"CHRONOTECHNICS OF THE PRESENT, TIME-CRITICAL MEDIA PROCESSES"

**Detailed content by chapters:**

**TEMPORALISING THE PRESENT, RE-PRESENCING THE PAST**
- Archiving the present & co-presence of the past: A technological Moebius loop
- Disruptions of the present generated from within (and preserved by) technological media
- The tempor(e)al in the cinematographic apparatus
- Auratic presence and the aesthetics of "live"
- Motion analysis and the "present time window" in neurological terms
- (Mass-)Media-induced "trauma"
- Instantly recording the present
- The event is the signal: "live" TV transmission
- Schabowski's "sofort": the asymmetrie between "live" signal transmission in radio and television, and architectural walls
- Faster than "live", "less than no time": Telegraphy, coding, and the undertunneling of the transmission channel
- Douglas Rushkoff's *Present Shock*
- Between Storage and Interaction with the Present: Video Recording
- Time-Critical Signal Manipulation of the Present: Digital Video Recording
- Archival manipulation of the already present: Real-time editing
- Media analysis of the present in high frequency
- The algorithmic non-present
- Traditional and posthuman understanding of affect
- The micro-temporal momentum of affect
- TempoR(e)alities and "The Crannies of the Present" (Massumi)
- New "shapes of time"
- Electronic media tempor(e)ality: "acoustic space" (McLuhan)
- The "acoustic" structure of electronic media
- "Liquefying" the archive
- Not yet memory? Focus on storage tempor(e)alities
- Micro-archiving the present: Intermediary storage, delay lines
- "Time of non-reality": *Totzeit*, negative time
- The micro-temporal *camouflage*: High Frequency Trading
- Interplay: Gaming with the Pin Ball machine
- Micro-archiving presence from analog to digital technologies: functional soundings
- Media-induced shock more general
- "Shock" with Benjamin
- Media-induced presence / "Realtime History"
- The anachronistic momentum of technical recording
- Signal "immediacy": dissimulated presence

"POSTING" DIGITAL PRESENCE: A MICRO-TEMPORAL REGIME
- "Post-digital" media culture? Sustaining a critical philosophy of algorithmically driven technologies
- The sublime presence of ubiquitous computing
- The re-entry of the "analogue" in the "post-digital"
- Micro-archiving presence from analog to digital technologies
- A core of the operation: sample-and-hold
ALIEN TEMPORALITY. The Clash between Symbolical Time and the Temporeal in the Technosphere
- The technochronos hypothesis
- Techno-logically induced "time" figures
- From "Time" to Frequency Domain
- "Real-time", "live", storage
- Thermodynamic Versus Logical Time: Reversible Computing
- Sublime Temporalities: Nuclear, and Aesthetic Time-Criticality
- The Clock as Time-Keeper, and the "Y2K Bug"
- The Alienation of Time to Sound: Sonification of Computing
- "Mobility"? Between Spatial and Temporal Transfer
- Delayed Transfer
- From "Live" Analog Telecommunication to Internet Synchronization
- P. S. Disruptive Heterochronoi, and Techno-Traumatic Media Time

MICRO-ARCHIVING THE PRESENT. The Impact of Time-Critical Media Technologies
- Instant recording: Archiving the present and re-presencing the past
- The temporalised cyborg, signal time and acoustic media archaeology
- Deconstructing the historical sense of time from within technological media
- Time of the tape: spools, loops
- "Liquefying" the archive
- Not yet memory? Focus on micro-storage tempor(e)alities
- Micro-archiving the present: Intermediary storage, digital delay
- The micro-temporal camouflage: High Frequency Trading
- The aesthetics of "instant replay"
- "Temporary Storage"
- "Time of non-reality": Totzeit, negative time
- The temporal wall arising: Moore's Law

SIGNALS IN ACTION
Time-critical media
New kinds of bio(algo)rhythmization
The temporal momentum in technical (micro-)infrastructures
From time-based narrative to time-critical action
Archival storage becoming time-critical technical memory

SYNCHRONIZATION BETWEEN HUMANS, BETWEEN HUMANS AND NON-HUMANS, AND BETWEEN NON-HUMANS AT ALL
Synchronicity as message of the measuring medium
Synchronization from a media-archaeological perspective
Chrono-Technical Violence: Synchronization
Audio-Visual A/Synchronicities
Time-Critical Media Operations as Implicit Chrono-(Syn)Sonicity
Resonance and "Syntony"
Radio "Time Signals"
The Time-Critical Television Image
Digital Synchronicities
"Social" Media Synchronization

==============================================
There is time-based, time-critical and time-giving media on the one hand (part A), while such chronopoetics is suspended in its techno-archival states on the other (part B). Both extremes are defining media temporality.

Synchronizations (Present Media Times):

TEMPORALISING THE PRESENT, RE-PRESENCING THE PAST. Towards a media-epistemology of technologically induced temporal affects

Archiving the present & co-presence of the past: A technological Moebius loop

Electronic transduction, the conversion of signals into information units (bits), interactive human-computer interfaces, the speed of micro-processes, recursive algorithms and feedback loops all result in new ways of negotiating "the present".

Technical media know to address human observers and users not only to their eyes and ears, but on their existential level of sensation of being-in-time. So-called "analog", signal-recording media systems like photography or the phonograph have been, for the first time in cultural history, able to technically address, manipulate and challenge human perception in its most essential sense of being-in-time.

But there is a dissonance between affective and cognitive human experience of times past when coupled to technical media. Here, a dissonance takes place; a gap between technical timing and subjective sensation of time opens. Especially audio-visual media address the human perception on its most essential sensation of being-in-time (both on the level of the physiological senses and in neuronal cognition). Technological media actually generate, store, and re-generate temporal presence, while cultural discourse symbolically frames temporal experience into a "historical" context.

Time-critical action in electronic and digital technologies develops into an epistemology which radically challenges traditional "ground" temporal horizon spanning between a heavy "historical" past and an emphatic future, with a shifting emphasis on actually nonlinear, algo"rhythmic"¹, con-temporary events.

Such augmentation of the present happens in the tight coupling of human time with machine time, resulting in resonant atunement (analog) and high frequency pulsation (digital). Analytical aesthetics deals with such affective temporalities.² But different from the phenomenological or neuroscientific focus on the human time-window of the present moment (roughly three

seconds), media-archaeological analysis concentrates on the technomathematical temporal condition of signal processing itself. "Media archaeologists [...] describe the non-discursive practices of the techno-cultural archive. Media phenomenologists [...] analyze how phenomena in various media appear to the human cognitive apparatus, that is, to the mind and senses."³

While the human sense of "the present" is challenged by the immediacy of analog signal transmission and the delays of digital data processing, a different (non-)sense of time unfolds within technologies themselves. At that moment, human-related phenomenological analysis clashes with the media-archaeological close reading of the technological event, in an impossible effort to let the temporeal articulate itself.

Technologically induced temporality affects the contemporary in two ways: a) temporalizing and archiving the present (technically corresponding with analog delays and digital intermediary storage), b) re-presencing disembodied faces and voices in shock-like manners since photo- and phonographic recording.

The current transformation of "analog" media recording into the digital one is dramatic for memory culture. In the transformation from analog to digital transmission media, an act of technical archiving takes place, which condenses the heterogeneity of different times into micro-storage.

Whereas analog broadcasting (radio, television) has been connecting the viewer to the event in front on the camera in temporal indexicality ("live" transmission), digital signal transmission is "archival" per definition: it takes intermediary computation ("real time"). Digital media culture is a micro-storage structure - the "algorithmic archive".

The most radical form of "archiving presence" is the encapsulation of intrusive affects; according to Mardi J. Horowitz "a traumatic experience remains in a kind of memory storage". There is a link between the "presence affect" and storage theory. "One of the major features of trauma is its inherent latency of belatedness — the inability of the trauma victim to grasp and assimilate the traumatic existence in real time"⁴ - just like the "latent" electrostatic image in Xerox copying machines, and the phenomenon of magnetic remanence. Latency, here, correlates with the neurological notion of "implicit memory" where contents are not available to consciousness.

In technical terms of digital calculation, the delay is inherent in the notion of "real (signal processing) time" already - different from the time-indexed "live" signal transmission. Trauma studies often lack a close reading of the

technologies which are involved. One step further, the media-archaeological approach identifies traumatic tempor(e)alities which have been induced by technology directly.

Disruptions of the present generated from within (and preserved by) technological media

G. W. F. Hegel once defined the tone as transitive being. Such ephemeral cultural articulations have been subject of philosophy for long time. Media archaeology (in terms of technological measuring of a sound as event) allows to ground such insight in the signal event itself. With the emergence of signal recording media like photography, phonograph, cinematography, magnetic tape and finally digital recording, however, technical media allow for capturing the present, resulting in an unforeseen disposal of tempor(e)alities. Such media-induced time shiftings and time axis manipulations - while apparently smoothly integrated into everyday cultural practices - still are an affective shock which the cultural unconscious has not yet fully digested.

"Archiving" the present is understood here not in the passive sense of accumulating signals or data in a structured way, but rather in Foucauldean and Derridean terms as a generating principle (archive / arché). Different from what Gumbrecht more recently called "production of presence"5, the focus is on technological abilities to generate fuzzy presents. The terminological effort of smeared present is deliberately close to the concept of fuzzy logic in computing science.

Psychological presence effects for players of computer games emerge in moments of suspense of self-consciousness. The expression "for the present" (which equals einstweilig in German) reminds of Husserl’s conceptual protention6, while retention is "the process by which an awareness of 'now' is synthesized with previous instants held momentarily in consciousness to yield a sense of temporal unity and flow."7 The sonic equivalent to this state of extended consciousness of the present is acoustic reverberation; any damped oscillation slowly fades away. It is exactly at that point that vacuum-tube based electronic developed the circuit which produces undamped, sustained oscillations as basis for, e. g., radio transmission or synthesizer tones. While the very retentive experience of presence in phenomenology creates the impression of a “living” present exactly because it tends to death (a Heideggerean "being-to-death"), the electronic loudspeaker-based acoustic presence is a timeless present.

5 See Hans Ulrich Gumbrecht, Production of Presence. What meaning Cannot Convey, Stanford, Calif. (Stanfort UP) 2004
The administrative arché and the traditional "archive" (the symbolic order as operated in the textual record) has been technologically challenged by non-alphabetical media recordings (starting with photography and the phonograph), allowing for not simply "archiving" presence in the symbolical mode, but to restore presence to the affective, signal-based level of perception. The tempor(е)ality of affect is now being matched by micro-technical moments of intermediary storage.  

Due to the ephemeral nature of its object, the study of presence has become inseparable from the study of its archiving media. Recording media have molded the perception of presence; analogue signal-recording media and recently signal-processing (DSP chip based) media have enhanced the power of generating the affective experience of presence. Recording technology made it possible for the first time to store, repeat, and manipulate presence. An escaping moment (the physical signal) now became an object of communication analysis that could be replicated and analyzed. The different ways of storage result in different ways of re-storing presence both in individual and collective "memory". In digital media, the symbolic regime and signal recording converge: the alphanumeric code, algorithmically processed in hardware-based signal processing.

Different from alphabetically coded memory of the past, signal storage media can immediately re-create the affect of presence in human temporal sensation. What is cognitively know as belonging to the past (the familiar "historical" record) is phenomenologically perceived as affect of presence, resulting in a cognitive/affective gap which has not yet been reconciliated.

While recent research has discovered that the specific phonetic alphabet which is still in current use today has been invented to record, store and transmit the musicality of Homer's oral poetry, a different kind of alphabet - the digital code - nowadays dominates most processing of cultural communication. The conversion of analogue to digital media archives is not just another mode of cultural memory but a dramatic transformation of its essence. Algorithmic re-presencing needs to be thoroughly reflected by both media and cultural theory.

There are chrono-traumatic irritations of the sense of the present caused by signal recording and data processing technologies. The symbolical or technical inscription of traumatic experience is not only bound to specific historical situations, but rather much deeper rooted within the techno-epistemology of media themselves. From the phenomenological perspective, photography, phonography, cinematography, videography, the magnetic tape, and finally digital recording affect the human sense of time. Although apparently accommodated in every day consumption, this intrusion of the technically recorded past into the present has not yet been cognitively digested and continues to irritate the "cultural unconscious" - an explicit analogy to Benjamin's neologism of an "optical unconscious" which was inspired by Sigmund Freud's psychoanalysis, describing temporal evidence which is not

---

accessible to human senses immediately but with the camera only - in slow motion and fast forward display.

Media-induced irritations of the sense of the present happen in irruptive ways; such incisions of time are traumatic temporealities - pluralizing the tightly coupled time triad of past-present-future into a plurality of micro-temporal figures of delay, anticipation and intra-temporal (time-critical) moments. These temporealities share central features with what in academic memory studies has become known as the unhistorizable of traumatic remembrance. Next to "the distinctive role of media in mediating collective trauma"⁹, there is a traumatic irritation both of presence and the present induced by media technologies themselves. Psychological symptoms like being "out of sync" indicate a micro-temporal irritation; the Lacanese "real" invades the symbolic order as temporeal (German Zeitreal).

The tempor(e)al in the cinematographic apparatus

[When Chris Marker, in a reflections of his film Sans Soleil, tried to remember a January he once spent in Tokyo, he realized that he rather remembered the images he then filmed there - images which had replaced his organic memory by storage media.]

Any cinematographic projection derives from a storage medium (phonotgraphic image series on celluloid). But the professional shooting of a cinematographic sequence is a form of repetitive presence itself: camera shots as intervals which mostly require repetitive shooting ("takes"). Still every "take" - even for the most narrative "fiction film" - is a time-authentic recording, since it is unique in its individual nuances.

Can cinematograpic experience be "historicized" and thus be integrated into historical discourse, or does the shock of its oxymoronic power of "re-presencing" (Vivian Sobchack) the dead, the passed, remain a traumatic momentum, that is: not entering conscious symbolical mastering? Has the shock of the first "movie" screening in Paris 1895 been digested in the cultural unconscious at all, or does it insist as a sub-cultural irritation? "As soon as one is aware that a film can be viewed again - that this experience of presence can be repeated - it becomes a record [...]."¹⁰ But "[i]t would be more accurate to say that photography and the cinema produce the sense of a present moment laden with historicity at the same time that they encourage a belief in our access to pure presence, instantaneity."¹¹

Auratic presence and the aesthetics of "live"

¹¹ Doane 2002: 104
Theodor W. Adorno remembers an acoustic scenario where he once was able to compare his actual listening to a nightingale through the open window with the radio transmission of the same bird's song: "[...]

the author [...] managed to listen to it over the radio when the windows were open. The result was that we were able to hear the radio nightingale a bit earlier than we could hear the real voice because sound takes longer to reach the ear ordinarily through space than by electrical waves. The real nightingale sounded like an echo of the broadcast one. Thus the 'radio voice' creates a strong feeling of immediate presence. It may make the radio event appear even more present than the live event.\(^{12}\)

Where does "live" stop and "delayspace"\(^{13}\) start?

The destruction of the "aura" of a work of art by technical reproduction (Walter Benjamin) is foremost an intrusion into its temporal structure; "aura" is bound to its specific (almost Bergsonean) time figure, between the temporal now ("the present") and auratic appearance ("presence" and "re-presencing").

Technologies of communication are analogous to "those phenomena and conditions that contribute to the production of meaning, without being meanings themselves"\(^{14}\) - the Kantean \textit{a priori} transformed into a processual element, plausible for the technological production of presence.

It has been a feed-backward effect of recording technologies that made it possible to perceive existing events as "live".\(^{15}\) The tele-presence induced by electronic images in television news differs from the most determining characteristic of the museum: "the necessary presence within it of objects, things which by their presence in the museum, claim a particular status [...]"\(^{16}\) - in fact the status of real presence.

But image transmission by the digital camera is not really telepresence any more. The recursive loop between technically mediatized art and "live" art is known from closed-circuit video installations already.

\textbf{Motion analysis and the "present time window" in neurological terms}

"Archiving presence" opens a temporal window of affective indeterminacy, "a zone between a 'not yet' and 'always already over'"\(^{17}\). In neurological terms, the brain does not store memory images or acoustic melodies respectively.

\(^{13}\) A term coined by Marcus Bastos for his media theatrical performance 2014; http://www.eventualidades.net/delayscapes
\(^{14}\) Gumbrecht 2004: 8
\(^{15}\) Philip Auslander, Liveness. Performance in a Mediatized Culture, 2nd ed., London (Routledge) 2008, 56
\(^{16}\) Silverstone 1992: 35
\(^{17}\) As expressed in the \textit{abstract} for the symposium \textit{Timing of Affect}, Academy of Media Arts, Cologne, 30 May - 1 June 2013
rhythms as such but rather operates with Delta codification: just the differences between waves are registered.

It is by intervention of measuring equipment like digital motion capturing that what appears like expressions of a continuous present dissolves ("analysis") into micro-intervals of quasi-musical motions. What looks and sounds like a transitive relation between a musician and his instrument, might not be a musical gesture at all but rather a "servo-mechanism" in cybernetic terms of signal communication between the animal and the machine.

(Mass-)Media-induced "traumatic" temporality

If "catastrophe does [...] always seem to have something to do with technology and its potential collapse"18, the collapse of the TV image of Rumanean dictator Ceaucescu ("Trasmissione directa") has been the traumatic message of the medium itself.

Trauma belongs to the essential experiences of technoculture; its defining characteristics is the disruption of time and space19. Trauma arises with the technological signal recording and - transmitting media themselves (since photography); traumatic time is a non-historicisable experience (eventality), coupled with genuine media time (time-criticality). There is no past in media. Trauma is the non-archivable; its temporal figure is not (historical) narrative but repetition which lends itself to recording technologies.

In his analysis of the photographic moment, Walter Benjamin defines the camera's ability to arrest the ephemeral and the contingent: "The camera gave the moment a posthumous shock, as it were." With the moving photographic image, "perception in the form of shocks" was even established "as a formal principle"20. - which is montage. "The very rapidity of the changing images in film is potentially traumatic for the spectator and allows the cinema to embody something of the restructuration of modern perception."21 Along with the French Apparatus media theory, such kind of non-discursive practices is already embodied in the technical devices itself: in the mechanism of the intermittent image: "They have a knowledge effect."22 "[...] contemporary media technologies serve as the major site wherein contemporary trauma is not just witnessed but actually produced and registered as traumatic in the first place."23

18 Doane 1990: 229
19 See the "Indoduction" by Mousoutzanis, in: New Media and the Politics of Online Communities, ed. by Aris Mousoutzanis / Daneil Riha, Oxford (Inter-Disciplinary Press) 2010 (in eBook format), ix-xix (xvii f.)
The techno-traumatic incident already occurred in the very first photographic recordings: taking out of a moment (or intervall) out of historical time, an ekstatic temporality, which "mechanically repeats what could never be repeated existentially"24. Once the singular "spark" of the apparent historical accident25 as narrative or dramatic category coincides with technical lightning (the photographic flash or other light-recording), it is transformed into media time, culminating with the electronic image where the cathode ray image is a bombardment of electric sparks indeed. "Exstatic time breaks with the ordinae conception of time as a succession of 'now' moments and presents us with truly historic time: 'moments, when a minute lasts a lifetime, or when a week seems to fly by in next to no time. This is what Heidegger calls 'ecstatic temporality', or time taking place in its authentic moment of ek-sistence'."26

Catastrophe does not only enact a time different from conventional historical experience but is ekstatic towards the parameter of time itself, representing "that which cannot be contained within [...] an ordering of temporality"27. The media situation goes with an "acceleration of its temporality to default 'real-time' reporting"28.

Not the visual "content" of the representation as such but its temporal instantaneity is the traumatizing momentum. Therefore TV live transmission of the 9/11 attack has been participative itself, as Paul Virilio commented.29

Crisis-readiness roots in communication engineering itself. Both Wiener by "harmonic analysis") and Shannon (by stochastic analysis) treated the scenario of an enemy air plane approaching its target and the correlative anti-aircraft artillery reaction as an act of "communication".

The contemporary routine background condition of persistent crisis-readiness30 is a function of the time-critical conditions of media technologies themselves. The category of crisis has traditionally been bound to human agency31; in times

27 Doane 1990: 233
28 Frosh / Pinchevski 2009: 303
of electronic signal processing crisis witnessing is not an exclusive human capacity any more. The permanent state of alert commonly associated with "live" broadcasting and "breaking news" editing is an emanation of the essence of electronic media: the speed electro-magnetic waves and the real-time paradigm in digital signal processing. The focus thus shifts from the human witness augmented by mass media to an analysis of signal and data processing within the technologies involved.\textsuperscript{32} The technologically induced witness affect results in "crisis-emotions among those who were not physically present at the event but nevertheless feel themselves affected by it"\textsuperscript{33}.

Different from microtime-sensitive measuring devices, there is (at least for humans) no perceptible difference between the "live" transfer of electric signals and their replay from phonograph, magnetic audio or video tape, or digital storage disc. Such replay does not come from memory but is signal-technical "re-presencing"\textsuperscript{34}.

The affect of the \textit{instant} is not simply a discursive effect or a phenomenological perception but the temporal essence of electro-magnetic wave propagation itself: almost no \( \Delta t \). When Walter Benjamin defines the singularity of the instant as "the spark of accident"\textsuperscript{35}, this spark is no metaphor but operates literally in electronic media - a pure function of technological temporality (tempaurality).

