, gap opens

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-concept" = 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") subjecting 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; what later became mass-media like the phonograph, kinematography, electronic television first develped for experimental research, for analytic, not projective purposes (even the genuinely theory-born computer). Any listening to music on records or to radio programs 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, micro-temporal events 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; 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

Media eventuality

- 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" 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" concepts of event-orientated programming; in philosophical phenomenology, "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) converge 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

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

Beyond experimentation

- in historical research, past events not experimentally re-enactable (except in experimental archaeology): argument of historians usually applied to differentiate their hermeneutic discipline from the natural sciences; media-archaeological experimentation (as opposed to historicism) providing access to the invariants of knowledge in time

- "How should an experimenter proceed when faced with a Black Box?" = Wilhelm Ross Ashby, An Introduction to Cybernetics, London 1956, 87; cybernetics replacing 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 becoming operative: In science, "mathematical symbols [...] have a particularity: they reveal structures" = Max Born, Symbol and Reality, in: Objectivité et réalité dans les différentes sciences, Archives de l'Institut International des Sciences Théoretiques, Brüssel 1966, 151 f.; in fact: they become media-archaeological operators themselves (*poiesis*).

- 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" = Born ibid.

- distinction between referential and operative writing correlating with the distinction between semiotic and signal-processing systems

Artistic experimentation as metaphor?

- artist group *Ohio* producing 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" = Ohio (Uschi Huber / Jörg Paul Janka), in: Zeitschrift für Medienwissenschaft 1/2009, 104-113 (104). 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*

- Jan-Peter Sonntag, in his "Son:arc project", re-staging 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", kind of electro-magnetic Tsunami caused by solar turbulences, seen in September 1859 as emantation of "Nordlichter" around the globe; nineteenth century electric telegraphy disturbed by such "natural radio" even before radio as cultural broadcasting had been invented - 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.

- case Nikola Tesla; sometimes difficult to keep his serious inquiry into electric engineering distinct from the para-psychologic discours attached to his name - for which Tesla partly has to be blaimed himself. Therefore media-archaeological reading tries to resist the seductions of aesthetic imagination, in even saving the engineering Tesla against Tesla himself

- 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 failes within the electromagnetic field = Johannes Gfeller, Der Referenzgerätepool von *AktiveArchive* an der Hochschule der Künste Bern, in: Schubiger (ed.) 2009, 212-221 (215); 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

The media-ecological challenge

- data centers absorbing high amounts of (cooling) energy; hardware of media infrastructures (Starosielski) connected to "rare earths" economy

and electronic waste problem (Parikka, *Media Geology*); still energy / matter not the core issue of "information society", but its techno-epistemic object / event, the "bit": information neither matter, nor energy (Norbert Wiener); "materialist" media archaeology reductive; increasing "cybernetization" of environmental culture (Hörl 2017)

- matter and energy "finite resources in the closed system of planet Earth" = Sean Cubitt Sean Cubitt, Finite Media: Environmental Implications of Digital Technologies, xxx (Duke University Press) 2017; "finite media" argument missing the specific aspect of "digital" media; energy consumption for electronic media in times of radio and television already; vs. Turing 1937: time-critically finite machine in the computational (algorithmic) sense; "as matter", they media "inevitably tied to physics, especially the dimension, of time" = Cubitt op. cit.; media-epistemic fascination with information theory - triggering Media Science - giving way to media-ecological concern; re-entry of nineteenth-century concern with matter + energy, though with negative prefix; thermodynamic (Boltzmann) vs. information (Shannon) entropy: W. E., Time, Temperature and its Informational Turn, in: Culture Machine, vol. 17 (2019), issue "Thermal Objects"

- Cubitt's notion of "finite media" vs. Turing's notion of the "finite automation" from 1937; symbolic order clashing with the "real": mathematical finiteness model of *computation* vs. actual *computing* (in terms of energy and matter and limited resources; former epistemic fascination for algorithmic media receding in favour of their energy consumption; a step back to nineteenth century concerns (in Norbert Wiener's sense) - just that what has been a positive concern in c19 is not provided with a negative prefix; quest for a more specific analysis for media specificity of the *digital* entropy

- "Uncovering and exhibiting digital media's entanglements with energy, behavior and environment through artistic practice" = Samir Bhowmik, Breaking the Circuit: Encountering Media's Entanglements with Environment and Behavior through an Energy Art Practice, pre-print Leonardo 2020, https://mediarxiv.org/a4kf5, accessed 25 October, 2020, "Abstract"; energy-consuming "analog" media systems like radio and television broadcast infrastructures already energy-consuming; specific difference made by the "digital" (beyond the obvious massiveness of "cloud" computing); differentiation between thermodynamic (Boltzmann) and informational entropy (Shannon) and its related "energy" question

Operative diagrammatics: Symbolical notation as (re-)construction of a machine

- "Invention takes place on a middle level between the concrete and the abstract, the level of diagrams" = Gilbert Simondon, On the Mode of

Existence of Technical Objects [FO 1958], London (University of Western Ontario) 1980, transl. into English Ninian Mellamphy; http://accursedshare.blogspot.com/2007/11/gilbert-simondon-on-mode-of-existence.html, 63

- electromagnetic induction detected by Michael Faraday empirically as physical phenomenon, while James Clerk Maxwell then approached it in radical mathematical analysis; his equations empirically tested again by Heinrich Hertz, resulting in what later became radio signal transmission by oscillating electric sparks - operative media diagrammatics

- operative diagrammatics as electro-physical "embodiment" of symbolic / algebraic languages; computational mathematics, once implemented in the physical world, transforming into being-in-time; Warren S. McCulloch applying term "embodiment" of logical (Boolean) algebra to neurons

- media archaeology concerned with media on their structural (mathematical design) and on their machine level (material instantiations of Foucault's *l'archive*); understanding (technical) media as materiality-in-action, operative diagrammatics; mathematics time-critically and micro-temporally incorporated into the machines

- diagrams not simply forms of two-dimensional visualization of logical reasoning but symbolical machines themselves - though depending upon the human mind as "interpretant" (Charles S. Peirce) to operate them in the one-dimensional time domain; human interpretant replaced by algorithms in technical computing =Frieder Nake, Das algorithmische Zeichen und die Maschine, in: Hansjürgen Paul / Erich Latniak (ed.), Perspektiven der Gestaltung von Arbeit und Technik. Festschrift für Peter Brödner, München / Mering (Rainer Hampp) 2004, 203-223, as expressed in the "impulse diagram" of clocking and computational cycling units, analysable by the "Logic analysator"; linguistic proposition becoming machine

- programming the computer, in its media-archaeological "epoque" (meant chronologically and functionally time-invariant at the same time) closer to the idiosyncacies of the hardware than to the logics of the reasoning mind; Assembly - different from "high level" programming languages - remaining close to the machine, culminating in the single key to operate one bit

- Reuleaux' symbolical notation accentuating the machinic modules; Babbage accentuating temporal flow = Charles Babbage, Laws of Mechanical Notation, http://history-computer.com/Library/CharlesBabbage:LawsOfMechanicalNotation.pdf; "mechanical notation" allowing to reproduce the procedural behaviour of the designed machine, expressed in his Timing Diagram

(cycling units), and Flow Diagram; Doron Swade, Automatic Computation. Charles Babbage and Computational method, in: The Rutherford Journal = http://www.rutherfordjournal.org/article030106.html; flow chart in computer programming introducing a symbolic temporal order into the machine regime; human sketch here operates on the machine symbolically, not materially

- logic branching with Babbage; Andrew Ferguson, A History of Computer Programming Language = http://cs.brown.edu/~adf/programming_languages.html