Different from electronic live transmission in radio and television, cinematographic images can not testify real time, since the time of recording and the time of replay are separate. The moment of projection has no inherent relation to the temporal scene (chronosphere) caught in the images\textsuperscript{36}

\section*{Instantly recording the present}

Against the user claim for immediately fetching all kind of data, restricted access has been an old archival virtue of temporal defer to be rediscovered - with a view on the essence of academic university as well. Online access to data results in a culture of "immediacy, whereas traditional (academic) knowledge require delay in reflective thinking."\textsuperscript{37}

\begin{flushleft}
(Indiana University Press and the British Film Institute) 1990, 222–239 (223)  
\textsuperscript{32} As encompassed by the definition of \textit{media witnessing} as "the witnessing performed in, by, and through the media": Frosh / Pinchevski 2009: 296  
\textsuperscript{33} Frosh / Pinchevski 2009: 301  
\textsuperscript{34} On that term see Vivian Sobchack, Afterword. Media Archaeology and Re-presencing thePast, in: Erkki Huhtamo / Jussi Parikka (eds), Media Archaeology. Approaches, Applications, and Implications, Berkeley / Los Angeles / London (University of California Press) 2011, 323-333  
\textsuperscript{36} See Kerstin Volland, Zeitspiele. Inszenierung des Temporalen bei Bergson, Deleuze und Lynch, Wiesbaden (GWV Fachverlage) 2009, 92  
\end{flushleft}
There has been a remarkable media-technologically induced difference between the situation of people waiting at St. Peter's Cathedral in Rome for the new pope to be announced in 2005 (Benedict XVI) and in 2013 (Francesco), from continuous eye-witnessing of the present moment to I-pad-augmented witnessing. Time-discrete photo-testimony is a kind of macro-sampling of the present (which micro-technologically happens in the sample-and-hold mechanism of analog-to-digital conversion itself).

Different from the archive which is symbolical order, recorded by symbols (alphabet), thus: spatial orders, audio-visual media record signals which are physically functions of time; this becomes apparent in, e. g., Gordon Bell's My Life Project recording project, operated by the permanently worn data eye-glass. When these are being re-played, our senses are affected, in a non-historical way. There is no memory here, presence happens, like any electronic re-play is dynamic. Instead of psychoanalytic trauma-research now: an analysis of the techno-traumatic momentum (traumatic irritations of re-presencing induced by analog and digital technologies, such as the phonograph once and the real-time, that is: techno-archival present in Web 2.0 cache memories of short-time data buffers and registers.

Duration is the conceptual contrast, as defined in Henri Bergson's Creative Evolution: "For our duration is not merely one instant replacing another; it it were, there would never be anything but the present [...]. [...] Memory [...] is not a faculty of [...] inscribing them [sc. recollections] in a register." There is no register, different from stored-program computing (the familiar von-Neuman architecture) where the register figures centrally within the CPU to operate at all.

Another case is Finnish media-arist Erkki Kurenniemi's audio-visual self-recordings over decades, from analog to digital devices. "We would make a mistake if we think that, in contrast to Erkki’s attitude towards presence, we could refer to a ‘normal’ sense of presence in the present: to an unmediated, integral presence. Nothing as such exists either. We are always anticipating and deferring, missing the presence. But if we all ‘live with it’, Erkki has articulated his life around it and explored the full consequences of the utopia of a divisible present in both existential and technological terms. Films, images and videos, here, are time capsules. But not of any time, but the time of a deferred, diminished presence. To begin an archive based on documents of such a nature means first to negotiate a debt. An archive would need to give back the presence that Erkki took away from his life moment by moment."

The new immediacy of archival time in terms of online accessibility and instant re-play may be compared to a situation from the area of visual recording of

An argument by Angela Maiello (PhD student, University of Palermo), research presentation at the colloquium Medien, die wir meinen, Humboldt University Berlin, summer 2013
40 Constant, Erkki Kurenniemi (In 2048) (preliminary work towards) an online archive; online http://kurenniemi.activearchives.org
movement. The production and projection of documentary film since the beginnings of cinematography had been a rather heavy and slow apparatus-depended process, and copies were expensive. Around 1968, with the arrival of the first Sony "portapacs" as portable video recorders (used, e.g., by Nam June Paik), "meant a breakthrough, because you could immediately play back what you had recorded."\(^{41}\)

Archives have always been summoned "to give back time" - which requires that they first withdraw data from the temporal economy of the present (as represented in the practice of immediate access on the Internet). "But what if they are asked to give back presence?" <Constant ibid.>.

Erkki Kurennimi's self-recording (which has been pornographic to a large degree) oscillates between the obsession of memoryless, libidinal consumption of the present, and the pleasures of its immediate recording.

**The event is the signal: "live" TV transmission**

Just like phonographic signal recording, video transmission and recording can not but register even stillness as "moving" which is the physical nature of the time-signal and the rotating or scanning apparatus itself, performing what mathematics names an "integration" of the recorded movement.

At the moment of the catastrophe seconds after launching the Challenger space shuttle in the US, "[...] television itself was on the scene - witness to the catastrophe. And the played and replayed image of the *Challenger* exploding [...] constant evidence of television's compulsion to repeat - acts as a reminder not only of the catastrophic nature of the event but also of the capacity of television to record instantaneously, a reminder of the fact that television was *there*. The temporality of catastrophe is that of the instant."\(^{42}\)

When at the notorious press conference on Thursday evening November 9th, 1989, in Berlin, the spokesman of the central GDR government Schabowski, by mistake, announced the implementation of the new liberal travel regulations for East Germans as "sofort" ("immediate"). This enunciation of "sofort" was technically transmitted "immediately" as well, as a live signal by television and radio indeed. In the public, this triggered an immediate rush to the border gates and the opening of the Berlin Wall since their claim to the border police was faster than the East German political, or Russian troops military administration, could react to, or correct, in real time.

[The public printing press, due to its latency in the processing and production of news, could declare the new travel regulations, in a more official, regular formulation, only on next day Friday. As the head of the East Berlin department for passport and registration, Major Dieter Graeber, answered to journalist

\(^{41}\) Tjebbe van Tijen, We no longer collect the Carrier but the Information, interviewed by Geert Lovink, in: MediaMatic 8#1 (January 1994), online https://www.mediamatic.net/en/page/12834/we-no-longer-collect-the-carrier-but-the-information, accessed November 27, 2018

\(^{42}\) Doane 1990: 231 f.
Peter Schubert's question "Wann und wie erfuhr die Volkspolizei von den neuen Reiseregeln?" in the newspaper two days after the event: "Eigentlich im Augenblick ihres Inkrafttretens, als sie im Fernsehen, in der 'Aktuellen Kamera' bzw. bei der Pressekonferenz mit Günter Schabowski verkündet wurden. Wir reagierten darauf mit einer buchstäblichen Mobilmachung all er nur verfügbaren Kräfte, um den zu erwartenden Ansturm der Berliner auf unsere Meldestellen und die Grenzübergänge Herr zu werden."\(^{43}\)

The techno-traumatic momentum is not restricted to "historical" incidences like resulting from the "nine-eleven" terrorist attack on New York in 2001 as televisual witnessing\(^{44}\), or other kinds of mediated Post-Traumatic Stress Disorder\(^{45}\), but actually already results from the subliminal irritations and micro-shocks which are technologically induced in human perception once coupled to recorded or transmitted voices, images, or computatinal intelligence at all.

Until recently, radio and television, and nowadays mobile media "greatest technological success has been its ability to be there - both at home and ubiquitous. "Hence the most catastrophic of technologocial catastrophes is the loss of the signal"\(^{46}\). One effect of real-time digital video and sound transmission of events is that their "witnessing" on its most essential technological level looses its indexicality.

\textbf{Schabowski's "sofort": the asymmetrie between "live" signal transmission in radio and television, and architectural walls}

In vehicle transport sensation, the intercontinental flight experience of "jet-lag" indicates a delayed, "deferred present", a differential time experience where time is physically experienced \textit{transitively} while emerging in transition, an irritation of the present literally \textit{on the fly}.\(^{47}\)

On the micro-temporal level of tele-communicative signal transmission, in "inner time consciousness" (in Husserl's sense), though, "live" transmission is phenomenally experienced as immediate - which corresponds with its strict electro-physicality, the speed of light in electro-magnetic wave propagation.

Electro-magnetic induction itself induces what Heidegger termed "ecstatic" temporality in \textit{Being and time} (1927) which differs from time as succession, like the momentary event of the soccer goal transmitted in live television. Here, the

\(^{43}\) Interview "Großer Andrang durch neue Reiseregulierung" in the East Berlin newspaper Berliner Zeitung No. 266, Saturday / Sunday 11 / 12 November, 1989, p. 16
\(^{44}\) See Doane 2002: 13 ff.
\(^{45}\) See chap. 3 "Screen Trauma", in: Amit Pinchevski, Transmitted Wounds. Media and the Mediation of Trauma, New York (Oxford University Press) 2019, 65-86
\(^{46}\) Doane 1990: 238
\(^{47}\) For an analysis of such phenomenological time, see Sara Scharma, In the Meantime. Temporality and Cultural Politics , Durham, NC (Duke University Press) 2014
"Augenblick" corresponds with the ecstatic "now"\textsuperscript{48}, "realtime history" like Beckham's goal during the World Cup in Germany 2006. "The goal, when it came, struck like a flash of lightning. There and gone in an instant. And yet everything was now transformed - an electrifying moment\textsuperscript{49}, electrifying in a media-literary sense, since: "The aliveness of tele-technologies is the effect of the power (energy) source that is the condition of their possibility; namely electricity."\textsuperscript{50} This is the Foucauldean \textit{a priori} in times of technical signal transmission media.

The collapse of the Berlin Wall, in the night of November 9th, 1989, has been an effect of such non-delayed televisual presence, in its inherent urban \textit{technopolitics}.\textsuperscript{51} At a press conference in East Berlin, the spokesman of the ruling Socialist Unity Party of GDR (SED) Günter Schabowski was asked upon the enactment of the new unrestricted travelling opportunities for East German citizens. His verbally articulated answer "sofort" ("immediately") coincided with its electro-magnetically immediate, \textit{live} signal transmission, resulting in an immediate run of East Berliners to the gates of the Berlin wall. The narrative sequence of events which is the traditional condition for historical events was compressed into almost no delay, faster than any administrative or military chain of communication could ever react.

According to Walter Benjamin's \textit{Theses on the Notion of History}, dialectic history "flashes" like an image to be seen never again - which is indirectly a description of the electronic image. The irritation of the human sense of the present by electronic media of "live" transmission operates in the hidden mode; only subconsciously humans register micro-moments of delay.

[Benjamin wrote this before video tape recording from television arrived; in fact since 1963 videotape machines (just like the subsequent video-disc) allowed for the \textit{instant replay} of decisive moments in sporting events. The instant, once the temporal icon of pure present, became iterative; extended (or rather: distanced) presence by signal recording in fact transforms delay into the archive.]

The scripted talk in radio and television was once introduced against the risks of unsheltered unscripted commentary in live transmission and "breaking news".\textsuperscript{52} Different from cinema-montage which allows for dramatical time order since it is a storage medium, electronic, signal-based media and their adequate format of "breaking news" in television, rather relate to the experience of contingency. The significance of the electronic media event is in its temporal

\begin{itemize}
\item \textsuperscript{48} Paddy Scannell, \textit{Television and the Meaning of Life}, Cambridge (Polity) 2014, 188
\item \textsuperscript{49} Scannell 2014: 173
\item \textsuperscript{50} Scannell 2014: 48
\item \textsuperscript{51} See \textit{Technopolitics Salon} "Media archeologies of the present", xxx, Berlin, 28th January 2016
\item \textsuperscript{52} Scannell 2014: 114
\end{itemize}
immediacy, "where the referent becomes indissociable from the medium"\textsuperscript{53} whose message is "live" signal transmission.

**Faster than "live", "less than no time": Telegraphy, coding, and the undertunneling of the transmission channel**

In nineteenth century already, the electric telegraph increasingly separated communication of information from physical transportation, delivering messages faster than mobile vehicles could ever achieve.

In the same epoch, the psycho-physiological discovery of the "tenth of a second" as perceptual unit of presence coincided not only with the chronophotographic analysis of motion and the cinematographic frequency of image projection to produce the impression of a continuous movement, but as well with the "dot" and "dash" rhythm of telegraphic communication. In fact, their measuring and transmission instruments were cooriginary. Commenting on "modern communication", Thomas Edison's chief laboratory engineer remarked: "We all live on a tenth of a second world."\textsuperscript{54}

The essence of the temporal economy of tele-communication is capitalist chrono-logics, as remarked by Karl Marx in 1857: "[...] while capital must on one side strive to tear down every spatial barrier to intercourse, i. e. to exchange, and conquer the whole earth for its market, it strives on the other side to annihilate this space with time, i. e. to reduce to a minimum the time spent in motion from one place to another"	extsuperscript{55} - as already remarked by Heinrich Heine, in his 1844 comment on the opening of a new railway line between Rouen - Paris, "killing space by time".\textsuperscript{56} But the transformation into a different kind of temporal suspense of such shrinking delay intervals (in German literally *Nachträglichkeit*) known from postal communication, in times of mathematically informed, is binarily coded data transfer.

In current communication culture, there has been not only a "transsubstantiation" (a term borrowed from Christian liturgy) from conventional communication infrastructures to media networks, but within technologies itself: from "analog" to "digital". In algorithmically compressed, coded transmission, the quality of live transmission collapses into "real-time".

There is a recursion of telegraphic (that is: symbolically discrete) signal transmission in digital broadcasting: "[...] new media via cables or satellite

\textsuperscript{53} Mary Ann Doane, Information, Crisis, Catastrophe, in: Patricia Mellencamp (ed.), Logics of Television. Essays in cultural criticism, Bloomington / Indianapolis (Indiana UP) 1990, 222-239 (222)


\textsuperscript{55} Karl Marx, Grundrisse. Foundations of the Critique of Political Economy (Rough Draft), Harmondsworth (Penguin) 1973, 538 f.

reconstruct media temporal configurations by the acceleration and compression of time."\(^{57}\) This happens within such signal transfer technologies itself: audio and video compression is a core operation for digital signal processing in streaming media. The Internet provides for (almost) immediate electronic copies of binary values stored in central servers - rather topological than transmissional (in the traditional signal broadcasting sense).

**Douglas Rushkoff’s *Present Shock***

Technological control over time becomes universal in turingmachine time.

"[N]o matter how precisely we can count our milliseconds, neither our bodies nor our businesses are proving as programmable as our computers. [...] While our technologies may be evolving as fast as we can imagine new ones, we humans and our culture evolved over millennia and are slower to adapt. The body is based on hundreds, perhaps thousands, of different clocks, syncing to everything from the sun and moon to levels of violence and available water. We can't simply declare noon to be midnight and expect our body to conform to the new scheme as if it were a Google Calendar resetting to a new time zone. Neither can we force our businesses to conform to an always-on ethos when the people we work with and for are still obeying a more deeply embedded temporal scheme."\(^{58}\)

Communicational connectivity of being always-on is an affordance of electronic media. But only when combined with mathematical intelligence, the punctual present explodes into the multitude of real-times.

Rushkoff defines presentism as a result of the pervasiveness of digital technology where everything is "now", but the very term *now* still continues a metaphysical concept of the present. What really puts the term into quotation marks is real-time signal processing which in fact achieves a dissimulation of the "now" itself.

"Each moment is a new decision point more than it is part of some journey through time. In digital media, we are participating in a real-time event, not being taken along some linear path."\(^{59}\) What articulates itself through Rushkoff’s *persona* is the message of hypertextual Internet communication topology itself.

The present condition, as analyzed by Rushkoff, has become con-temporary in its literal sense: living in real-times, communicating instantaneously, co-

---

57 Mira Moshe, Media Time Squeezing: The Privatization of the Media Time Sphere, in: Television & New Media 13(1), 2012, 68-86 (73)
existing simultaneously, being always-on, in post linear time - even timeless.

At the same time, the computational condition of data-processing in the present is de-archiving: moving programs and data from the hard drive to the Random Access Memory. Random access to intermediary storage devices is a mode of fuzzy present as opposed to the Read Only Memory frame of the conventional nation-state.

Rushkoff defines the "present shock" as a kind of timelessness. "We are becoming an a-historical society, with no sense of story, [...]. We’re going from a world where we find meaning over time to one where we do it in the moment. It’s a digital society, where everything is a sample or a duration." Is culture prepared for digesting this tempo-real irritation of its traditional symbolic time order, or will it results in an ongoing traumatic disorder of times out of joint? 

"[...] we begin with some wobble — the kinds of initial reactions to a presentist, real-time world. But slowly, over time, we become more mature in our ability to deal with this new temporal environment" (ibid.).

**Time-Critical Signal Manipulation of the Present: Digital Video Recording**

Digital video recording is an almost dialectic interlacing of cinematography on celluloid and electronic live image transmission: "In the convergence between a repetition and a renewal lies the tendency to archive while bringing forward: past and present instantly simultaneous in the fragmented image. While it loops the past, the digital creates an image of an archival strategy where time passed becomes constantly accessible for the future. [...] reality's duration seems to have become a continuous stream of information potentially open for another time."

Digital recording does not require the delay time of chemically "developing" the negative on celluloid any more but renders immediate monitoring functions. Different from the well-acquainted monitor function known from video camera recording on tape and live television, the digital moving image recording allows for immediate intervention. "[D]igital equipment has been built on this ability of storing information efficiently for the purpose of immediate and direct access to, and interaction with, it. What is stored on a hard drive are data that can be retrieved via a number of points or routes as made possible by the RAM, governed by the agency of the operative algorithm and resulting in an algorhythmicised present."

**Archival manipulation of the already present: Real-time editing**

60 Rushkoff, in: Huspeni 2013
61 Markos Hadjioannou, From Light to Byte. Toward an Ethics of Digital Cinema, Minneapolis (Univ. of Minnesota Pr.) 2012, 174
62 Hadjioannou 2012: 201
Visible Cities, created in 2009, is a webdocumentary and multi-screen installation, developed by the LAT-23 collective in Sao Paolo, Brazil. The online version generates automatic clips of 8 minutes, by randomly mixing pre-recorded and live footage from webcams organized in sets of pre-defined tags and listed on the project's database. The installation version fill a darkened room with 5 monitors that display the live cameras, organized according to a collection of tags periodically sorted. The premise is that intermittent images of a place result in a situation opposite to the one to be expected. The automatic editing process creates films that evolve in real-time from algorithmic decisions:

"Visible Cities aims to subvert the logic of filming and editing typical of cinema and video, with procedures of capturing online signals and tagging the resulting materials. The goal is to produce films in which live footage produce unexpected results. It is impossible to anticipate what the online webcams embedded on the project's database will display. By approximating them by a combination of tagging and spatial proximity, the piece stimulates arbitrary relationships between distant places" (ibid.).

The footage is already existing, but the spatial relations and order in which it will be displayed is generated every time the user clicks on the play button. Like George Legrady's installation Pockets full of Memories, this kind of Self-Organizing Map relates to genuine computer art which is generative aesthetics (Max Bense et al.). When the images are edited through programming rules, the algorithmic collage replaces narrative dramatization.

**Media analysis of the present in high frequency**

It takes an observational temporal difference to clearly separate actual news (information) from the redundant archival accumulation of data from the past.

On the final announcement in the radio play Vergiss nie, was du gesehen hast, broadcasted 24th of June, 2013, at Deutschlandradio Kultur channel, the editor "m" writes on 26 June: "The news message at the end of the play" - an US-American bomb attack on Iraq nuclear plants -" of course, is part of the fictive drama and the end of a bitter story by the Finnish author Ilkka Remes." What in a dramaturgical con"text" serves as a "authentification signal" is not identifiable as fictive in the time-critical context, when listened to just as final part of the radio play itself - which then sounds like "breaking news". Instead of the cultural / semiotic con"text" there is a temporal context, better called: synchrony, which - when interrupted - creates the traumatic intrusions of the War of the Worlds effect achieved rather in the notorious radio play adaption (Orson Welles) than in H. G. Wells' literary version itself.

---

64 Denise Agassi, Marcus Bastos, Claudio Bueno and Nacho Durán
A culture of "TV on demand" in the Internet (based on the electronic archive) replaces live TV. Even streaming media involve micro-temporal storage (the necessity of buffering a whole frame, which opens a juridical door or copyright violation claims).

It was in 2006 that the BBC ("The Future of Television is on demand") based on a digital archive allowed for "seven day catch up", followed by ZDF in Germany (Mediathek) soon after.66

From "archiving" presence to delayed presence (a question of storage theory, the question arises: When does "transmission" end and "storing" start?: A radio conversion broadcasted on German FM radio Kulturradio in the morning of 24th October 2013 at around 8.25 a.m. was finally supplied with the information that the conversation had been recorded an hour ago. Ironically, the talk was about the supposed interception of chancellor Angela Merkel's private cell phone by US intelligence service NSA.

As pointed out by Timothy Barker67, cinema separates movement into stills, television fragments images into discontinuous lines and the digital computer converts signals into bits. This results in new, discrete temporalities which on the discursive surface are documented by performative practice ("social media").

High-frequency uploads and "streaming media" online religates the formerly separate ("secret") archive to the almost immediate present (depending simply on bandwith and channel coding conditions). Formost the financial markets are now based on the time-scale of high frequency computing, resulting in fluctuations and rhythms which nano-temporally subvert the notion of the present moment itself. The trading floor turns into media theatre. Media and cultural theory has so far attempted to account for such media-induced temporalities in terms of acceleration and speed.

In algorithmic computing, there is a radically new quality of the way times are operationally engineered - what Boris Groys refers to as perpetual series of presents.68 The symbolic order of cultural time which has so far been based on the clearly separated temporal categories past, present, and future, implodes into operative anachronism. Technological devices that sample the present techno-mathematically "analyse" time through Fourier Transform.

In the media-economy of high frequency trading, the beast are time-beasts. The time lense shifts from macro-temporal economical cycles to micro-temporal intervals. At places such as the virtual Stock Exchange, time-critical

68 Boris Groys, Comrades of Time, in: D. Hauptmann / W. Neidich, Cognitive Architecture, Rotterdam (010 Publishers) 2009, xxx
temporalities become economical temporealities. High Frequency Trading operates with time-"hiding" purposes like these, just like perceptual experiments in the 1960s: smuggling ultra-short moments of Coca Cola advertising into a regular TV movie, not consciously noticed by the viewer. Time-critical economy works especially in businesses.

**The algorithmic non-present**

It is in the very time-critical nature of stored-program computing (in the so-called von-Neumann architecture) that the present infinitesimally implodes. When *in being*, a technologically implemented algorithm makes the digital computer operate in multiple cycling-units, while at the same time adhering to its "one step at a time" imperative of linear (as opposed to parallel) processing. There is no actual present moment until the program comes to an result. The present rather has to be induced by observation, e. g. in the debugging mode where the actual computing can be frozen into a single step or machinic "state" (Turing's term⁶⁹).

**Traditional and posthuman understanding of affect**

The cybernetical assumption of co-original (therefore analogous) signal processing in animals and machines (Norbert Wiener) results in combined human-machine systems. The cybernetic organism incorporates exogeneous components extending the self-regulatory control function in order to adapt it to new environments."⁷⁰ From this derives a guiding hypothesis for the current project: This cybernetical assumption counts for the *temporal coupling of* human and (chrono-)techologies as well. Once human perception is "tightly" (Fritz Heider) coupled to a technical medium, it is subject to its technological tempor(e)alities; Henri Bergson's *Matière et Mémoire* describes the interlacing of present perception and past recollections as electric circuitry indeed. The affordance (Heidegger's *Zuhandenheit*) of new time technologies not only shapes but generates temporal consciousness. When humans are in the Internet browsing state, memory there is not past, but a spatio-temporal latency.

Different from Henri Bergson, Gilles Deleuze detaches the affect from the subject-body and rather locates it within the techno-corporeal assemblage⁷¹ - which results in a techno-trauma indeed. This becomes evident in electronic imagery and the "scanning finger" (McLuhan) of the cathode tube ray in analog television and video as such: "It addresses our nervous system directly. It

---

⁷¹ See Mark B. N. Hansen, New Philosophy for New Media, 32 f.
creates a being of the sensation that exits in itself and reveals to us a state of becoming-nonhuman"\textsuperscript{72} in terms of a "pre-personal perception"\textsuperscript{73}.

"[A]n understanding of the messy materialities of affective regimes stems largely from nineteenth-century physiology, experimental psychology and a variety of scientific and experimental measurements [...]. In other words, there is a media-archaeological side to the notion of affect as well."\textsuperscript{74}

The **micro-temporal momentum of affect**

Affect is a signalling of a non-discursive, non-narrative traumatic timing. The co-origin of trauma studies (Freud) and technical cinematography around 1900 is not coindidental in itself. To formulate it rather in engineering than in psychological terms, there is human perception of signals in the Low Frequency Band of which the mind is consciously aware (like audio signals between 16 Hz and around 16 kHz), as opposed to signals in the High Frequency Band which are there but not perceivable for human senses - a sublime existence. There are time events (and their manipulations) of which humans are simply not aware, just like radio and television transmission as technical event (carrier frequencies). But still they result in affective modulations of human sensation - indirectly, as *sublime tempor(e)ality*.

The tempor(e)ality of a deferred present becomes evident from experiments on the formative interval of perception, a micro-temporal lag between the brain activity initiating a movement and the conscious registering of the decision to act. The notion of delay, for technologies of telepresence, is a rather alien idea; it is the metaphysics of the instant which buttresses their contemporaneity. Regarding the techno-traumatic tempor(e)ality flashing from electronic television is bound to the temporality, the difference between analog and digital becomes literally "decisive", since sudden change (catastrophe) corresponds with digital switching: "The time proper to catastrophe might be thought of as compatible with that of the digital watch where time is cut off from any sense of analogical continuity, and the connection between moments is severed. One is faced only with the time of the instant - isolated and alone."\textsuperscript{75} This is true, though, since the implementation of the escapement-controlled mechanically wheeled clock.

Technologically induced micro-traumatic moments escalate with the rupture between mechanical cinematography and electronic (analogue) images: "With film, the brain does not 'fill in' the images on the screen - it fills in the motion between images. With television, the brain must fill in (or recall) 999.999 percent of the image at any given moment, since the full image is never

\textsuperscript{73} Claire Colebrook, Gilles Deleuze, London (Routledge) 2002, 38
\textsuperscript{74} Jussi Parikka, What is Media Archaeology?, Cambridge / Malden, CA (Polity Press) 2012, Introduction, 30
\textsuperscript{75} Doane 1990: 238, note 3
present on the screen." The "given moment" is time-"data"; absence is being micro-temporalized, towards the "tempo-real".

Affect is not only a mode of temporal experience, but itself a radically time-critical form of perception. According to Brian Massumi, affect precedes consciousness within human signal processing, as demonstrated by registering an electric impulse on the skin. Thus a disruptive gap between affective and conscious ("thoughful") perception of one and the same micro-event takes place, resulting in an affective/cognitive temporal dissonance - in fact the traumatic tempo-momentum.

Once photography, the first autonomous media agency in its modern sense, became subject of the archive, the sense-affective, presence-generating power of signal-based media cuts short the distance which is a prerequisite for historical analysis, in favor of mnemonic immediacy - the "electric" moment, a shock for the affective experience of temporal presence and past.

It has been Hermann von Helmholtz who detected that the run-time (speed of propagation) of signals in the motoric nerves of a frog counts around 24 meter/sec. This speed recalls a synchronization problem within humans, when technical audio-visual synchronicity might lead to irritation when compared to physical signal run-times in real nature; a lightning stroke is seen more immediate than the accompanying thunder is heard. For the temporal domain of human perception, the media psychologist Herta Sturm once experimentally explored that while every day perception which always includes a slight temporal delay of reaction involving a kind of inner, subvocal speech, electronic media force their audience into immediate affection. Immedia interfaces deprive humans of their natural chance of delayed perception. Does nothing or everything happen within this half-second? Electronic immediacy, the almost missing micro-temporal gap, results in asynchronicity in signal processing time regarding humans on the one hand and electronic machines on the other, a difference in phase delay of signal transfer between technology and human physiology. But quasi-technological timing can be detected within human neuroprocessing itself, a kind of chrono-engineering. Pre-emptive activity is what apparently is stimulated in the pre-frontal cortex of the brain which does not simply react to incoming sensations but time-critically tends to anticipation (familiar from the difference between "live" and "real-time" signal transmission within communication media).

"The word communication will be used here in a very broad sense to include all the procedures by which one mind may affect another. This, of course, involves not only written and oral speech, but also music, the pictorial arts, the theatre,

76 Tony Schwartz, The Responsive Chord, Garden City, N. Y. (Anchor) 1974, 16
77 Brian Massumi, Parables for the Virtual, Durham / London (Duke UP) 2002, 28f; see Barker 2012, 87
79 Hertha Sturm, Wahrnehmung und Fernsehen: Die fehlende Halbsekunde. Plädoyer für eine zuschauerfreundliche Mediendramaturgie, in: Media Perspektiven 1/84, 58-65 (61)
the ballet, and in fact all human behavior. In some connections it may be desirable to use a still broader definition of communication, namely, one which would include the procedures by means of which one mechanism (say automatic equipment to track an airplane and compute its probable future positions) affects another mechanism (say a guided missile chasing this airplane).\textsuperscript{80}

A perceptual gap opens between the actual moment of the audio track and the visual frame in cinematography: introducing a loop which allows for the pre-cursive "reading" (by photo-cell) of the audio track on the film reel. Between the run-time of audio-through-air and visual emanation reflected from the screen opens a techno-traumatic micro-temporal gap (that is, induced by a technical asynchronicity).

\textbf{TempoR(e)alities and "The Crannies of the Present" (Massumi)}

The delayed present unfolds as a function between the techically mediated and the immediate. "Journalism" in the media-archaeological sense not only refers to the French \textit{jour}, the day-to-day reports in the early Medieval Annalist tradition, but as well to the chrono-technical rhythm of the printing press.

According to Freud's definition, both affect and trauma break through the cognitive "Reizschutz" of symbolically ordered time which surrounds human perception. If taken literally, Freud's expression of the psychic "apparatus" corresponds with media in techno-logical resonance. From there derives the psycho-technological power of media - the techno-trauma. The potential of media is the technological real, resulting in specific forms and experiences of tempor(e)ality.

Even if "tele-vision" seems to indicate that the scopic regime is remote: perception from afar by definition, optical sensation itself is based on electro-magnetic waves which reach the human eye almost instantaneously. Human perception - even if watching a video recording - is always in the present, but in different audio-visual ways / waves. TV is always "in the now" (from the camera and broadcasting perspective); with online communication media, the receiver as well is always "on". Already TV "live" transmission (on the signal side) provided for synchronicity in time, a being-there-in-time (while not in space), in decisive difference to cinematography which is a storage medium, re-projecting an always delayed present - even with a shrinking difference in the \textit{Zwischenfilmverfahren} of German TV on occasion of the Olympiad 1936 in Berlin.

A critical moment happened at the Riga documentary film festival in 2001 on September 11th, when after watching a film projection in the cinema theatre, the audience was led for a coffee break into the adjacent conference room. There a TV monitor showed the puzzling images of a collapsing World Trade Tower. In the TV live coverage, the electronic medium came "to itself" (in

\textsuperscript{80} Warren Weaver, Recent Contributions to the Mathematical Theory of Communication, in: Claude Shannon / same author, The Mathematical Theory of Communication, Urbana (University of Illinois Press) 1964, 1
Hegelian terms). On that Tuesday, the looped CNN "breaking news" interrupted the filmic event - breaking the cinematic situation by the TV apparatus.

In analogy to the "optical unconscious" identified by Walter Benjamin in relation to the camera lens, there is the "temporal unconscious" as well. Time-critical analysis focuses of the _arché_ of the signal event itself as incipient actions, known from electro-acoustic analysis of the transitional "attack" in striking a musical tone, or the flashing cinematographic image. Such a temporal event does not necessarily unfold in a chronological order. The integration of the past with the here-and-now of the present, and the immediate becoming-past of the present moment ("the infra-instant", according to Brian Massumi) are "differential aspects of the same integral enactment".

**New "shapes of time"**

On the scene of human culture, a new drama gets into focus: the technologically induced _chronopoetics_ of microtemporal processes. Both in neuroscience and in studies of electronic and digital technologies, the analysis of time-critical action develops into an epistemology which radically challenges the traditionally familiar terms of emphatic time, with a shifting emphasis towards the non-linear, stepwise sequential, loop-folded, algo-"rhythmic" events. There is a privileged affinity between sonic tempor(e)alities and time-critical, "timely" media.

**Electronic media tempor(e)ality: "acoustic space" (McLuhan)**

Sonicity for the analog electronic media epoque has been identified by Marshall McLuhan. The wall painting created by René Cera, Pied Pipers All (1969), for McLuhan's seminar room at the university campus in Toronto, in a psychodelic manner unreveals the television image as a sonic event. Whatever its apparent content, the tempo-real message of electronic media is "acoustic" in McLuhans sense of a different temporality: "[...] he argued that electronic media were submerging us in this acoustic environment, with its own language of affect and subjectivity. Acoustic space isn't limited to a world of music or sound"; the environment of electronic media itself engenders this way of organizing and perceiving chronospheres.

But the digitally modulated (PCM) electrosphere of today differs from this

---

81 As expressed by Brian Massumi, The Crannies of the Present, lecture at the Sawyer Seminar, Harvard University, end of April, 2014
82 The English adverb _timely_ correponds to German "rechtzeitig, zeitgemäss, fristgerecht, frühzeitig"; see http://www.dict.cc/englisch-deutsch/timely.html, accessed September 8, 2014
83 See http://www.greatpast.utoronto.ca/GalleryOfImages/VirtualMuseumArtifacts/PiedPipers.asp; accessed September 2nd, 2014
radiosonic (AM) metaphor. With digital numbers, central characteristics of what McLuhan diagnosed for the printing press age have returned, thus bracketing the age of analog electronic (mass) media as a interplay of modernity. In a dialectic synthesis, mobile digital telecommunication is now combined with the characteristics of "acoustic space" which is simultaneity. According to Marshall McLuhan's *Media Log*, "[s]imultaneity is related to telegraph, as the telegraph to math and physics." But this discrete simultaneity is of a different kind. "Now, Internet 'radio' isn't radio; it does not exploit the spectrum, and that is a big difference" - just like the difference between music recorded in vinyl grooves and its compact disc inscription. Close analysis reveals bit streams which allow for information theory, thereby: mathematical intelligence to control the event of electro-magnetic signal transmission. This happens in sublime manipulation on the micro-temporal level. Even if (according to the Sampling Theorem) human perception might not even notice the difference between a high definition analog television image and its digital equivalent, ontologically this image has transformed into a different time-object once the critical perspective of the "receiver" is not humans but technologies themselves.

The sonicistic sphere in McLuhan's sense is (almost) simultaneous instead of time-linear: "Acoustic space is capable of simultaneity, superimposition, and nonlinearity, but above all, it resonates. 'Resonance' can be seen as a form of causality, of course, but its causality is very different than that associated with visual space" (ibid.). Through resonance in a physical - not symbolically coded system, micro-events can cause distant objects to communicate - close to time-tunneling and Tesla-like energy transfer.

Sound is not just mechanical attacks, vibrations to the ear or aesthetic pleasure for the brain (von Helmholtz) but addressing the human (pseudo-)sense of temporality. The true message of sound as event is processual time. The 'tuning of the world' (Schafer 1977) is a timing of the world as well. What looks physical (acoustic) is temporal in its subliminal affect. If the "sonic environment" is extended to so-called Hertzian waves as well, electromagnetism turns out as sublime temporality in all ways.

The chrono-poetical specificity of such sonicistic articulation can not be captured and subsumed by the logocentrism of traditional narrative historiography. "Acoustic space", as emphasised by Marshall McLuhan, is of a different temporal nature: not linear, but synchronous or reverberating. McLuhan once called it "echo land" - which brings us back to signal delay time and micro-temporal folding.

Acoustic echo implies delay, the very temporality induced by the medium as channel of signal transfer which once led Aristotle in his treatise Peri psyches to deal (media-)philosophically with the "Inbetween" (to metaxy) - no neo-logism.
as a term by Aristotle, rather a graphical neo-graphism by writing the adverb with a capital letter, thus turning it into a noun which (after its translation by medieval scholars) turned into the well-known *medium*.

"PHOTOGRAPHY was the mechanization of the perspective painting and of the arrested eye", whereas "Telephone, gramophone, and RADIO are the mechanization of post-literate acoustic space". Such sonic space is understood here as the epistemological existence of sound.

Notwithstanding his confusing electricity and electronics, McLuhan thereby made a crucial discovery about the intrinsically "acoustic" structure of electronic mediascapes. In a letter to P. F. Strawson, author of *Individuals. An Essay in Descriptive Metaphysics* (1959), McLuhan quotes from that work: "Sounds, of course, have temporal relations to each other ... but they have no intrinsic spatial characters."  

The immediacy of electricity has been valued essential by McLuhan as the definite difference to the Gutenberg world of scriptural and printed information: "Visual man is the most extreme case of abstractionism because has has separated his visual faculty from the other senses [...]. [...] today it is threatened, not by any single factors such as television or radio, but by the electric speed of information movement in general. Electric speed is approximately the speed of light, and this constitutes an information environment that has basically an acoustic structure."  

At the speed of light, information is simultaneous from all directions and this is the structure of the act of *hearing*, i.e. the *message* or effect of electric information is acoustic - even when it is perceived as an electronic image (as defined by the video artist Bill Viola in his essay "The Sound of One Line Scanning").

Very media-archaeologically, McLuhan's identification of the essence of electronic media as "acoustic structure" evidently refers to an epistemological ground, not to the acoustic figure (what ears can hear). This ground-breaking took place with the collapse of Euclidian space into Riemann spaces and culminates around 1900 with quantum physical notions (the para-sonic wave/particle dualism, up to the "superstring" theory of today) on the one side, and Henri Bergson's dynamic idea of matter as image in the sense of vibrating waves and frequencies. McLuhan's "acoustic space" is oscillating time and implicitly re-turns in Gilles Deleuze's "interval" philosophy. Less

---

88 McLuhan, "Five Sovereign Fingers Taxed the Breath" (1954), xxx
92 Henri Bergson, Matter and Memory, London (George Allen & Unwin) 1950, 276
philosophically, it actually happens within algo-rhythmic media.

In a media-archaeological sense, the message of the sonic is not limited to the audible at all, but a mode of revealing modalities of temporal processuality - which requires epistemological auscultation.

If phenomenology is not reduced to human sensation, perception and mind, it extends to a kind of phenomenology of and by the machine as made possible by signal sensors. It is the "sample&hold" mechanism which not simply translates but even transsubstantiates (to borrow a term from Catholic religious liturgy) the analog physical world into digital computability.

It is not just a further variance in the long history of philosophy of time but, in identifying concrete techno-logical scenarios that media archaeology analyses new "shapes of time" (George Kubler) - by reading circuit diagrams instead of knowledge historiography only. The sample-and-hold mechanism performs the ephemeral archive - with its records being "stored" only for a fraction of a millisecond. Condensers as among the smallest electro-physical storage elements, combined with transistors, function as micro-archives here. The electronic bit - other than most people think it - is a temporal being in such electronic circuits, not punctual, but a suspended instant of time (as voltage)

The media-archaeological approach still shares a core cybernetic assumption (cybernetics is not historicized here as a chapter in the history of knowledge, but still burns in the hearts of media archaeologists): From the coupling of humans to techno(chrono)logical beings (artefacts), a specific experience of time results.

By elaborate chrono-techniques, the question of "temporality" is de-coupled from history as a specific concept of narratively organizing temporal sequences. Once chrono-analysis is suspended from the historical discourse, a more radical challenge arises: Is it possible to deal with micro-temporealities without mentioning the transcendent signifier "time" at all - in favour of a multitude of descriptive terms, a "field"? "Time - today [...] - seems to reveal a new structure and to unfold in a rhythm that is different from the 'historical' time that governed the nineteenth- and the early-twentieth centuries. In this new chronotope - for which no name exits yezt, even though we live within its forms - agency, certainty, and the historical progress [...] have faded into distant memory."93

["Just as linear history begins with writing, it ends with TV"

94, McLuhan radically declared in a post-Hegelian mode. History depended on a cultural technique which is alphabetic, linear writing. The "writing" of images and texts on the cathode ray tube for television and computer monitors is of a different kind. Electronic media, therefore, are not just another variance in the history of technology but establish a new kind of temporal reality which escapes the concept of history.]

93 Hans Ulrich Gumbrecht, After 1945. Latency as Origin of the Present, Stanford, Cal. (Stanford University Press), 38

94 Marshall McLuhan, Counterblast, New York (Harcourt, Brace & World) 1969, 122, as quoted in Bexte 2008: 332
In contemporary society where the grand symbolical horizon and panoramic (pan-chronic) bird-eye view of temporal extension (religious eternity, the epoques and philosophy of history) has been condensed into (or even replaced by) ever shrinking temporal intervals and a focus on condensed present, the close analysis of decisive temporal actions reveals the drama of time-critical media.

The public TV channels in Germany legally are obliged to provide the possibility for users of streaming media online access to a selection of broadcasts stored for a week. What techno-cultural timing unfolds is an extended present, differentiated by a media dramaturgy of minimal or even micro-times.

The "acoustic" structure of electronic media

As a counterblast to the so-called "visual turn" or "pictorial turn" declared by W. T. Mitchell long ago, recent years proclaim another rebellion against the Gutenberg galaxy, which is the "sonic" or "acoustic turn", accompanied by new methods of making information and even knowledge accessible over the so long neglected acoustic channel of perception (audio interfaces, methods of sonification of data to the time-sensitive ear). It has been McLuhan who anticipated this turn already, a theorem bound to his analysis of the electronic age which he sharply discontinues from the machinic age.

Notwithstanding his confusing of electricity and electronics, McLuhan made a crucial discovery. In a letter to P. F. Strawson, author of *Individuals. An Essay in Descriptive Metaphysics* (1959), McLuhan quotes from that work: "Sounds, of course, have temporal relations to each other ... but they have no intrinsic spatial characters."95 The immediacy of electricity has been valued essential by McLuhan as the definite difference to the Gutenberg world of scriptural and printed information: "Visual man is the most extreme case of abstractionism because has has separated his visual faculty from the other senses [...]. [...] today it is threatened, not by any single factors such as television or radio, but by the electric speed of information movement in general. Electric speed is approximately the speed of light, and this constitutes an information environment that has basically an acoustic *structure*."96

Very media-archaeologically, McLuhan's term "acoustic structure" evidently refers to an epistemological ground, not to the acoustic figure (what ears can hear). This ground-breaking took place with the collapse of Euclidian space into Riemann spaces and culminates around 1900 with quantum physical notions (the para-sonic wave/particle dualism, up to the "superstring" theory of today) on the one side, and Henri Bergson's dynamic idea of matter as image in the sense of vibrating waves and frequencies. McLuhan's "acoustic space" means oscillating time and implicitly re-turns in Gilles Deleuze's "interval" philosophy.

In an epistemological sense, the sonic is not about (or limited to) the audible at all, but a mode of revealing modalities of temporal processuality. At the speed of light, information is simultaneous from all directions and this is the structure of the act of *hearing*, i.e. the *message* or effect of electric information is "acoustic" - even when it is perceived as an electronic image, as defined by the video artist Bill Viola in his essay "The Sound of One Line Scanning". 97

"Liquefying" the archive

David Lynch's film *Inland Empire* which begins with the image of a spinning record on a record player. "As the needle drifts across the timeles surface of reified sounds, we are, once again, in the realm of mechanical preproduction and the logic of industrial time."98

Henri Bergson's criticized the mechanical (escapement-driven) clock measurement of time as mathematization which is spatialisation instead of temporal duration. Technical juxtapositions, interjections, cuts and ruptures result in the loss of the chronology and directionality of time. "[T]he digital fragmentation of time is terrifyingly opaque and illegible for the human subject."99 Such a technological sublime leads to a sublime micro-tempor(e)ality.

With the present interpreted as a function of memory operations (both neurologically and digitally), the transformation of the traditional tempaurality of archival storage needs to be observed. From archival space to archival time, the archival "field" gets into focus. Dynamic micro-media memories induce a cultural shift of emphasis from permanent storage to restless transfer. With the aesthetics of re:load, the affinity between the archival operation and cybernetics turns out, resulting in feedback memory and timeshifting. Once these transformations have been analyzed, the topic "suspended memory *versus* total recall" results in a plea for the secret archive again.

There are good reasons for questioning the static concept of an "archive" as appropriate term for digital record structures since as a metaphor it is increasingly becoming a hindrance for the analysis of dynamic data storage and circulation. The computer hard disc moves stored data in post-structural ways, just like the gramophone record and the magnetic tape did with recorded electronic signals (sound and / or video) before.100

**Not yet memory? Focus on storage tempor(e)alities**

98 Zoltán Glück, After Midnight, or: The Digital Logic of Time Fragmentation in Inland Empire, in: Munitionsfabrik 19 (2008), HfG Karlsruhe, 8-11
99 Glück 2008: 9
100 On the archive becoming processual in digital algorithms, in accordance with Alfred North Whitehead's philosophy of the dynamic event (*Process and Reality*, New York 1929), see Barker 2012
The volatility of data stored in SRAM or DRAM makes all the media-epistemic difference.

According to Husserl, time is a stream of experiences with an infinite chain of now-points which are temporal impressions, each of them embedded in a time-sphere of retention (a now-point just passed) and a protention - 'an expectation of a now-point which is still in the future but which becomes a now-point in the present'[^101]. This rather time-critically counts for acoustic (the mechanical vibrational touch) and haptic sensation especially.

There is micro-memory involved in the sonic perception of presence already; the present is by no means experienced as punctual "now". On the micro-acoustic level this re- and protention has been discussed to explain melody experience by Edmund Husserl[^102] and Henri Bergson and fits into what neuroscience calles the time-window of "presence" as perceived within humans: about three seconds of duration.

**Micro-archiving the present: intermediary storage, delay lines**

Electro-mechanic transmission of photographic images via telegraph cables in 19th century was performed via intermediary storage, the "digital" data carrier of punched cards. Even if at first glance, rather complicated, it relieved communication engineering from the delicate time-critical synchronisation problem between sender and receiver.[^103]

"In the convergence between a repetition and a renewal lies the tendency to archive while bringing forward: past and present instantly simultaneous in the fragmented image. While it loops the past, the digital creates an image of an archival strategy where time passed becomes constantly accessible for the future. [...] reality's duration seems to have become a continuous stream of information potentially open for another time."[^104]

Between the archive and the anarchive there is temporary storage. Proper archives essentially aim towards long-term, if not even the unlimited preservation of their documents and today's media archivists grapple

[^104]: Markos Hadjioannou, *From Light to Byte. Toward an Ethics of Digital Cinema*, Minneapolis (Univ. of Minnesota Pr.) 2012, 174
desperately with the problems of technological obsolescence; the
temporalisation of archives therefore is an anarchival element in the economy
of cultural tradition. New concepts like *The Archive in Motion* (Rossaak 2010)
and `temporary archives` are symptoms of this temporalisation of the archive.
The immediateness of the retrieval of immense volumes of data through online
databases contends with an increasingly short-term maximum usability period,
which contemporaneous culture knowingly accepts. Yet this temporalisation of the
symbolic order is predetermined at the operative level of the present itself,
namely in the practice of signal and data transmission. Delay lines served the
micro-synchronisation of PAL colour television signals as well as the short-term
maintenance of data words in the first electronic computers. It belongs to the
nature of so-called new media that they compute by shifting voltage levels
interpreted as binary states, constantly accumulating interim values and then
deleting them again. The mathamatisation of technical communication by
Shannon results in a transmission channel which consists of discrete
temporary storage - an unexpected return of the familiar archival or yet
critically radicalised. The vocabulary of classic archivology fails when faced
with such micro-temporal modes of technological action.

"Time of non-reality": *Totzeit*, negative time

Not only do electronic systems tend from perceptible timing operations to
subliminal micro-temporal operations (like the in- or rather de-creasing clocking
and cycling units in digital computing); a new quality emerges with "binary"
information theory: Norbert Wiener's notion of "time of non-reality" which is
negative time which does not "count" in binary counting (computing) - real
switching moments (*hysteresis*).

There are in fact different classes of the temporal *inbetween*: the Dirac-impulse
(the momentary interruption - approaching the ideal time-criticality of the
"real") and the temporal moment evolving inbetween switching or flipping
binary alternate states. Such a "time of non-reality" (Norbert Wiener)\(^{105}\) only
counts when the speed of calculation approaches the real-time window of
presence. For re-presencing the past, an empty signifier is required. But how
the represent a void without turning it immediately, and by the very process of
signification, into a presentation, i. e. a mark of presence? Mathematically, the
cipher (literally *zero*) is to fulfill this function; on the typewriter keyboard, it is
the key for *blanc* which performs this (which, in digital terms, is nothing but a –
positive – bit as well, indifferent to other ciphers or letters or ASCII signs).
Maybe the only way out is to quit the semiotic realm, not musing about signs
any more, but reconsidering signs as signals, i. e. as very physical impulses –
the very flow and energy of the Internet (as) information. Neither the local
inbetween - the *spatium* - nor the arithmetic symbol "zero" is simply nothing;
suspension (German / Hegelian "Aufhebung") is the temporal correlate to these
terms.

---

\(^{105}\) See Claus Pias, Time of Non-Reality. Miszellen zum Thema Zeit und
Auflösung, in: Axel Volmar (ed.), Zeitkritische Medien, Berlin (Kulturverlag
Kadmos) 2009, 267-279
The micro-temporal camouflage: High Frequency Trading

Within virtual data event-fields like the digital Stock Exchange, time-critical temporalities become economical temporalties. High frequency trading operates with time-"hiding" purposes which had been tested in perceptual experiments in the 1960s: smuggling ultra-short moments of Coca Cola advertising into a regular TV movie, not consciously noticed by the viewer). This brings us back to the cinematographic affect.

A certain irritation of presence by the technical manipulatiuon of optical human perception of movement is based, among other criteria, on the physiological phenomenon of irradiation. This refers to the core procedure of kine-mechanics - not in its sense of creating an illusion of figurative movement, but as sensational (optical) physiology.

In the conventional view, for understanding economic and financial markets, long-term trends (diagrammatic time lines) have to be examined. Now that such events happen on the scale of seconds and time-fractions below, analysis has to approach such signals in terms of communication engineering and mathematical stochastics like (or even as) noise, that is: statistically insignificant. In the runup to the 2008-2009 financial crisis, a concentration of miniature flash crashes occurred in banking stocks: "[I]t suggests a link between what goes on at a sub-second level and what happens on the scale of months. At that point it started to look like an ecological system. Because [...] you have predators of all sizes [...] The algorithms are all looking for and picking up some kind of weakness in those particular bank stocks [...]" - not actually causing the crash, "but they were like sensors of the impending bigger weakness".106

Such time-critical algorithms are time-beasts. The focus of Delta-\( t \) analysis shifts from macro-temporal economical cycles to micro-temporal intervals.

Interplay: Gaming with the Pin Ball machine

The human hand is time-critically coupled in the cybernetic sense in the case of the Pin Ball machine, as described in a typescript entitled "Flipper" by Friedrich Kittler from the late 1960s or early 70s which immediately anticipates the first generation of computer games. If a human being is defined by his gaming instinct, he becomes inhuman once his partner is an automaton. This counts for the temporal aspect of gaming as well. The human pinball player with his hand(s) as interface to the automaton has to critically adopt to the electric tempor(e)ality of the machine.107

When discretely (not analogically / diagramatically) calculating either in his mind on quare paper with a pencil and erasing head, man is in (Turing-)Machine state.

The challenge of anti-aircraft prediction in World War II from the point of view of the artillery, as confronted by Norbert Wiener - gave 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.

The human "Flipper" game player with his hand(s) as interface to the automaton has to adopt to the tempor(е)ality of the machine; Kittler inserts a Latin quote. The equivalent to tactics in the temporal field of such cybernetic human-machine couplings is time-criticality.

Cybernetics has replaced the notion of the present moment as stasis by the insight into "Circular Causal and Feedback Mechanisms in Biological and Social Systems" 108.

Human cultural behaviour is bound into the symbolic regime - be it traffic lights inducing their binary stop-and-go, or the symbolic clocking of 24 hours a day. Still, in an individual experience a whole world of variances and delays unfolds between. On the even more subliminal level of temporal perception, "different stimuli which are processed within a temporal window of approximately 30 ms are treated as co-temporal, i. e., a temporal relationship with respect to the before-after dimension cannot be established for such stimuli. Information gathered within a temporal window of 30 ms is treated as a-temporal, i. e., there is no temporal contuity defined and definable for stimuli that follow each other within such intervals." 109 There is a tempor(е)al sublimity of "digital media", underscoring human perception in favour of an apparent continuity of time, but still being sublimely time-discrete.

**Micro-archiving presence from analog to digital technologies: functional sounding**

As long as it is not supplemented (or merged) with an optical perception, the perception of a bodyless voice from the past from a recording leads to an essential lack of the sense of origin.

The most common notion of "historical" time is based on an external observation, drawing of a distinction (in Spencer-Brown's terms 110) between past and the present. In digital computing, this distinction has collapsed

---

108 The original title of the so-called Macy-Conferences in New York, ed. by Heinz von Foerster 1949, and subsequently by v. Foerster / Mead / Teuber 1950, 1951, 1953, 1955
110 George Spencer-Brown, Laws of Form, Portland, Ore. 1994
technologically into the most minute, i.e. binary micro-temporal différance (in Jacques Derrida's neo-graphism), as has been applied e.g. in the ENIAC computer: "[W]e feel strongly in favor of the binary system for our [sc. "memory"] devices. Our fundamental unit of memory is naturally adapted to the binary system since we do not attempt to measure gradations of charge at a particular point in the Selectron [sc. cathode ray tube] but are content to distinguish two states" - which makes all the difference to analog computing.

The electro-magnet relay and later the flip-flop materially provided for such a truly binary device. "On magnetic wires or tapes and in acoustic delay line memories one is also content to recognize the presence or absence of a pulse of (if a carrier frequency is used) of a pulse train." This leads to the time-functional use of sound which is sonicity.

Technical recording of sound itself is a process of storage. "The breaking of the time constraint has profoundly changed the nature of acoustic communication." The temporality (and volatile being-to-death) of sonic articulation which hitherto could only by recorded symbolically by mnemonic notation is transformed into space and visualization by the very act of recording, making it available for analysis "outside of time". The temporal essence of sound is thereby turned into a reified, objectified time object, from evanescence to the literally ob-scene.

The traditional sound record - like the textual record - can be included within an institutional archival frame. With digital sound, though, literally every bit of sonic articulation becomes part of a generalized "archival presence", since a) every digital signal processing involves ultra-short quasi-archival intermediary storage and b) every sound "bit" becomes numerically addressable and thereby accessible to mathematical / algorithmic manipulation. The archival frame is deconstructed and re-turns from within the digital archival records themselves. From analog to digital "archiving" of sonic presence, "the manner of storage determines the kind of control that can be exercised over it" - from manipulation to distortion. At the same time, the analog-to-digital conversion results in a transsubstantiation of the audio signal: from the primary physical event to information which is essentially neither energy nor matter. Thereby the signal loses its time-indexical trace; transitive wave forms become numerical, geometricised time. Electro-magnetic sound transduction must therefore to be set into quotation marks: "[...] the digital 'transduction' process includes the digitalization of the analog signal by the ADC, its <micro->storage and / or manipulation in binary number format, and its reconstruction as an anlog signal by the DAC" - which is the conversion of an electronic

112 Burks et al. 1961 / 1976: 227
113 Barry Truax, Acoustic Communication, Norwood, N. J. (Ablex) 1984, 117
114 Truax 1984: 119
115 See Laura Marks 2002
116 Truax 1984: 139
embodiment of a number representation stored in the computer memory to discrete voltage steps at fixed time intervals (D\(\text{t}\)). The physically continuous original waves are thus transformed into square waves; in fact every binary computational act is an abrupt form of oscillation between zero and one in a time-sequential form. Only by smoothing the square wave by filters the wave becomes continuous again.

A kind of micro-archiving of presence is conceptually and technologically implied in the real-time processing of signals, since as a digital time-discrete sampling and quantizing of moments from the present signal (punctualising the continuous signal event) it requires intermediary short-time storage of data. The concept of real-time and "interrupt" for user input in computing dislocates the metaphysics of pure presence to micro-deferred presence.

The present signal event and its immediate storage merge into one with the increasing digital, i.e.: archiving recording of present spaces. Space itself is being transformed into time-coded snapshots by increasing instant photography (I-pad) which step by step ("one bit at a time") samples presence (sampling in both technological and meso-temporal meaning). Space becomes re-windable\(^{117}\), just as it is indicated in the notion of \textit{tx-transform} as technology of time axis manipulation.\(^{118}\)

**Media-induced shock more general**

The traumatic implosion of an electronic image (as in the case of the last transmission a public speech by Ceaucescu in Rumania December 1989) is of a different kind than the disruption of a celluloid film. Recently, the momentary break-down of Greek state radio and TV broadcasting by a sudden government decision for budget shortages resulted in a technologically induced shock: "It is quite an experience as Silence and Black reigns on public Greek media. In TV it was much more dramatic because the closure had already been announced and there were theatrical countdown moments when the frequency was shut down."\(^{119}\) Indeed, the visual shock of abruptly finishing broadcast is of a different kind than the acoustic experience.

"**Shock" with Benjamin**

Human perception is shaped by the variant media conditions. In a way close to what Marshall McLuhan later termed "the medium is the message", Walter Benjamin interprets film not in its content but rather as a setting just like a physiological experimental laboratory. The dramaturgy of "choque" accommodates the audience on the perceptual level to the speed of modernity and time-critical moments. What escapes the imaginary (the cinematographic screen and its illusion of flowing movement), is subliminally perceived as a

---

118 \textit{tx-transform} is the title of a short film produced by Martin Reinhart with Virgil Widrich (35 mm, Austria 1998)
119 E-mail communication by Konstantinos Vassiliou on August 13, 2013
fragmented series of 24 frames per second, involving a permanent affective /
cognitive dissonance on the non-discursive level already.

Walter Benjamin coined the term "physische Chokwirkung" for the
cinematographical image. Different from the photographic punctum
(Barthes), the traumatic moment in the filmic image is its temporal movement-
thus closer to the phonographic voice. Whereas an image can be motionless
endurance, a recorded sound can not but dynamically unfold - between the
temporal now ("the present") and auratic appearance ("presence" and "re-
presencing").

In his notorious essay on "The Work of Art in the Age of Reproduction" (1936)
Walter Benjamin identifies a loss of aesthetic "aura" which is bound to tradition
and the uniqueness of the work of art in space and time by means of technical
reproduction (mainly photography, but as well phonography, influential up to
Baudrillard's notion of simulation. Furthermore, Benjamin sees human
perception shaped by the variant historic media conditions. In a way close to
what Marshall McLuhan later termed "the medium is the message" he
interprets film not in its content but rather as a setting just like a physiological
experimental laboratory, when stating that the audience is subjected by the
apparatus into a psycho-laboratory test situation. The dramaturgy of
"choque" accommodates the audience on the perceptual level to the speed of
modernity and time-critical moments, as expressed in Ernst Jünger's writings
on photography.

The anachronistic momentum of technological recording

Woody Allen's film Zeelig operates with digitally interpolated past as fictitious
testimony. Unlike the Barthean "punctum" in photography, the anachronism is
not imbedded in the recording itself any more.

The time-critical moments of mémoire involontaire in Marcel Proust's A la
recherche du temps perdu which look contingent can be neuro- and media-
archeologically "grounded". The reanimation of phonographically un-dead
sound recordings falls short from the theological notion of redemption; so let us
not be trapped to follow a hidden "messianic" eschatology masked by so-called
media archaeology. With any re-play of an old phonographic recording of
Caruso's voice, history-defying short circuits presuppose that the mechanical
and electromagnetic rules known to the designers of sound recording devices
are still in operation today. Indeed, the phonographic record allows for time axis
manipulation against the physical and cognitive law of the irreversibility of
history. "New media, as vehicles that carry our senses and bodies across the
space-time continuum, introduce to us old modes of experience [...]. Media

120 Walter Benjamin, Das Kunstwerk im Zeitalter seiner technischen
Reproduzierbarkeit, in: same author, Illuminationen, ed. S. Unseld, Frankfurt/ M.
(Suhrkamp) 1969, 148-184 (172)
121 "Das Publikum fühlt sich in den Darsteller nur ein, indem es sich in den
Apparat einfühlt. Es übernimmt also dessen Haltung: es testet." Walter
Benjamin, Das Kunstwerk im Zeitalter seiner technische Reproduzierbarkeit
[*1936], Frankfurt/M. (Suhrkamp) 1963, 26
thus bear the messianic power, in Benjamin's special sense of that word, to
forever alter the past."\textsuperscript{122}

The Edison phonograph did not arise from desire for a memory medium. In fact
it rather unintentionally resulted from Edison's experiments in speeding up
transmission of telegraphic signals, recording the Morse code dots and dashes
on an intermediary storage device (the embossy telegraph with rotating discs)
for accelerated transmission: "[...] to make a repeater that would store words
without the labor of the human hand [...]"\textsuperscript{123} - just like the draughtsman Henry
Fox Talbot developed photography from his wish for images from nature to be
liberated from the inaccuracies of his painterly hand.

If for this reanimation of dead sounds and images the word "redemption" might
be applied, this is not simply a reference to Walter Benjamin's "messianic"
historical materialism; we might phrase it rather the other way round:
Benjamin's phrasing is now itself redeemed by technical media of suspended
time.

**Signal "immediacy": dissimulated presence**

"Presence" expresses a subjective perception of non-technicity in media
participation, well known from traditional rhetoric as the figure of hiding the
awareness of artificial speech configuration *dissimulatio artis*. When a voice
from phonographic record is being re-played, both the technicity of the
apparatus and the historicity of the actual recording are being forgotten in
favour of the physiological a/effect of presence. Bolter & Grusin, developing on
McLuhan's *Understanding Media*, describe such *immediacy* for the realm of
visual representation "whose goal is to make the viewer forget the presence of
the medium (canvas, photographic film, cinema) and believe that he is in
presence of the objects of representation"\textsuperscript{124} - whereas *hypermediacy* actually
emphasizes the presence of the medium and does not dissimulate it in favour
of the impression of using a previous (familiar) one - just like modernist
painting, according to Clement Greenberg, is defined by making the material
medium itself the aesthetic message.\textsuperscript{125}

"*POSTING*" DIGITAL PRESENCE: A MICRO-TEMPORAL REGIME

"Post-digital" media culture? Sustaining a critical philosophy of
algorithmically driven technologies

\textsuperscript{122} John Durham Peters, Helmholtz, Edison, and Sound History, in: Lauren
Rabinovitz / Abraham Geil (eds.), Memory Bytes. History, Technology, and
\textsuperscript{123} Peters 2004: 188
\textsuperscript{124} Jay David Bolter / Richard Grusin, Remediation. Understanding New Media,
\textsuperscript{125} Clement Greenberg, Toward a Newer Laokoon [1940], in: idem, The
Collected Essays and Criticism, vol. 1: Perceptions and
Judgments, 1939-1944, Chicago / London 1986, 23-38
The expression "from analogue to post-digital", like any "postism", already suggests a temporal vector, a linear, almost teleological evolution. In a genuinely media-archaeological critique of such chrono-logic historicism, computer-based culture gets progressively used to non-linear figures of temporality, as known from computer programming itself: the "GO TO" jump order in algorithmic source code, and other figures like iteration, loop, and recursion.

It is this "post-digital" temporality which deserves close analysis. The micro-temporal features of the "post-digital" condition result in almost imperceptible, fundamental irritations of the sense of the present. The technical core of such operations of sampling the visual present is the sample-and-hold mechanism for converting analog signals into digital bits. This invites for a revision of the perceptual impression of visual movement from chrono-photographic reproduction. Human perception of the "present" is affected by sublime micro-technological zones of indeterminacy between the analog and the digital, especially in its sonic emanations.

The historicism suggested by the adverbial trajectory from analogue to the post-digital is seductive. In many media-archaeological respects, the digital image has preceded the analogue one, like Alexander Bain's telegraphic image transfer already in early 19th century.

The "Editorial" of the Post-digital Research journal APRJA provides a working definition of the post-digital: "Post-digital, once understood as a critical reflection of 'digital' aesthetic immaterialism, now describes the messy and paradoxical condition of art and media after digital technology revolutions. 'Post-digital' neither recognizes the distinction between 'old' and 'new' media, nor ideological affirmation of the one or the other. It merges 'old' and 'new', often applying network cultural experimentation to analog technologies which it re-investigates and re-uses. It tends to focus on the experimential rather than the conceptual" - which nowadays results in an explosion of emergent "labs" in digital humanities.

The current discussions on the "post-digital" remind of the former debates on the "post-modern". Against the post-isms, Jean-François Lyotard, in The Postmodern Condition, rather defines the "post" as enhancement, not as "beyond". If in that sense "postmodernity" did not represent a new age, but rather repeated essential features of modernity, let us rather re-think the "digital" than dismiss it too early. It takes time to confront the challenge of the digital epistemologically. The fact that in ubiquitous computing the digital seems to have become part of everyday culture - just like listening to music from an MP3-Player introduced complex compression algorithms into popular culture - does not mean that contemporary culture has already digested the shock of digital electronics invading the analog world.

It is almost a "law of media" (Marshall McLuhan) that when the experimental, initial era of a "new medium" (where it is still consciously media-archaeologically experienced and reflected by the users) is transformed into a mass medium, the techno-logical message of the medium recedes behind its semantic and cultural "content". After "the digital" has been culturally ingested and become an everyday commodity with ubiquitous computing, culture is not yet "post-digital" but - in analogy to traditional radio and television - in a "mass-digital media" age. The digital, though, still needs to be media-theoretically and epistemologically to be "ingested" (Freudian Durcharbeiten) - which requires hard-edged techno-mathematical analysis of processual algorithms (radical media archaeology). The focus of my argument is therefore not on the term "post-digital" how it is used in the discourse of digital artistic practice which serves as a kind of tranquillizer for humanities: "It points to an attitude that is more concerned with being human, than with being digital."128

McLuhan's posthumously published manuscripts on media time under the title Laws of Media are a kind of a media theoretical equivalent to Hayden White's seminal Metahistory. According to McLuhan, there is a chrono-logical (not simply annalistic) figure of how technical media unfold in cultural time indeed: First - in its media-archaeological incubation - the new technology (such as cinematography or video, or the phonograph whose material presence receded behind the loud-speaker) itself is subject of attention and avantgardist experimentation; after a time of cultural accommodation it becomes a simple commodity and the focus shifts from the medium's message to ubiquitous content.

Significantly, one of the uses of the term "post-digital" developed in the sonic context. Kim Cascone coined and uses the term in his article "The Aesthetics of Failure: 'Post-digital' Tendencies in Contemporary Computer Music"129; this referred to the glitch, to circuit bending, to "media archaeological" research art. Nicholas Negroponte declared "The digital revolution is over" at MIT Media Lab in 1998.130 In his version of the "post-digital", Cascone directly referred to Negroponte's manifesto in his analysis that "the revolutionary period of the digital information age has surely passed"131. Indeed, when the media-archaeological incubation phase is over (experimenting and experiencing a technological invention), the technical a priori becomes a black box in favour of aesthetic interfaces.

But inbetween is techno-locigal formats and "apps". Here not the complex medium apparatus as such is the message like with radio and television before; rather, their specific electronic affordances and software tools themselves have become the sub-mediatic message. It is tools such as Max, SMS, AudioSculpt, Pure Data, and other that make possible "post-digital" music (Cascone) which is characterized by micro-sonic, almost DNA-like operations.

131 Cascone 2002
As has been demonstrated by Martin Heidegger with the human use of the hammer as tool already, it is only from the failure (and noise) of a technology that the medium articulates itself.

"[Glitches, bugs, application errors, system crashes, clipping, aliasing, distortion, quantization noise, and even the noise floor of computer sound cards are the raw materials composers seek to incorporate into their music."\(^{132}\) Jem Finer defined the term \textit{post digital}, in relation to his own artistic work, as "a return to a tactile relationship with ideas and materials informed by over 30 years of working with computers. A practice that seeks to transcend mediation via a screen and locate itself in the physical world, rather than at one stage removed, through digital representation". He first formulated the term in relation to his 1000-year-long musical composition, \textit{Longplayer}\(^{133}\). But there is more involved than just a nostalgia for the haptic dimension in analogue media interfaces; this "retro"-mania is rather an epistemological symptom, the longing for re-gaining a sense of temporality which has lost in high-frequency media culture operations."

In a couple of other new media art works as well, the "post-digital" primarily refers to the re-entry of the physical existence and that into "the abstractness of the digital world" (ibid.). But then, is it only the hardware-oblivion of most digital media users and theorists which leads to this recent discovery that even the most immaterial and virtual mediascapes radically (that is: on the media-archaeological level) ground in ultimately analog electro-physics. The "bit" has always been (and still is) nothing but an extreme articulation of the continuous - from the conceptual "digital" back to the analogue.

\textbf{The sublime presence of ubiquitous computing}

In his book \textit{The Computer for the 21. Century} (1991), Marc Weiser predicted ubiquitous computing: "Specialized elements of hardware and software, connected by wires, radio waves and infrared, will be so ubiquitous that no one will notice their presence."\(^{134}\) Digital media transform into a \textit{sublime} presence - sublime in Edmund Burke's and Immanuel Kant's sense of something which is there but can not be figuratively imagined by humans.

This reads like a counter-historical recursion of the first "digital" writing system in culture: the vocal alphabet, which in the first generation had been subject of media-critical attention (Platon, \textit{Phaidros}), but then became cultural everyday practice, so that writing and reading hermeneutically shifted from the awareness of signifiers to a focus on semantic content.

All the more the media-archaeological veto is required, a kind of \textit{katechon} ("beholder") as defined in the 2nd epistle of apostle Paul to the city of  

\(^{132}\) Cascone op. cit.  
\(^{133}\) As quoted in: http://en.wikipedia.org/wiki/Postdigital; accessed May 11, 2015  
Thessalonike: The task is to defer public oblivion of the techno-mathematical conditions for articulations in so-called digital culture.

**The re-entry of the "analogue" in the "post-digital"**

The discourse of the "post-digital" is useful when it helps to get rid of the simplistic use of the adjective "digital" which is confused with binary computing - whereas "digital" cultural techniques are as old as culture itself (counting with fingers, vocal alphabet, Morse code).

The "digital" has been at work already in alphabetic writing and the cinematographic frame sequence. The "analogue" media came inbetween: photography, phonography, electro-magnetic broadcast media (radio, television). With computing, the digital returns; in techno-mathematical terms, the numerical ("digital") signal analysis in the frequency domain is the inverse value ("Kehrwert") of the analogue wave form in the time domain.

Media-temporal loops happen in insular modes, different from media-historical emplotment of technological evolution. The alphabetic code corresponds with telegraphy, against which telephony (analogue signal transmission by electric transduction of the human voice) intervenes. But with "voice over IP", even telephony returns as digital communication.

Terms like the "post-digital" still fall victim to the symbolical time regime of historical discourse. Each postism affirms the narrative plot that technologies are being invented, they emerge, they flourish, they end, to be succeeded by another technical dispositive.

The term "post-digital" is meant to express that media culture has entered a stage where the digital as such is not an object of newness and excitement any more since in everyday life, in academic practice and in media art it has become common to work interactively. I still insist that the digital challenge, even if practically "ingested", has not yet been epistemologically and critically digested and needs ongoing media-archaeological distancing reflection.

We might be "post-digital" in the sense of everyday usage of media, but when we stay aware of NSA data surveillance tools, we certainly still have to critically investigate the algorithmic digitality and tempor(e)ality.

On the phenomenological side, it is true that communication culture has become "post-digital" insofar as computational algorithms embedded in mighty processors have become so efficient that most humans are not even aware of the discreteness of digital events (be it sound, be it vision, be it communicative interaction) unless a momentary breakdown of real-time processing happens - which leads to a common confusion between "live" (as affective experience) and "real-time" (as its technological condition). On the level of physiological perception the "analogue days" return - but just as a time-continuous simulacrum, dissimulating its time-discrete and micro-archival nature of intermediary storage. In that sense, the storage-programmable computer (the "von Neumann architecture"), coupled with predictive algorithms (the "future in the past" mode of temporalizing presence), is the technology to be focused.
Micro-archiving presence from analog to digital

The media-archaeological spelling of (micro-)tempor(e)alities on the one hand reminds of the Latin notion for realitas from res, the material artifact. Media time is embodied temporalities. The spelling of tempor(e)ality is further influenced by philosophical thoughts which relate being to time (Martin Heidegger) and proclaim a process-oriented ontology (Alfred North Whitehead). But at the same time, media archaeology is more strictly grounded in the technical sense. German "geerdet" (grounded) is an expression from electro-technical engineering, indicating that circuits in hardware have to be connected with the physical "mass". Media phenomenology is not necessarily restricted to human sensation, perception and mind, but extends to a kind of phenomenology of and by the machine as made possible by signal sensors. It is the "sample&hold" mechanism which not simply translates but even transsubstantiates (to borrow a term from Catholic religious liturgy) the analog physical world into digital computability.

In reading concrete techno-logical scenarios such as circuit diagrams, media archaeology identifies new "shapes of time" (George Kubler). The sample-and-hold mechanism (before the signal actually gets digitally quantised) performs the the ephemeral archive - with its records being "stored" only for a fraction of a millisecond. Condensers figure among the smallest electro-physical storage elements, and combined with transistors they function as micro-memories here. The electronic sound slice is a temporal being in such electronic circuits, not punctual, but a suspended instant of time as voltage.

The observational separation between past and the present has shrunk technologically into the most minute micro-temporal différence in digital computing. The fundamental unit of memory, the electro-magnetic relay, for electronic engineers seemed "naturally adapted to the binary system" since they did not attempt to measure gradations of charge at a particular point but were "content to distinguish two states"135 - which makes all the difference to the time-functional classical black & white television scan line, and to analog computing. The flip-flop as truly binary device provides for the rhythm. Magnetic wires or tapes or acoustic delay line memories recognised the presence or absence of a pulse or (if a carrier frequency was used) of a pulse train.136 All of the sudden, beyond the phenomenological notion of the continuum of time (Bergson), computer time sounds different.

A core of the operation: The sample-and-hold mechanism

136 Burks et al. 1961 / 1976: 227
The canonical sampling-theorem describes the digital ratio of the "slicing" of a continuous signal flow in order to preserve the signal fidelity intact. The current notion of "streaming" media in online access to audiovisual content metaphorically disguises the discrete nature of signal processing and linear buffering.

In Jim Campbell's media art installation *Church on Fifth Ave* (2001), a matrix of 32 x 24 (768) pixels made out of red LEDs displays a pedestrian and auto traffic scene in New York from an off street perspective. A sheet of diffusing plexiglass is angled in front of the grid. As the pedestrians move from left to right the figures gradually go from a discrete representation to a continuous one - or metaphorically from a digital representation to an analog one.¹³⁷

The message of this installation can be understood in the media-epistemological sense. Once being subject to algorithmized signal processing, any "analogue", apparently continuous representation of an event is irreducibly discrete - which shows up in the very artefacts ("glitches") the "post-digital" aesthetics is so fond of. This is noticable on the margins of the Campbell QuickTime Movie itself. The analogue here becomes a retro-nostalgic re-entry within the digital.

Human perception tends to smooth discrete data into coherent signals anyway, since it functions as a kind of digital-to-analog converter, when confronted with the pixelised image resolution - just like in mechanical cinema frame sequences and analog television scan images already.

Epistemologically, the digital infinitesimally approximates the physical world. But the perfidious power of "the digital" unfolds with Digital Signal Processing, since this allows to simulate the "worldly" analog signal in high temporal fidelity - like physical modelling does with instruments in electronic music.

Between the analog and the (post-)digital a techno-mathematical operation reigns. Any periodic wave signal - be it auditory in the time domain or a visual pattern in space - can in reverse, by means of the Fourier Transform, be numerically addressed in the frequency domain and thereby becomes accessible to computing intelligence.

In times of communication technologies which are based on the Sampling Theorem, the human sense for the difference a natural and an artificial sound or movement fails. Digital computers have become capable to successfully re-the voicing of the analogue world.

Media archaeology locates the scene of the "digital" where it precisely happens. Every digital device, in its physical media-archaeological essense, remains ultimately analogue in the temporal sense. Any switching between two binary states from low voltage "zero" to a higher level "one", however abrupt, is (electro-)physically time-consuming but literally does not count; Spencer-Brown's term "drawing a distinction" is a time-critical act itself. According to

¹³⁷ http://www.jimcampbell.tv/portfolio/low_resolution_works/fifth_avenue/church_on_fifth_avenue
Adrian Mackenzie, such "dead-time refers to a spacing or non-identity 'within the presence of the living-present [...]". Norbert Wiener once coined this by the enigmatic expression "time of non-reality". This *inbetween* is the temporal equivalent the Aristotelean notion of *to metaxy* which became, in Latin scholastic translation, the *medium* of signal transmission.

Luciano Floridi, describing the phenomena of ubiquitous computing and the "Internet of things", sees "[t]he threshold between here (analogue, carbon-based, off-line) and there (digital, silicon-based, online) [...] fast becoming blurred [...]. The digital is spilling over into the analogue and merging with it." This actually extends to the temporal dimension: "[T]he very distinction between online and offline will disappear." Indeed, Global Positioning Systems calculate a position in space as a triangulation of signal runtime differences - space becomes a function of time-critical communication. "Radio Frequency IDentification (RFID) tags store and remotely retrieve data from an object and give it a unique identity, "like a barcode" (ibid.). Thereby the material present is coupled to the archive already.

ALIEN TEMPOR(E)ALITY. The Clash between Symbolical Time and the Temporeal in the Technosphere

**The technochronos hypothesis**

The discussion of "heterochronia", which has been inspired by Bachtin and Foucault, is mainly related to human cultural discourse. Radical media archaeology is a way to detect the "other times" rather within machines. On the other hand, its focus on concrete techno-chronical scenarios prevents from the allure of an all to speculative (tempo)realism.

Technological devices - different from previous cultural techniques and trivial machines - embody a tempor(e)ality of its own. Since technologies come into their media-being only when being operative and signal processing, as chrono-techniques, their *technológos* is essentially intertwined with the question of time.

The *technológos* hypothesis does not claim any metaphysical reality, though.

---

141 Floridi 2010: 16
Technological devices have been functionally engineered, and programmed, with a rational design. But such a design, once it is implemented into real matter, knows more than its inventors. Different from Harman's and others' object-oriented ontology, media archaeology is the method to investigate this hypothesis radically, that is: grounding it in actual material reality (hardware, electronics), and the symbolic order (software, code), as precise as possible. Like hermeneutics is applied to reading texts to unfold their implicit meaning, radical media archaeology investigates the techno-logical diagram (such as circuit design and algorithmic flow charts), and its material implementation (its actual circuitry) to reveal its technológos.

Most radically, within technologies, an alienation from the human, or cultural, sense of time takes place. In regard to this heterochronia of technologies as such, the expression "alien temporality" alludes to Ian Bogost's Alien Phenomenology (2012). It replaces the anthropocentric analysis of human "inner sense of time" (in terms of Edmund Husserl\(^{143}\)) by a second-order observation, which is the question how "time" is presented to another entity\(^{144}\), the measuring "sensors" from the point of view of the machine. This leads to a techno-logical, rather machine-oriented phenomenology. Rejecting the notion that there is one homogeneous time "containing" (or rather, in Heidegger's techno-logical sense "enframing") all entities, machine-oriented ontology (MOO)\(^{145}\) rather insists that "times arise from machines as well"\(^{146}\). In allusion to Immanuel Kant's definition of the cognitive temporal a priori, machine time is nothing other than a form of its inner-technological sense. This sense becomes concrete in sensors like the A/D converter that transduces "analog" time-continuous signals into "digital", that is: computable frequencies. Looked at in this perspective, "[e]very machine has its internal form of temporality and these temporal rhythms differ among themselves" (Bryant ibid.).

**Techno-Logically Induced "Time" Figures**

In vernacular discourse, the notion of "time" is rather diffuse, and can actually be grounded and precized by counter-checking the termini technici for timing in engineering. As it has been remarked in the introduction by Lionel Pearson to Aristoxenus' *Elementa Rhythmica*: "One of the difficulties in reading Aristoxenus is to distinguish the special or technical use of a word from its general meaning. Greeks of his time were devising their own technical and scientific terminology."\(^{147}\)

In the Aristotelean definition, time comes into existence only by counting

---


\(^{145}\) Bryant 2014: 15

\(^{146}\) Bryant 2014: 157

intervals; his disciple Aristoxenus, in his fragment on Rhythm, coined the term *chronoi* ("times") in the plural, for rhythmic prosodic, or musical articulations in micro-time. All kinds of rhythms and tempor(e)alities chronopoietically unfold from within the machine, even when they are not noticed by humans at all. Chronotechnical analysis is required to reveal the implicit temporalities of technical beings, and to identify their *chronoi*. Aristoxenus’ term for the smallest rhythmical units of long and short intervals can be extended, or re-actualized, to the data cycling units in digital computation.

Radically new, techno-mathematic forms of trans-temporality result in an epistemological turn of "time"; e. g. the notion of "recursion", as time-figure, has been triggered by algorithmic thinking.

Technologies turn time into an epistemic toy. For example, the so-called Harmonizer allows for pitching voices from male to female bandwidths in real-time, avoiding the magnetophononic Mickey Mouse effect which arises from a speeding up of the tape. This requires real-time calculation from within a microchip, and has been the reasons for younger Friedrich Kittler to learn to program in Assembly code, which is necessary for carrying out such time-critical tasks. And the Ableton Live sound editing software allows for rhythm manipulation. Dynamic time warping is based on an algorithm that measures similarities between two temporal sequences and equalizes them. When a rhythm is played by a real drummer, this beat feels human exactly by not being always just in time; Warp Markers allow bringing various loops into sync with one another. In reverse, other software allows for a rehumanizing of electronic drum machines, remediatizing algorithmic reasoning with the music rhythm.

The challenge which arises from technological media to the cultural notion of "time" does not simply lead to further variations of the individual or collective sense of time, but essentially transforms the ontology and the functionality of time itself. As its other ("alien" heterochronia), the tempor(e)alities of technical media pose a challenge to symbolical (cultural and historiographical) "time". The semantics of so-called "time" as a transcendent signifier in cultural discourse, already lags behind against the techno-logical description of escalated media *timings*. Terms for such *timing* in communication engineering like "delay", "loop" or "realtime" turn out more precise than the inherited emphatic semantics of "historical" time, or the "inner sense of time" (Husserl).

The mathematical theory of information has transformed both the scientific understanding, and engineering of communication. This media-epistemic shift has already created new cognitive territories - in theory. In practice, cultural discourse semantically lags behind the state in which digital technologies already are and act. Digital information has not yet changed cultural conventions of how humans conceive and inhabit space and time, nor the predominant discourse of history itself, while practically resulting in new, multiple kinds of tempor(e)alities already. Technological chronopoietics involves alternative modes of dealing with what occidental discourse used to call "history" - if not denying "time" as such. Time itself is a transcendent signifier

---

148 See Shintaro Miyazaki, Algorhythics. Understanding Micro-Temporalities in Computational Cultures, Computational Culture 2 (2012), online
no more: "Time probably appears to us only as one of the various distributive operations that are possible for the elements that are spread out in space."\textsuperscript{149}

\textbf{From "Time" to Frequency Domain}

"Radical" media archaeological analysis identifies the concrete scenarios (media theatre) where the symbolical, cultural time regime confronts the entropic temporality of real matter, its thermodynamics. From that derives the typographical play of characters in "tempor(e)alities". On that stage, a cognitive chrono-logical concept confronts the techno-logical real.

[By time-critical analysis, tempor(e)alities turn out, which operate below and beyond human sense of time. "Non-human time is the order of the day, be it the fatal geological time of the Anthropocene or the nanoseconds of the algorithms informing our mediated realities" (Call for papers Paris PhD training seminar). On a macro-time scale, a multiplicity of temporal layers occurs with the Anthropocene discourse indeed. Since human-centered culture has begun to leave an everlasting footprint of the earth's crust, the complex, layered interrelation between "social time, technological time, and human time in relation to deep time, archaeological time, planetary time"\textsuperscript{150} is reconsidered. But the climate change debate is still anthropocentric. It is negligent of another drama that concerns the \textit{cognitive} environment. In parallel to human-induced climate change, a "noosphere" (Teilhard de Chardin) has arisen, a new kind of environment (McLuhan) which arises from \textit{within} technology and its \textit{logi(sti)cs}.

To \textit{un}think time is impossible for human intuition, according to Immanuel Kant's concept of the tempo-spatial \textit{a priori}. But this can be achieved by switching temporal observation to the technomathematical machine. Does it really make sense for the nonhuman observer - and the "radical" media-archaeological point of view - to suppose a dimension called "time" at all? Process-oriented ontology\textsuperscript{151} asks to think technologies from \textit{within}, to consider the time of the machine as opposed to the human time of experience. "[W]hat makes questions of temporality and experiences of media aesthetically interesting are situations in which multiple temporalities are present and rub against each other\textsuperscript{152}, such as the cinematic gap which opens between the nonhuman, time-critical projection mechanism, and the human experience of continuous movement. A media dispositif, such as cinema, is a system consisting of human and non-human agencies (in terms of ANT). Media phenomenologically, what counts in a cinema screening is its usually ninety minutes symbolic time frame to actually tell a narrative that may, in the imaginary time, last two months. But cinematography's own temporality, which is the condition for that

\textsuperscript{149} Foucault 1986
\textsuperscript{150} Katja Kwastek, in: The Aesthetics and Politics of Slowness: A Conversation, in: ASAP/Journal 4.3 (September 2019), 467-483 (479)
\textsuperscript{151} See Bryant's insistence on the "operative" qualities of the machine: 2014: 38
phenomenological time experience, is only subliminally accessible to humans: It is the machinic event unit of twenty-four frames per second, which in combination with the discrete clock-like intermittent machinery, and the turning shutter, betrays the human sense of continuous movement. This inner machine time is linked to other realities than the human film experience - it is actually closer to the step-wise algorythm (Miyazaki) of the Turing machine. "There is therefore a time in or of the medium, but is that really the only thing that matters when I go to the movies? No." says Koepnick (ibid.). In his media anthropocentrism, "[w]hat really matters is the relations and tensions between the mechanical time of the film, the plot time of the film the story time of the film, the time it takes to watch the film, and the kind of time that we bring as viewers to the auditorium, our memories and anticipations, our patience and durational commitments, our expectations and curiosity - and it is the meshing and interactions of all these different times that makes the experience of watching a film aesthetically interesting." (Koepnick ibid.)]

But this anthropocentric time experience is not the only interesting aspect for media-epistemological investigation. Machine-Oriented Ontology has a different kind of perception. What literally matters here is the machine aisthesis as well, which is a function of its technical materiality, and logical coding. In order to call this nonhuman sense of time to attention, the cultural semantics and vocabulary "time" is displaced (if not even replaced) by technical terms for a multitude non-discursive temporal operations. Subjective, collective, or aesthetic temporal experience such as "slowness" is rather addressed in terms of signal processing, such as the "delay line" in electroacoustics to achieve the echo effect, or for reverberative data memory (RAM), and the "delta-t" for intervals. Electronic media posit a technical rather than affective sense of timescales.

What radical media archaeology is aiming for is - at least momentarily - a suspense of analysis from the human time experience, which is aesthetic, and phenomenological time, in favour of looking specifically at what the technical medium does. For example, in computing there is "the idea of command and execution in algorithmic code and specifically the moment of it not working - that is, that a command doesn't necessarily mean that there is an execution, which brings to the fore a thinking in a completely different kind of time that is not human but machinic."153

There is no "digital time" in its proper sense. In computing, the frequency domain turns out as the reversal of the familiar time domain. What appears as "time signals" to humans, after Joseph Fourier's mathematical analysis of vibrational events in his 1822 Théorie analytique de la chaleur (The Analytical Theory of Heat), can be decomposed into its single sinusoid partials which can be addressed in terms of their amplitude and frequency. In computing, this becomes the discrete operation of numbers.

Technomathematical discrete time sampling is most discrete microtemporal segmentation. Once signals from the time domain (such as wave forms) have been computationally sampled in A/D conversion, they do not exist in time at

all any more, but rather in its mathematical reversal, this is, in the frequency
domain which can be numerically addressed and thereby communicated to the
digital computer. This makes it accessible to numerical algorithms, that is:
chronopoietic tools instead of an a priori called "time"; Fast Fourier Transform
an algorithm that computes how temporal sequences can change from the
time domain into the frequency domain.

The elementary unit of technological being-in-time is the time-varying signal
for analog media; for the digital, it is discrete pulses. Fourier analysis
transforms the temporality of the physical signal into a mathematical pattern,
which is the frequency domain of its single components.

What if there is, in information theory, not even multilayered temporalities, but
no more "time" at all, when thermodynamic entropy is replaced by Shannon
entropy? Binary computation is generating new epistemic time-objects instead,
like ergodic time, Markov chains, and Wiener's notion of a "time of non-reality"
which occurs between binary switching states. In principle (en arché), at "bit" is
timeless in its lossless reproducibility and calculability.

"Real-time", "live", storage

In contrast to phenomenology, radical media-archaeological analysis reveals
figures of timing, which occur within technologies. These are alien to the
human "inner" sense of time in terms of its different chrono-logics, and
alienated from the human since in high-frequency electronics, and computing,
the temporal event surpasses, or recedes behind, human awareness.

Norbert Wiener's notion of a "time of non-reality" names the switching interval
between two alternating voltage states in a flipflop circuit. This tempoReal
literally counts, while the term "real-time" is, in fact, a betrayal: for just-in-time
processing, it rather refers to a temporal interval, which is defined, and
relativized, by a trask to be performed. In human-computer interaction (like
video gaming), computational "real-time" is relative to the human
phenomenology of a temporal time-window called "the present".

Real-time computing hardware and software systems (aka reactive computing)
are subject to constraints in bitstream transfer, such as the operational
deadlines from an event to its system response. By contrast, a non-real-time
system is one for which there is no deadline, even if fast response or high
performance is desired or preferred. "A real time system may be one where its
application can be considered (within context) to be mission critical."155

The term real-time derives from its use in early simulation. While its current
usage implies that a computation is "real-time" when it is "fast enough",
originally it referred to a simulation that proceeded at a rate that matched that

---

154 See Claus Pias, Elektronenhirn und verbotene Zone. Zur kybernetischen
Ökonomie des Digitalen, in: Jens Schröter / Alexander Böhnke (eds.),
Analog/Digital – Opposition oder Kontinuum? Zur Theorie und Geschichte einer
Unterscheidung, Bielefeld (Transcript) 2004, 295-309
of the real process it was simulating. Analog computers have been capable of simulating an event much faster than in real-time.

Already the concept of "live" transmission of radio, and television content, only makes sense in terms of human aisthesis, but has been a betrayal of the physical temporal gap. Even in ultra-speedy electro-magnetic waves a minimum delay occurs, which finds its limits by the speed of light. When it comes to sound propagation, this delay is more critical, since human ears soon sense a temporal delay in acoustic waves that travel with comparatively slow speed of 330 m / sec. That is why, in time-critical analysis, the umbrella term "audio-visual" media breaks apart with the asymmetry, for human senses, between the transmission of electromagnetic and of mechanical waves.

Already the technical effect of electronic tele-presence has transformed the contemporary into rigid signal synchronization. In terms of engineering, the electric resonant circuit enables radio communication, and only the time-critical, exact synchronization of "live" television signal transmission and reception creates the impression of a steady image for the human eye. Only in the cosmic dimension, electro-magnetic signal delay becomes visible in the distortion of moving targets like astronauts in Slow Scan Television transmission to the observer on earth.

In reverse, storage media constitute a kind of suspended time channel of signal transmission.

**Thermodynamic Versus Logical Time: Reversible Computing**

With any machine implementation of logical reasoning and algorithmic computation, between the input signal and its output, bits get lost in the course of their calculation by logical gates. For an AND operation, e. g., from two input signals, only one output signal results. This informational loss can be measured in terms of entropy, and its physical loss is the emittance of heat. Here, the symbolic order confront the mateReal: If logical states are treated like physical states, they are subject to the laws of thermodynamics\(^\text{156}\), which induces its irreversibility. But logical operations, as it has been demonstrated by Landauer, can be formulated in a reversible way, so the initial state can be inferred from the final state. This includes the necessity for increased storage of bits, though, which otherwise get lost in calculation. For experimental, media-epistemic investigation, such computers have actually been constructed.

**Sublime Temporalities: Nuclear, and Aesthetics Time-Criticality**

A case where both heterotopia (in Foucault's sense of "Other Spaces"), and heterochronia, intertwine, is the challenge of how to communicate the danger of nuclear waste deposits to the far future, and possible "aliens".

High-speed photography has played a decisive role in analysing, and documenting, the first nuclear tests, which goes along with the development of the effective von Neumann architecture of computing to pre-calculate such nuclear fissions. Such time-critical series of micro-events are neither perceivable, nor calculable, for humans any more. From that derives the aesthetics of a "sublime" media temporality - both as speed, or as slowness. John Cage composition As Slow as Possible for piano first, then for organ, makes the listener "think about durations that may exceed human existence" (Kwastek: 481) - which, in the Halberstadt organ installation, will actually last for 600 years to play.

In his thoughts on so-called Harmonic Analysis, Norbert Wiener refers to the lowest organ tone, which results in pulses rather than tones for human perception. But even for seemingly continuous tonal events, the machine knows its different, discrete time. But when slowing down acoustic vibrations as such, an alienation takes place. "What if you could slow down the playback of sound to an almost standstill?" [...] in looking at the tides I was faced with an oscillation that mobves in a wavelike manner at a decelerated speed that, for humans, might resemble just that: an almost standstill."157

Tide prediction machines have been devised by Lord Kelvin in 1872, which is an analog computer for real-time simulation. The "acoustic episteme" of vibrational force (Goodman) and oscillations (Oersted) has been triggering computational reasoning indeed.158

"The temporalities that traverse our lives are becoming increasingly more difficult to negotiate" (cfp). But even the focus on "the complexities of experienced time" (cfp), and the irritations of the human sense of the present, is still an anthropocentric perspective, against which Graham Harman's Objekt-Oriented Ontology, Karen Barad's New Materialism, and the technológos hypothesis, set an autonomous thing-time.

With(in) technology, "time" is turned from an a priori, or transcendent signified, into an operational signifier. The clock generator in computer CPUs is timing in the sense of symbolical time-giving, while at the same time being a subject to entropic temporeality at the same time. The "clock rate" in computers is derived from the frequency of an oscillator crystal which is, first of all, is producing a "sonic" time signal: a fairly precise sine wave. It is then the temporal "drama" on the stage of the media "theatre" of electronic circuitry, which transforms the analogue into a digital square wave to make it accessible for, and adjust it to, computing applications in its discrete sense of time. "Treat time as discrete", Turing advised.159 A clock distribution network inside the CPU

159 Turing, State of the Art, xxx
is responsible for the time slots which characterize time-discrete computing, as a micro-infrastructure of literally "hard-wired temporality". The focus on time-critical technologies allows to locate the precise techno-epistemic momentum of "digitization" in the translation of the physical world into the regime of computation. An A/D converter is provided with a "clock" pin to set the sampling rate. Under- and overclocking, as temporal information, arrives at the border of entropy - the intentional reduction, or increase of waste heat produced by the CPU (as adversarial acceleration of microchip ageing). In graphene-based transistors, electrons are capable of tunnelling at low voltages and therefore leads to ultra(s)low power consumption, enabling increased processor clock speeds. Radial media archaeology looks as precise as possible at such time-criticality: "After each clock pulse, the signal lines inside the CPU need time to settle to their new state. That is, every signal line must finish transitioning from 0 to 1, from 1 to 0. If the next clock pulse comes before that, the results will be incorrect." This "time of non-reality" (as it has been coined by Norbert Wiener) reminds of neuron relaxation time in the human brain, which triggered cybernetic system thinking.

"[T]he polytemporality of the present, the increasing heterogeneity of the timescapes we inhabit" (cfp), are pluralizing "time" into chronoi (Aristoxenus). But "rhythmanalysis" does not only refers to the cultural, but to the nonhuman chronosphere as well. The "cycles" in computer data processing rather correspond to the musical rhythm than to the simple meter that is the "clock time" of music. The Clock as Time-Keeper, and the "Y2K Bug"

Cultural analysis pays attention to the "historical complexities of temporal and spatial form" (cfp), but the "historical" is itself, already, a function of a symbolical temporal (in-)formation.

Technological media are not just an escalation in the long genealogy of cultural techniques, but they develop self-referential, auto-poetic tempor(e)alities which alter or irritate the established phenomenological categories of "inner" time perception and cultural memory. For this other time to happen, in the cybernetic sense, "[i]l faut que cela fonctionne dans le réel et indépendamment de toute subjectivité." The sun-dial itself serves as a circular argument of how time comes into being only by symbolic discretization, that is: the

160 See the forthcoming Hardwired Temporalities book project by Kyle Stine / Axel Volmar (eds.), Amsterdam UP (Recursions series)
162 Entry "Clock rate", https://en.wikipedia.org/wiki/Clock_rate; accessed February 26, 2020
164 See Koepnik 2019: 480
symbolical machine: "Depuis toujours, l'homme à cherché à conjointre le réel et le jeu de symboles. [...] il a mis des chiffres à l'endroit où s'arrêtait, à chaque heure du jour, l'ombre du soleil" (ibid.). Such new chrono-poetic figures require a close reading of actual technical operations within time-critical and time-based media (their tempo-realities), while challenging the notion of traditional philosophy of time in favour of genuine media-temporality

Lacan emphasizes "to what extent it is essential to our being-there, as they say, to know the time"166, which is the chronołógos. He reminds of the role of clocks in the early modern episteme, which is exactly the Cartesean epoch Heidegger refers to, in his lecture "Time of World-Image". Such clocks worked by weights (energetic entropy), but they "embodied the measure of time" by quantizing (negentropically) the apparent, phenomenal "flux" of time with their escapement mechanism. The core chronological drama is how the tempoReal of entropic time is adjusted to the symbolic order of "vulgar" clock time - and how ergodic (computer games) time, in reverse, is implemented in entropic materiality.167

"A lot can be said about this time not being the real one, it still passes there, in the clock, all alone [...]" (74). For his interpretation of the clock as time machine, Lacan then strongly recommends the reading of Descartes' posthumously published book called Of Man, which gives a machine description of the human body. "Flip through it, and confirm that what Descartes is looking for in man is the clock. [...] It isn't purely and simply the opposite of the living, the simulacrum of the living. That it was constructed so as to embody something which is called time and is the mystery of mysteries, should put us on the right track. What is in play in the machine? That at the same time someone called Pascal busied himself constructing a machine, still very modest, making additions, shows us that the machine is tied to radically human functions. It isn't a simple artifact, as could be said of chairs, tables, and of other more or less symbolic objects, among which we live [...]. Machines are something else. They go much further in the direction of what we are in reality, further even than the people who build them suspect" (74). Philosopher Hegel, though, with his focus on the embodiment of the Spirit of his time, and his dream "that Napoleon was the Weltseele [...] completely failed to apprehend [meconnu] the importance of this phenomenon which was beginning to come into view in their time - the steam engine" (74). The steam engine stands for another, thermodynamic, entropic "time" than the symbolical

clock time, which is, nevertheless, subject to entropy, in its mechanic frictions.\textsuperscript{168}

The inner-machinic temporal physics, and logics, are human to the degree that all such devices are direct artefactual functions, that is, they have been created from within techno-cultural knowledge. Technology, in its \textit{lógos} aspect, is a physically reified mind, resulting in a second nature, Hegel's and Gotthard Günther's notion of "objectiver \textit{Geist}" and the "second machine" \textit{alias} computing. But on the other hand, technically in/formed "[m]atter, far from being a passive stuff awaiting our formation or instructons instead modifies our designs on all sorts of unexpected ways. [...] The inventor of the clock did not intend for it to striate every aspect of life\textsuperscript{169}, when its content had been the "clocking" of prayers in the Monastic medieval context, but its techno chrono-logics developed in terms of McLuhan's definition of the medium as its technical \textit{message} and temporal \textit{massage}.

Time protocols, like the Medieval chronicles, and narrative historiography, still belong to the symbolic order; "maps and clocks are technologies for imposing spatial and temporal order " (cfp). But a different temporeality emerges when the symbolic is embodied in the real. The mechanism of timekeeping is slowed down by "friction" (Clausewitz\textsuperscript{170}) which occurs at the moment of contact between the supended pendulum and the actual clockwork. A damping of the clockwork signals occurs unless they are negentropically kept constant by negative feedback circuitry. There is always a loss of energy in oscillations. This \textit{momentum} asks for description "in strictly thermodynamic terms, as a dissipative system\textsuperscript{171}.

While in symbolic narrative time, any event temporally unfolds between a beginning and an end, a "timeless" oscillation in \textit{sounding} media (by feedback-coupled electron tube, or transistor circuitry) is achieved by the ideal, undamped sine tone. Only when conceptual computation becomes electronic computing, in the actually implemented encounter between symbolical chronológos and the mateReal, temporality is re-introduced by matter and energy.

Only since Christiaan Huygens, with its isochronic oscillation, the pendulum can meet the scientific (Newtonean) requirements of an autonomous exact time.\textsuperscript{172} A clock, even with astronomical revolutions as its reference time, is no embodiment of a transcendent natural time, but itself a time-generator. Essentially the clock is an analog-to-digital converter, transducing the regime of matter of energy into the symbolic time order. The motions of the pendulum and the moments of its contact with the escapement are coupled to convert potential to kinetic energy, and energy to information (Mackenzie ibid.).

\begin{thebibliography}{9}
\bibitem[168]{168} See Isabelle Stengers (with Didier Gille), Time and Representation, in: \textit{idem}, Power and Invention. Situating Science, Minneapolis / London (University of Minnesota Press) 1997, 177-212
\bibitem[169]{169} Bryant 2014: 22
\bibitem[170]{170} Clausewitz, \textit{Vom Kriege} [1832], Munich 2003: 36
\bibitem[171]{171} Adrian Mackenzie, \textit{The Technicity of Time. From 1.00 oscillations/sec. to 9,192,631,770 Hz}, in: \textit{Time & Society} 10, nos. 2-3 (2001), 255, referring to Stengers and Gil 1997
\bibitem[172]{172} Mackenzie 2001: 244
\end{thebibliography}
information theory, the thermodynamic, physical, one-directional time arrow (Boltzmann entropy) is matched by entropy as mathematical measure of information value (Shannon entropy\(^{173}\)).

For digital machines, there is no sense of "time" at all.\(^{174}\) For digital computing, Alan Turing advised: "Treat time as discrete."\(^{175}\) The mathematical foundation of algorithmic step-by-step calculation turns mathematics into a symbolic time machine. This symbolic ordering returns within concrete machine time. "In order to automate calculation processes, a discrete clock signal is needed. This clock signal started out with a frequency of 1 hertz (Zuse’s Z1) and has, with the evolution of electronics and micro-electronics, been sped up to 4 gigahertz or more in contemporary computers."\(^{176}\)

A computational catastrophe of the symbolic time regime has been the so-called "Y2K bug". In the first half century of electronic computing, there has been the common method of storing in only two bytes a date from the 20th century. Its alternative is the possibility of expressing a date by counting a bit for every moment since a system dependent fixed date, such as UNIX time. But "so-called 'timer-tics' are extremely difficult to decipher if the fixed date is not known. In East German data files, many different possibilities were used to express dates or numbers"\(^{177}\), resulting in alien historicity.

**The Alienation of Time to Sound: Sonification of Computing**

The earliest sound, which emanated from digital computers, has not been its sound chips, but the direct sonification of its time-discrete von Neumann architecture. "The clock signal of early digital computers could be heard by redirecting it to a speaker membrane which oscillated in synchronicity. Computers like the Zuse Z23 or the TX-0 from MIT [...] had built-in speakers that were connected to the data bus of their processors. On this bus, only two different signals (for the binary values 0 and 1) were possible, so the speaker’s membrane always oscillated within two amplitudes. The frequency of the signal depended on the change of those signals on the bus. Those speakers were implemented to help the programmer or the user detect if the computer..."

\(^{173}\) See Horst Völz, Grundlagen und Inhalte der vier Varianten von Information, Wiesbaden (Springer Vieweg) 2014), and Braynt, Machine Ontology, xxx


\(^{175}\) Turing, State of the Art, in: xxx


program had crashed. In this case, the cacophony of the regular computer operations changed to a rhythmical noise from the speaker [...]. Back in the day, bored engineers [...] and hackers misapplied this technology to generate distinctive sounds. To do this, they had to write programs whose only purpose was changing the audio monitor bits. This was the technology that shifted computer sound into culture. Until the 1980s, beeper and piezo speakers were used in different computer systems for putting out ‘1-bit sounds’. Since the human ear cannot perceive frequencies as high as the base frequencies of even these ‘slow’ CPUs (ranging from a few hundred kilohertz up to 4 megahertz), programmers could use them to generate any acoustic frequencies using pulse frequency modulation. Even polyphony could be simulated with pulse frequency modulation (Höltgen 2018, section 3).

The programming of early sound chips revealed the time-criticality of digital computing itself: "[T]he function of sound chips puts specific demands onto the programmer. He or she has to code ‘in time’ with the system to generate rhythmically correct sound outputs. Programming the TIA (and the other PSGs that followed) requires an exact calculation of the program’s time requirements" (Höltgen, 2018, section 4).

"Mobility"? Between Spatial and Temporal Transfer

For an analysis of this current media situation, and tracing tempor(e)alities in the age of "mobile media", the very term "mobile media" already lags behind, which is a left-over from the discourse of modernity and its material transport vehicles. Mobility is still associated with linear ("analog") migrations and non-linear ("digital") dislocations in topological space and time; within the temporal and diagrammatic dimensions of mobility in media-based communication, though, the despotic signifier "time" itself implodes. From there results the necessity for alternative descriptions of the dynamics within the chronopoietical field. The plausibility of the category "mobility" for analysing the current condition turns out as an antiquated remnant of modernism, which blinds the insight into the topologies, diagrams and graphs of networked (chrono-)spheres. In the present "digital" condition, it is rather technomathematical topologies ("Internet traffic") and heterochronotopologies which dominate communication.

Delayed Transfer

As it has been described by system theorist Niklas Luhmann, state administration and bureaucratic governance allow for delayed transfer when actual files are recorded in alphabetic writing, and provided with a symbolic time stamp. The textual fixation of processual decisions does not save time but dates.178 This corresponds with the buffer for short-term storage in the Central Processing Unit of computing. The acoustic delay line, or the cathode ray-based

Williams Tube, have been developed for high-frequency electronic computing, to enable such a dynamic Random Access Memory.

On the large, "historic" time scale, similar intermediary storage institutions, like the archive (legal bureaucratic memory), the library (open access), and the museum (material heritage), have been developed for macro-temporal cultural "tradition".

Conventional heterotopic, time-suspending institutions like the archive, libraries, or museums, by the digitization of its cultural content, and its online alignment to the Internet chronosphere, transmute from enduring spatial storage to delayed transfer.

While such institution remain within the familiar sphere of cultural techniques, inner-technological storage is *alien* heterochonics.

**From "Live" Analog Telecommunication to Internet Synchronization**

"Serial" time, which is known from television as a program format, has been part of a geometrization (mathematization, rather than spatialization) of time as opposed to the sense of "enduring" time, as it has been expressed in Henri Bergson's critique of chronophotography.

"In the space-time world of electric technology" already, "the older mechanical time" had begun "to feel unacceptable"; linear perception has thereby been replaced by synchronisation. "By electric tapes, synchronization of any number of different acts can be simultaneous. Thus the mechanical principle of analysis in series has come to an end" (ibid.).

The digitizing of signals in communication channels has transformed the *time* of transmission into numbers, as it becomes evident in the PING signal as a test for internet communication, with its "time-to-live" as a decreasing number count, and symbolical clocking.

Against contemporary face-to-face dialogue in real space, there is the technical reality of asynchronic Internet communication. The very term "synchronization" is indicative of the arbitrary symbolic regime: technically forced time.

The temporality of "Social" Media is revealed to humans once they are coupled to its machine diagram. The Global Metronome Project technologically allows for absolute tempo synchronization to enable networked musical performance.  

---

179 McLuhan 1964: 152
servers, in the acoustic realm, soon leads to irritations in "social" musicking; that is why the individual players are provided with system clocks. This temporal infrastructure allows for synchronization, via satellite, across unconnected devices in spite of their local diversity.

There is a nonhuman communication of temporalities when machines exclusively communicate with machines. The Global Positioning Systems calculates a position in space as a triangulation of signal runtime differences; space is hereby becoming a function of time-critical signal communication, like with the ultra-sonic echo location of the optical focus in automated Polaroid cameras, and with binaural human orientation in space already. But another schizo-chronicity opens: In accordance with relativity theory, "[t]ime passes more quickly for the satellites upon which GPS is dependent than airplanes and cars because they are further from the mass of the Earth. This leads to difference in determining the location of a machine on the surface of the planet and how it is calculated by the satellite. [...] these differences in temporal frames of reference add up to an error rate of about 10km a day. [...] In order to bridge this difference in rhythms in time, a temporal path must be constructed through the compensations of the clock"\textsuperscript{182}, which curved time.

The Internet is not only a stage for the bringing-together of different places as global "synchronisation" (Boris Beaude\textsuperscript{183}), but like libraries before, this neologism evokes as its equivalent "synchronization", too. The very term "synchronization" expresses the arbitrary, techno-logical enforcement of temporal actions. Its antinym is "heterochronocity".

As it has been predicted by Michel Foucault, the present epoch is, above all, the epoch of space and simultaneity as its contemporary condition: "[w]e are in the epoch of juxtaposition, the epoch of the near and far, of the side-by-side, of the dispersed. We are at a moment [...] when our experience of the world is less that of a long life developing through time than that of a network that connects points [...]. The site is defined by relations of proximity between points or elements; formally, we can describe these relations as series, trees, or grids."\textsuperscript{184}

\textbf{P. S. Disruptive Heterochronoi, and Techno-Traumatic Media Time}

Once human senses are cybernetically coupled to technological agencies, they become subject to a nonhuman, alien temporality and media \textit{eigen}times. From the rupture between the human experience (interface phenomenology) and what actually occurs within the media "subface" temporality (Nake), a cognitive dissonance arises, a techno-traumatic irritation.

\textsuperscript{182} Bryant 2014: 168 (with reference to astronomer Richard Pogge)
\textsuperscript{184} Michel Foucault, Of Other Spaces: Utopias and Heterotopias, translated by Jay Miskowiec from the French version ("Des Espace Autres", published in: \textit{Architecture / Mouvement / Continuité}, October 1984), in: Diacritics, Spring 1986, 22-26; quoted here from the online version
As long as devices, such as the Smart Phone, are simply (and literally) "ready-to-hand" (Heidegger), human users are usually unaware of this coupling. As it has been remarked in Walter Benjamin's "Work of Art" essay, the apparatus-free reality which is seen by the camera lense is in fact completely absorbed by its technical imaging. This correlates with the temporal experience of reality. The "vulgar" technological time regime becomes "present-at hand" (Heidegger) only in moments of error, of disturbance, or break-down (Heidegger, *Sein und Zeit*).

Against the media-archaeological investigation into the "inner time consciousness" within technologies themselves, media phenomenology deals with the irritations, which are induced by alien media temporalities, against the human sense of time. Such a case is the installations of an interactive holographic Holocaust witness to enable a speech-recognition based "dialogue" beyond his grave, as it is by the New Dimensions in Testimony program by the USC Shoah Foundation and the University of South Carolina in Los Angeles. It is software here, which selects and projects prerecorded video clips of the survivor in response to questions presented by an interlocutor, and efficient real-time computing, which renders the illusion of a "live" presence. Beyond a simple "digitization" of audio-visual testimonies that have been recorded on analog audio, or video tape before (such as the Fortunoff Video Archive of Survivors of the Holocaust at Yale University), this memory is algorithmicized, and a kind of ELIZAfic(a)ton - a reactualization of Josef Weizenbaum's seminal first computer chatbot from 1966. In the case of the hologrammed survivor Pinchas Gutter, his "testimony' is based on statistical probability, its media temporality being microprocessual rather than chronological" (Pinchevski 2019: 97). Thereby, the historical dimension is replaced by genuine media-time phenomenology.

Whereas the "weak" interpretation sees this as a kind of "mediatized" trauma, which is simply a dislocation of traumatic memory experience into another medium (Pinchevski), the rigid techno-traumata hypothesis assumes that the real trauma, here, derives from the technology itself, which challenges the human trust in "real presence" by real-time simulation. What once started with the phonographic choque of the disembodied voice, now recurs with a kind of Turing test. But for a generation of mobile media-born natives, which in Berlin bars, late at night, does not look for the presence of other guest any more, but rather checks constantly incoming e-mails and twitter messages from their online smart phone, there is no logocentrism any more, a privilegization of the present, which can be traumatized at all.

MICRO-ARCHIVING THE PRESENT. The Impact of Time-Critical Media Technologies

186 Amit Pinchevski, Transmitted Wounds. Media and the Mediation of Trauma, Oxford 2019, 20
Instant recording: Archiving the present and re-presencing the past

Archiving the present in real time takes place in Web-based formats of radio and video. For so-called "streaming" media, the old metaphor for the flux of time dissimulates the radically bit-discrete character of buffering data and the time-consuming complex calculation.

Not only companies increasingly demand instant analysis of the present condition. Big data analytics, when conducted at a velocity approaching real time, already has an immediate effect on decisions being made online. Instant micro-archiving of the present is conceptually and technologically implied in the real-time processing of data, as a digital time-discrete sampling and quantizing of moments from the present signal - a punctualisation and mathematisation of the continuous event. This requires fractions of intermediary short-time storage of data. The concept of real-time communication, time-sharing and "interrupt" for user input in computing dislocates the metaphysics of the pure present to micro-deferred presence.

A whole scale of micro-temporal "archiving presence" thereby unfolds, starting from ultra-short intermediary storage of electronic equivalents to zero and one in registers and flags, up to time axis manipulations after the digital sampling or recorded signals.

The media form of the analog present, for the longest time in 20th century, has been the notorious "live" transmission of signals by electro-magnetic waves. By means of digital sampling, data compression and real-time computation (the "digital" equivalent to "live" transmission), news media manage to achieve the "live" effect even under digital conditions - a "post-digital" effect. But in news radio channels, glitches frequently betray that the audience is dealing with digital re-play. What appears like actual news broadcast, by mistake (when the news speaker activates the wrong icon on his digital control panel) a message which has just been spoken is repeated again. All of the sudden (and as a shock for the temporal authenticity contract between listener and radio station) it becomes apparent that there is not direct live transmission any more, but digital sound files sampled and stored on the sublime micro-level - a presence which is always "archived" already. The present event and storage merge into one with the temporally augmented digital.

Frequently the present moment has been considered as punctual: between the "not yet" and the "no more". The Aristotelian, that is: numerical time-definition (culminating in Zenon's paradox of capturing the flying arrow at a moment) is discrete, a kind of sampling the present by clocks which Heidegger denounced as even "vulgar" time. Leibniz and Newton develop the appropriate mathematical tool for infinitesimally approaching this volatile moment which thus becomes a chrono-epistemic momentum. Just like Henri Bergson already criticized chono-photography's "mathematical" sequencing of pure movement.

The proverbial photographic moment has always been a paradox: from the moment of the photographic click (which in itself, at close reading, is never punctual but a shrinking interval), the present is transformed into endurance.
Analog archiving of the present is nowadays being matched by the "thickening of the present moment" in digital systems\textsuperscript{187} - a kind of micro-archival bubble.

With its instant digital recording, the present becomes immediately addressable and thus transforms into an implicit, sublime archival structure. By instant digital recording in real time, the present looses its metaphysical uniqueness before it even happens. The present no longer is granted time to take place, and instead is replaced by digital post-presence.

The temporalised cyborg, signal time and acoustic media archaeology

The media-archaeological approach does not historicize cybernetics to a mere chapter in the history of knowledge, but shares its enduring core assumption that from the coupling of human beings to techno(chrono)logical (artefacts), a specific experience of time results.

There is a specific alliance between the micro-patterns of auditory temporality\textsuperscript{188} on the phenomenological level and the processual being of technical media; the time-critical moments affect the most frequency-sensitive ("rhythmic") sense organ within the human which is hearing.

This has consequences for auditive re-presencing of the technically recorded past. If a movie projector is driven manually like in the vera early days, the visual perception is quite tolerant to slight temporal deviations. This is different with auditory signal replay.

Deconstructing the historical sense of time from within technological media

To what degree does the historicity of sound depend on its material embodiment? Phonographic "engraving" is sound in latency. The ontological status of recorded sound is waiting to be activated (German "in-Vollzug-Setzung"), to be "re-presenced" (a term coined by Vivian Sobchack in her analysis of media archaeology). Be it the analog reproduction of temporal wave forms or its digital reverse, the processing of atemporal mathematical frequencies, such "beeing-in-time" is not historical any more, but technological. It requires the media-archaeological ears to understand such sonicity.

Is the sound of an existing Roman era bell dating from the third century a more ancient sound than the sound created by an equivalent bell from present time production, the media archaeologist Paul DeMarinis asks. "For this to be the case we would have to think of the bell itself as an encoding of some 'sound'; that sound, in turn, would have to include the splashing of the molten brass, the beating by smiths' hammers etc. But the sound the bell produces in its


\textsuperscript{188} Don Ihde, Listening and Voice. Phenomenologies of Sound [*1976], Albany, NY (State University of New York) 2007, 87
current use is far from being a recording of these sounds."; even if the bell stems from the past, its sounding is always present.\textsuperscript{189}

[Bachofen's experience results in a more fundamental claim: "There are two roads to every kind of knowledge, the longer, slower, more laborious one of intellectual combination, and the shorter one, the one we cover with the energy and speed of electricity - the road of the imagination when it is touched by the sight and the immediate contact of ancient remains and grasps the truth in a flash, without any intermediate steps."\textsuperscript{190}]

A fundamental issue is at stake here: the need to de-couple the question of "temporality" from any narrative concept of temporal sequences which finally questions the notion of history itself.

Once our chrono-analysis is suspended from the historical discourse, a more radical challenge arises which is (among others) formulated in Timothy Scott Barker's book \textit{Time and the Digital} as well: Is it possible to deal with micro-temporealities without mentioning the transcendent signifier "time" at all - in favour of a multitude of descriptive terms, a "field"?

"Time - today [...] - seems to reveal a new structure and to unfold in a rhythm that is different from the 'historical' time that governed the nineteenth- and the early-twentieth centuries. In this new chronotope - for which no name exists yet, even though we live within its forms - agency, certainty, and the historical progress [...] have faded into distant memory."\textsuperscript{191}

Marshall McLuhan already had radically declared in a post-Hegelian mode: "Just as linear history begins with writing, it ends with TV"\textsuperscript{192}. History depended on a cultural technique which is alphabetic, linear writing. The "writing" of images and texts on the cathode ray tube for television and computer monitors is of a different kind. Electronic media, therefore, are not just another variance in the history of technology but establish a new kind of temporal reality which escapes the concept of history.\textsuperscript{193}

In contemporary society the pan-chronic horizon of temporal extension called "history" has been electronically condensed and algorithmically compressed into (or even replaced by) ever shrinking temporal intervals and a focus on the instantaneous present; close analysis of decisive temporal actions reveals the drama of time-critical media.

In techno-culture an augmented present unfolds, differentiated into a \textit{media dramaturgy} of microtimes; the public radio and TV channels in Germany are

\textsuperscript{189} Paul DeMarinis, According to Scripture [*2002], in: Ingrid Beirer / Carsten Seiffarth / Sabine Himmelsbach (eds), Paul deMarinis. Buried in Noise, Heidelberg (Kehrer) 2010, 247-252 (247)
\textsuperscript{190} Quoted here after Gossman, Orpheus, xxx, 49
\textsuperscript{191} Hans Ulrich Gumbrecht, After 1945. Latency as Origin of the Present, Stanford, Cal. (Stanford University Press), 38
\textsuperscript{192} Marshall McLuhan, Counterblast, New York (Harcourt, Brace & World) 1969, 122, as quoted in Bexte 2008: 332
\textsuperscript{193} McLuhan 1969: 122
even legally obliged to provide online access to a Mediathek, a library of broadcasts stored for a week. This is not an archive yet, but an extended window of the present.

"Liquefying" the archive

David Lynch's film *Inland Empire* which begins with the image of a spinning record on a record player. "As the needle drifts across the timeles surface of reified sounds, we are, once again, in the realm of mechanical preproduction and the logic of industrial time."\(^{194}\) The digital fragmentation of time, on the other hand, results in the loss of the chronology and directionality of time which becomes "][...]] terrifyingly opaque and illegible for the human subject"\(^{195}\), resulting in a sublime micro-tempor(e)ality.

With the present as a function of rapid memory operations (both neurologically and digitally), the transformation of the traditional temporal aurality of archival storage needs to be observed as well: from archival space to archival time, to the archival "field". Dynamic micro-media memories induce a cultural shift of emphasis from permanent storage to restless transfer. With the aesthetics of re:load, the technological affinity between the archival operation and cybernetics turns out, as manifest in feedback memory and timeshifting. Once these transformations have been analyzed, suspended memory results in total recall.

There are good reasons for questioning the static concept of an "archive" as appropriate term for digital record structures since as a metaphor it is increasingly becoming a hindrance for the analysis of dynamic data storage and circulation. The computer hard disc literally *moves* stored data in post-structural ways, just like the magnetic tape did with recorded electronic signals (sound and video) before. The archive becomes *processual* in digital algorithms.

Archival endurance (with its records oscillating between symbolic code and physically entropical decay) is undermined when a record is not fixed any more in a permanent storage medium but techno-mathematical flow replaces the physical inscription.

[Sonic auscultation is an attempt to capture the volatility of sound and reveal its temporal message in a concrete manner through the algorithmic stethoscope, which is software for sound analysis.]

[The video artist Bill Viola in his essay on what he calls the *sound* of electronic images pointed out "the current shift from analogue's sequential waves to digital's recombinant codes" in technology.\(^{196}\) Sampling and quantizing of acoustic signals analytically transforms the time signal into the information of frequencies which is the condition for technical re-synthesis (Fourier

\(^{194}\) Zoltán Glück, After Midnight, or: The Digital Logic of Time Fragmentation in Inland Empire, in: Munitionsfabrik 19 (2008), HfG Karlsruhe, 8-11
\(^{195}\) Glück 2008: 9
\(^{196}\) Viola 1990: 47
transform). Digitalization means a radical transformation in the ontology of the sound record - from the physical signal to a matrix (chart, list) of its numerical values. Media culture turns from phonocentrism to processual mathematics.

[The Technical Committee of the International Association of Sound Archives in her standard recommendations from December 2005 points out that any such rules of audio preservation need to be revised when changes of the technological conditions take place.]

Digital operating systems need constant up-dating (in terms of software) and data "migration" requires appropriate hardware to embody them. From that derives a change from the ideal of archival eternity to permanent change - the dynarchive.

[When the transfer techniques of audio carriers changes from technically extended forms of writing such as analog phonography to calculation (digitization), this is not just another version of the materialities of cultural tradition, but a conceptual change. From that moment on, material tradition is not just the function of a linear time base any more (the speed of history), but a new, basically atemporal dimension opens, short-cutting the emphatic time arrow and demanding for a partial differentiation as familiar from the infinitesimal calculus once introduced by Leibniz as a measure of change within speed.]

Not yet memory? Focus on micro-storage tempor(e)alities

[Media archaeology as method couples evidence of time-critical human perception tightly with technological knowledge. "Data Retention" in fact is most precisely known from static data storage within the computer. To ensure that the data in the elementary cell will not be altered, the SRAM (static Random Access Memory) must be supplied by a power supply that will not fluctuate beyond plus or minus five or ten percent. If the elementary cell is not disturbed, a lower voltage is acceptable to ensure that the cell will correctly keep the data. "In that case, the SRAM is set to a retention mode when the power supply is lowered, and the part is no longer accessible."

Micro-archiving the present: intermediary storage, digital delay

Already electro-mechanic transmission of photographic images via telegraph cables in 19th century was performed by intermediary storage, the quasi:"digital" data carrier of punched cards and relay amplifiers of the electric signals. This relieved communication engineering from the delicate time-critical synchronisation problem between sender and receiver.

---

197 See http://www.iasa-web.org/IASA TC03/IASA TC03.pdf, accessed June 2011
This is known in digital image transfer as well: In the convergence between a repetition and a renewal "lies the tendency to archive while bringing forward"; past and present become instantly simultaneous. "While it loops the past, the digital creates [...] an archival strategy where time passed becomes constantly accessible for the future. Reality's duration seems to have become an archival stream of information potentially open for access at any other time.\textsuperscript{200}

The micro-temporal \textit{camouflage}: High Frequency Trading

"Real time" does not come naturally, but is a technological artefact. There is a fuzzy present in the Internet. In Internet packet switching, ultrashort-time memory is integral in the technical part of the transmission itself where the traditional contradiction between storage and transmission collapses. With the "hyperbolic temporalities of digitality"\textsuperscript{201}, network culture is less about clock time but more about delays, latencies.

At the virtual Stock Exchange, time-critical temporalities become economical temporalities. High Frequency Trading operates with time-"hiding" purposes like these, just like perceptual experiments in the 1960s: smuggling ultra-short moments of Coca Cola advertising into a regular TV movie which was not consciously noticed by the viewer.

In High Frequency Trading the beast are time-beasts. micro-temporal worm holes. The focus shifts from macro-temporal economical cycles subsumed as "history" to micro-temporal intervals which undo the emphatic difference between the processual present and the archivized past. Time-critical media analysis in that sense helps to develop to create a new, different, non-historicist language of timings.

For the traditional time-based art forms like literature and theatre, such an analytic language has been developed, encompassing terms like endurance, frequency, recurrence, narrative speed, time-critical occurrence, anachronies.\textsuperscript{202} It is time to extend this language to the process which happen within the machines.

The aesthetics of "instant replay"

- Micro-archiving of presence is conceptually and technologically implied in the real-time processing of signals, since as a digital time-discrete sampling and quantizing of moments from the present signal (punctualizing / mathematization the continuous signal event) it requires intermediary short-

\textsuperscript{121 (110)}
\textsuperscript{200} Markos Hadjioannou, From Light to Byte. Toward an Ethics of Digital Cinema, Minneapolis (Univ. of Minnesota Pr.) 2012, 174
\textsuperscript{201} An argument by Jussi Parikka, Of Queues and Traffic: Network Microtemporealities, lecture at symposium Digital / social media and memory, Univesity of Glasgow, April 17th, 2013
\textsuperscript{202} See Gérard Genette, Die Erzählung, Munich 1994
time storage of data. The concept of real-time and "interrupt" for user input in computing dislocates the metaphysics of pure presence to micro-deferred presence.

In techno-mathematical media which not only allow for re-play of recorded sound but as well interaction and applying intelligent search and sorting on the basis of algorithms, a whole scale of micro-temporal "archiving presence" takes place, starting from ultra-short intermediary storage of electronic equivalents to zero and one in registers and flags, up to time axis manipulations after the digital sampling or recorded audio signals.

The instant archivization of the present becomes apparent with newsradio channels such as German "Inforadio" at radio Berlin-Brandenburg rbb) as frequent errors in (re-)play. What appears like actual news broadcast, by mistake (the new editor pushes the wrong button on his digital control panel) a news just spoken is repeated again. All of the sudden (shock for the "presence" instinct authenticity contract between listener and radio station) it becomes apparent that there is not live transmission any more (Rumanean "trasmissione directa"), but digitally stored ("sampled") sound files - a presence which is "archived" already. The present event and storage merge into one with the increasing digital, i. e.: archiving recording of present spaces. The presence of space itself is being transformed into time-coded snapshots like instant photography by I-pads which step by step ("one bit at a time") samples presence.

Different to the archive which is symbolical order, recorded by symbols (alphabet), thus: spatial orders, audio-visual media record signals which are physically functions of time. When these are being re-played, our senses are affected, in a non-historical way. There is no memory here, presence happens, like any electronic re-play is dynamic. Instead of psychoanalytic trauma-research, now an analysis of the techno-traumatic momentum is appropriate, about traumatic irritations of re-presencing induced by analog and digital technologies, such as: the phonographic voice of the dead and the real-time presence of archival records in Web 2.0 memories like the video portal YouTube.

"We would make a mistake if we think that [...] we could refer to a ‘normal’ sense of presence in the present: to an unmediated, integral presence. Nothing as such exists either. We are always anticipating and deferring, missing the presence." We all live with the media archive in both existential and technological ways. "Films, images and videos, here, are time capsules", but not of historical time "but the time of a deferred, diminished presence". A counter-archive would need to give back the presence taken away from present life moment by moment which actually happens on the technological micro-level as analog-to-digital-conversion ("sample-and-hold"). "Archives are always summoned to give back time. But what if they are asked to give back presence?" (Constant ibid.), just like Gordon Bell's My Life Project recording project, enabled by permanent data glasses.

203 Constant, Erkki Kurenniemi (In 2048) (preliminary work towards) an online archive; http://kurenniemi.activearchives.org
The augmented present became practical in the relatively data-poor audio
signal processing first: SONY publicised its IC Recorder ICD-SX733 (and other
models) under the heading "Recording a few seconds in advance - the pre-
recording function".204 "Technical Manuals as ultimate media-archaeological
"sources": "The pre-recording function allows you to record sound sources for
approximately 5 seconds prior to the point when you press REC/PAUSE. This is
useful for recording during interview of when making an open-air recording so
that you will not miss an opportunity to start recording" - the extended
"window of present" as known from Husserl's Phänomenologie des inneren
Zeitbewußtseins., in technical acts of re- and protention. The "half-second"205
which human perception needs to process the present is beaten. The secret of
this irritation of the present is a dynamic storage function: "Sounds for 5
seconds are buffered in the memory."

[A self-indexical malfunction (noise) suddenly pops up: "If you start recording
with pre-recording function using the built-in microphones, a click noise may be
recorded when you press REC/PAUSE"; therefore the use of an external
microphone is proposed.]

The condition of possibility of "irritating the present" is here, once more, micro-
storage. The system offers additional 24 photos in addition to the one actually
shot - which is, maybe not by coincidence, just a "cinematographic" second of
24 frames.

This is the moment to recall Gotthold Ephraim Lessing's Laokoon theorem from
1766. His notion of "the pregnant moment" is exactly not identical with instant
photography. Plastic and visual arts, he argues, should rather accentuate the
re- and protentive moment, as examplified in the ancient sculpture of the
Trojan priest which only hints to his immediate death narratively described in
Homer's Iliad.

Nowadays, in the age of almost unlimited storage capacities for digital data,
the pre-recording mode is replaced by continuous recording - the real-time
archive. Pro-active archiving here displaces the traditional repository for
records emanating from the past.

"Temporary Storage"

Between the archive and the anarchive there is temporary storage. While
archives essentially aim towards long-term, if not even the unlimited
preservation of their documents and today`s media archivists grapple
desperately with the problems associated with "long-termin archiving", the
temporalisation of archives is an anarchival element in the economy of cultural
tradition. Archives in motion and `temporary archives` are symptoms of this
temporalisation of the archive. The immediateness of the retrieval of immense

204 http://www.sony-asia.com/microsite/recorders_imanuals/ICD-
SX1000/gb/contents/TP0000019455.html
205 See Hertha Sturm, Wahrnehmung und Fernsehen: Die fehlende
Halbsekunde. Plädoyer für eine zuschauерfreundliche Mediendramaturgie, in:
Media Perspektiven 1/84, 58-65
volumes of data through online databases contends with an increasingly short-term maximum usability period, which contemporary culture knowingly accepts. Yet this temporalisation of the symbolic order is predetermined at the operative level of the present itself, namely in the practice of signal and data transmission. Delay lines served the micro-synchronisation of PAL colour television signals as well as the short time maintenance of data words in the first electronic computers. It belongs to the nature of the so-called new media that they compute and switch, constantly accumulating interim values and then deleting them again. The mathematisation of technical communication by Shannon focuses on coding and the transmission channel which requires discrete temporary micro-storage - an unexpected return of the familiar archival order yet critically radicalised. The stuffy vocabulary of classic archivology shatters on such temporal modes of technological action.

"Time of non-reality": Totzeit, negative time

Not only do electronic systems replace perceptible timing operations by subliminal micro-temporal operations (like the clocking and cycling units in digital computing); a new temporal quality emerges with "binary" information theory: Norbert Wiener's notion of "time of non-reality", in fact negative time which does not numerically "count" in binary computing - the real switching moments.

The temporal wall arising: Moore's Law

In ancient Greek, tó katéchon signifies "that which withholds". The term appears in an eschatological context in apostle Paulus' 2nd letter to the Tessalonians in the New Testament, adressing a situation inbetween storage and delay. For Christian theology, katechon is the term for delaying the return of the Anti-Christ, that is: the end of the world (later to justify the political order of the Roman empire and other institutions).

The katechon becomes a real techno-political issue in computing regarding the dynamics of so-called Moore's Law, proposed in 1965 by co-founder of Intel Gordon Moore, stating that the number of transistors in an integrated circuit doubles approximately every two years. But this law has its in-built structural limitation and temporal end: "[T]he law will run out of steam, i. e. the improvements of conventional ways of manufacturing microprocessors, graphics chips and other silicon components will hit a wall: drastically new ideas will be required." Nanotechnologies or even unconventional computing is the answer to beholding the end of "Moore's Law".

206 Gordon E. Moore, Cramming more components onto integrated circuits, in: Electronics, Bd. 38, Nr. 8 (1965), 114–117
208 As described, e. g., in Andrew Adamatzky (ed.), Collision-Based Computing, London et al. (Springer) 2002
Integrated circuits can be reproduced “with the ease of taking a picture, using optical masks in multiple exposures through the process of photolithography. The self-fulfilling prophecy of the semiconductor industry, called Moore’s Law, has turned into a stable temporality itself, serving as the primary basis for predicting future technological progress.” When such computational components become integrated in larger networks, this results in a new kind of infrastructure which is rather time- than space-oriented. With algorithms operatively embedded into ever smaller integrated circuitry, the new micro-city is populated by nonhuman actors. Techno-mathematical intelligence has finally replaced the concrete wall.

**SIGNALS IN ACTION. An Archaeology of Time-Critical Infrastructures within Media Technologies**

### Time-critical media

Philosopher Ernst Cassirer once pointed out that a technical being can only be captured during its actual operations. This distinct quality counts all the more for the technological escalation into electronic media. They are in their medium-being only when signal processing, electrically biased, "under voltage". This makes them especially sensitive to micro-temporal intrusion, irritation and manipulation - much more than previous cultural techniques like alphabetic writing which became time-critical only when coded into electric telegraphy.

"Bias" originally is a technical term in electronic engineering describing the necessary current to operate a vacuum tube (esp. triode) - a literally pre-conditioning, a ground tension for making the circuitry work at all, an electric (thus truly media-archaeological) a priori.

In electronic television, the exact synchronisation, thus timing, of signals becomes crucial for its success in the human aisthesis of image perception indeed. With techno-mathematical computing where minimal temporal moments become critical for the success of the whole process of internal calculation and human-machine communication ("interrupt"), time-criticality becomes a new epistemological object in the economy of knowledge. Since in media culture events are rather computationally counted than textually narrated, time-criticality needs to be focussed by process-oriented (thus dynamic) media archaeology.

---

209 Volmar / Stine, draft edited book project *Hardwired Temporalities. Media, Infrastructures, and the Patterning of Time*


Time-critical signal archaeology is not simply concerned with so-called "time-based arts" (which start with oral prosody and theatre already, leading to film and other mass media dramaturgies) but with *kairotic* media technologies. Time-criticality in its media-technological context does not refer to a philosophical or critique of contemporary politics or ethics but rather to a special class of events where exact timing and the temporal *momentum* is literally "decisive" for the processes to take place and succeed at all. Video artists like Nam June Paik and Bill Viola have articulated electronic media temporality, transcending simply time-based performances (like theatre) towards an archaeology of such time-critical processes. In its ancient Greek sense, *crisis* refers to the chances of decision, with its temporal form being an impulse rather than a duration or narrative - *kairotic* time. Kairos - the ancient Greek god of the decisive moment - becomes proverbial in post-modern just-in-time production in both industry and technologies, as well as in deadly situations like anti-aircraft prediction in Second World War.\(^{212}\)

In its etymological roots, "time" itself refers to divisions of continuity, to the cutting edge. Apart from its long aesthetic tradition, the cultural impact of time-criticality escalates with (and within) technological media, starting from photographic exposure time which almost shrunk towards zero. Signals which are operated with electronic speed can hardly be followed by human consciousness like, for example, symbols (printed letters) in textual reading. When signal transfer happens below human sensation, it can be spotted only by time-critical observation. For subliminal events the true archaeologist of time-critical knowledge are technical media themselves; only with the emergence of highly sensitive measuring instruments since the 19th century time-critical processes like the runtime of signals within human nerves became analyzable at all.

The analysis of time-critical signal processing both in animals and in machines reactivates previous cybernetic assumptions under the specific perspective of micro-temporalities. The acknowledgement of the unity of perception-in-action implies the notion of time-critical signal processing, encompassing both electronic and technomathematical systems. Time-critical signal processing as a topic of applied mathematics - in the neo-cybernetic sense - does not refer to electrical engineering only, but to organic bodies as well.\(^{213}\) Signals of interest range from sound, images, and sensor data to telecommunication (such as radio signals). Technical media, in this context, act as agents of signal analysis: biological data (from the human body) are retrieved (and transformed) by time-varying measure media such as sonography, electrocardiograms.

**Techno-logical clocking** *versus* religious timing

Coupled to ubiquitous time-keeping technologies, man becomes a servomechanism of his clock. McLuhan concludes: "This continuous modification of man by his own technology stimulates him to find continuous means of modifying it", resulting in time-critical symbiosis. Such an analysis brings together disciplines which are usually separated in the academic faculties: humanities, engineering, cultural studies, mathematics, neurosciences, media studies.

The relation between operative technologies and performative culture, considered on the media-archaeological level, concerns nondiscursive regimes with an inherent chrono-logics of its own. Are humanly triggered technologies - once they have become operative - indifferent to the question whether they have been installed out of a discursive bias or not, even if they bear the imprint of this bias in technical form? Is there any close association between cultural techniques like liturgy, e. g., and the algorithm as mathematical procedure? What differentiates general cultural technologies from genuine media technologies, and is there a non-cultural, auto-poietical element at work in technical media? Discursive metaphors both create and obscure media practice. An analysis of the techno-procedural arché (rather than simply historical "origin") of the oscillating mechanical clock from late medieval monasteries focuses on the epistemological dis/continuity from religious timing to genuinely time-based media processes, resulting in an awareness of differential oscillations (Huygens, Mersenne, Maxwell, Hertz et al.) which both separates and re-alignes the Pythagorean cosmology from the electro-technical and techno-mathematical media age. If time-measuring media is more than simply an assembly of technologies (tools, material artefacts) but depends upon the existence of a wide range of sensorial techniques which drive and modulate their specific development, the religious system of co-ordinated action comes under consideration. The relationship of religion and technology is a provocative one; they do not take on a common ground but belong to different realms of practice and experience. For Ernst Cassirer, in a somewhat paradoxal definition, "symbolic forms" such as myth and art (among others) are "the specific media created by mankind in order to dissociate itself from the world and thus be re-united with the world the more firmly" - religio as a special kind of symbolic action.

A case of a religious encounter with a technology is the numerical measurement of time. With the invention of the escapement-driven mechanical clock within the context of Benedictine monasteries which are based on strict temporal discipline, the sensation of micro-periodical oscillations entered the occidental chronosphere. Remarkably, the origin of the oscillating clock stems from the climax of liturgic practice. From such techno-logical coincidences, media archaeology rather seeks to develop alternative frameworks for understanding shifting relationships between humans and machines in diverse and even distinct cultural traditions. The oscillating clock started as a technique in religious timing, but auto-logically generated a non-human

214 See J. C. R. Licklider, Man-machine symbiosis, in: xxx, 1960
215 "[...] die eigentümlichen Medien, die der Mensch sich erschafft, um sich Kraft ihrer von der Welt zu trennen und sich eben in dieser Trennung umso fester mit ihr zu verbinden": Ernst Cassirer, Zur Logik der Kulturwissenschaft, Göteborg 1942, 25
mechanism, setting an artificial time-base. While apparently grounding in religious belief of world-order, the resulting techno-mathematical work auto-poietically started to develop into a world of its own.

On the one hand, only in combination with a Christian sense of temporal linearity and stimulated by a religious idea of infinity (since Augustinus) the question of time became open to be implemented in operative timing media. This mechanism, once it has been at work, rather unconsiously and paradoxically emancipated occidental culture from its dependency of cosmic-religious time.

The paradox might be formulated like this: In terms of cultural performance, the rhythmic sense of periodic beats is closely linked to monastic prayer and working practice, but triggered a rather nonreligious take-off in the awareness of operative oscillating mechanisms (the vibrating string, developing modern acoustics and other wave analysis to be synthecised in electronic media and the timing mechanism of computing itself.

In early 19th century, oscillation became even an epistemological term. As Hans Christian Ørsted remarked, if a human imagines a monochord string making its slowest vibrations, he might still be able to distinguish each vibration with our own eyes. But let the speed increase, "now we can no longer distinguish one vibration from the other, we see only the entire space through which the string vibrates filled by it. There is a gap between the point where the visibility of the individual vibrations ceases to the point where the deepest tone begins. Now imagine the vibrations proceeding with increasing speed and producing higher and higher tones"; in the end the speed of the vibrations becomes too great even to be perceived by the ear.

A most efficient device for intermediary storage of data in electronic high speed computing, the mercury-based acoustic delay line as Random Access Memory, required clocking for a sufficient synchronisation with the processing unit. "We might say that the clock enables us to introduce a discreteness into time, so that time for some purposes can be regarded as a succession of instants instead of a continuous flow. A digital machine must essentially deal with discrete objects."

New kinds of bio(algo)rhythmization

The sense of measurable prosodic "beats" (chronoi, in Aristoxenos' term) is

---

216 See Bernhard Siegert, Passage des Digitalen. Zeichenpraktiken der neuzeitlichen Wissenschaften 1500-1900, Berlin (Brinkmann & Bose) 2003
related to the engineering of poetic timing and the discreetisation of poetic speech articulations into distinct letters by notation (vowels and consonants), inducing its automatization and technological implementation.

The memory technique in oral poetry performances relies on senso-motoric synchronisation and feedback, sometimes significantly coupled with a string instrument. "La diffusion nerveuse est comparable à la propagation du courant électrique à travers un réseau de fils conducteurs." 219 Embodiment as form of *kinesthetics* epistemologically activates the assumption that both machines (technical or mathematical) and animals are governed by analogous feedback-processes.

The bio-rhythmical human experience of time (so-called "circadian time") as alternation of acticity and rest over the course of day and night is of almost musical nature - rhythmic. As remarked by McLuhan in his *Understanding Media* (1964), the electric light has already profoundly irritated this rhythm by extending the day-time by an artificial medium ("electric light"). Television consumption (which had been the occasion for McLuhan's study) increasingly structured human attention different from the traditional circadian time rhythm. In times of pervasive online computing, this rhythms becomes coupled with the algorithms of computing itself. Increasingly, the rhythms of human activity are shaped less by natural environmental cycles like the presence or absence of daylight, but "more by rhythms in the data streams that occupy an ever greater share of our attention" 220. So the "algorhythmic" 221 is no longer simply within the computing machinery, but it affects human temporal experience as such in a hybrid way - whenever human time and machine time are being directly coupled.

Culturally, a familiar way of information processing is the human-machine communication and its time-critical escalations in computer games. Such action / reaction loops were first tested in the psycho-physiological laboratory of Wilhelm Wundt at Leipzig University around 1900 with its central artefact being a telegraphic device coupled to a chronograph in order to measure the minimal delay time (*delta t*) between incoming signal and human nervous reaction. 222 Computer games are time-critical, with micro-temporal moves and short-time neurological memory. The message of the medium computer games is not stories, but instant feedback. Man experiences himself in time-critical cybernetics when interacting with digital media. Micro-temporal events which govern human action can only the analyzed by non-human instruments; they become crucial in neuro-biology: "Many phenomena recorded from brain structures such as the EEG (electro-encephalogram) [...] are expressible as


221 Shintaro Miyazaki, Algorhythmisiert. Eine Medienarchäologie digitaler Signale und (un)erhörter Zeiteffekte, Berlin (Kulturverlag Kadmos) 2013

222 See Claus Pias, Computer-Spiel-Welten, Munich (sequenzia) 2002
characteristic temporal activity patterns; their forms, however, mainly come from the recording method."

The temporal momentum in technical (micro-)infrastructures

The temporal constellation which has replaced the narrative time series unfolding between beginning and end, in human-computer interaction, is the mode of interrupt. Hereby, kairotic time replaces chronos. Such interactive events between computer and human unfold rather algorhythmically than rhythmically as familiar from traditional culture, coupled to the steps which unfold within the computer itself, where instruction-execution tables express an ordering of inner events.

A time-critically sharpened reading of McLuhan's "medium is the message theorem" leads to a focused inquiry of the temporal momentum in technologies. This does not only concern the macrotemporal bias of communication in the sense of Harold Innis' media theory of cultural and economic power infrastructures, but the intensive microtemporality that pervades signal transduction in electronic circuitry and data processing in Integrated Circuits - the drama of literally hard-wired temporalities within microchips which, as "embedded" or "ubiquitous" computing, are the elements of a topological (more precisely than traditionally "infrastructural") web of computational forces.

In a very different way, the temporal message of digital communication media is in temporal deferal: from live on tape to media content on demand. This is the temporal signature of webcasting different from broadcasting media like radio and television. This time-critical sovereignty and immediacy in access leads to a "tactilization", in fact: an almost haptic access to media time (to use one of McLuhan's terms for describing electroic communication). The clear distinction between what is present and what is past, what is transmitted "live" and what comes out of the archive, disappears. Some online-services of radio or TV channels offer access to commentaries on current news, while at the same time offering access to other commentaries on previous occasions. The delineations of the archive to the present become diffuse, almost fuzzy.

Technical Eigenzeit (the temporal logic inherent to media) shapes the collective perception of time; time itself looses its individual character. The study of time critically challenges media studies. What, in this sense, is the message of Internet-based communication? The dominant communication platform of today, the World Wide Web, needs to be analysed on its operative level of

224 See Andreas Bade, Das Internet als programmbegleitendes Medium des Hörfunks. Historische Entwicklung von Internet, Radio und ihrer Medientheorien, Hamburg (Diplomica Verlag) 2009, esp. 57-86, online http://www.mediaculture-online.de
225 "Zeit ist damit auch die Herausforderung einer Medienwissenschaft": Stefan Rieger, Kybernetische Anthropologie. Eine Geschichte der Virtualität, Frankfurt/M. (Suhrkamp) 2003, 143
temporal processualities and eventalities.

**From time-based narrative to time-critical action**

Whereas narrative once has been the dominant art of time, symbolically dramatised time orders are now being reorganized by technologies. Real time analysis belongs to computing and signal processing and is not narratable any more, subject(ed) to the instant. Henri Bergson insisted on human perception of durable time (conscience) as against chrono-photographical registering of temporal processes.

Story-telling is not an anthropological *a priori*. The traditional diegetic adaption of time-processing in the form of story-telling has become an anachronism itself with time-critical electronic and digital media; since the phonograph and cinematography, the essence of technical media is time-axis manipulation. In digital topographies, emphatic notions of time turn into a function of arithmetical micro-timing, since algorithmic media operate radically time-critical; time here becomes the decisive factor. In this radically temporalised culture, speed becomes crucial not only in computer games but as well in virtual war and economy ("high frequency trading"). When communication goes online, the culturally familiar mode of story-telling is replaced by variable configurations of time and non-predictable actuality - enumeration instead of stories. Taken to its extreme, this hypertemporality becomes somewhat arbitrary.

**Archival storage becoming time-critical technical memory**

Traditionally being part of symbolic suspension from time (called memory) and itself being an agency of storage, even the archive and archival usage become time-critical. From a media-archeological point of view, the traditional archive gets deconstructed by the implications of digital techniques. Since antiquity and the Renaissance, mnemotechnical storage has linked memory to space. But nowadays the static residential archive as permanent storage is being replaced by dynamic temporal storage, the time-based archive as a topological place of permanent data transfer. The archive transforms from storage-space to storage-time. Classical archival memory has never been interactive, whereas documents in networked space become time-critical to user feed-back.

In electronic media, the classical practice of quasi-eternal storage is being replaced by dynamical movements "on the fly" as a new quality. Memory is technically defined as "a device into which information can be introduced and then extracted at a considerably later time" - close to what is known as a buffer in electronics. Minimal delay memories are at work in time-based and time-critical media even the more if we do not notice them. Drastically, these binary micro-memories dissimulate apparent "live" transmission by calculation.

---

in real time. In the development of one of the first full-electronic digital computers, the Whirlwind project for the US Air Force under the direction of Forrester soon after World War II, the solving of the data storage problem proved to be the crucial one, since high-speed data processing (necessary for real time interaction as intended with the Whirlwind) is often slowed down by the bottleneck of intermediary data storage. The mercury delay line which was one of the alternatives proved to be too slow since it it based on electro-acoustic transduction. It finally took the electrostatic storage tubes (familiar with the TV tube) to address and store data with almost the proverbial speed of light itself. "The incorporation of the storage element depended upon the progress of the storage-tube-research and development [...] especially after parallel transmission of digits had been decided upon [...]."

Time-criticality here refers to both the external (techno-contextual) and the internal (techno-imminent) sphere. But writing this as a "history" itself dissimulates the time-criticality by submerging and suspending it within an overall narrative coherence. Time-criticality (which is about discontinuous moments) is better revealed by media-archaeographical analysis and diagramatic representation. Software is a new kind of cultural artefact: not a material object any more, rather an executable file which unfolds only when being processed - a truly processual time-object. A computer as hardware can be traditionally displayed as an immobile object, but its "bit-critical" processes are never in stasis, just like frequency-based acoustics (sonic evidence) needs performance in time to take place - different from visual images which persist in space. Contemporary time-criticalism thus focuses on technomathematically implemented algorithms.

SYNCHRONIZATION BETWEEN HUMANS, BETWEEN HUMANS AND NON-HUMANS, AND BETWEEN NON-HUMANS AT ALL

Synchronicity as message of the measuring medium

In accordance with cognitive studies, the cold media-archaeological analysis of technological synchronization sharpens the awareness of analogies, as well as differences, to signal processing within humans as well. It is by autocorrelation that the human brain fuses sequential impulses with ultra-short distance into one "tonal" impression in its time-critical, that is: sonic (not acoustic) sense. The musical "consonance" theory can be media-experimentally enacted by EEG measuring; it is the "coincidence neuron" which compares the primary signal with the delayed one. Here, synchronization (German Gleichzeitigkeit) actually happens within a fuzzy region of tolerance, since mental pattern

230 See Martin Ebeling, Verschmelzung und neuronale Autokorrelation als Grundlage einer Konsonanztheorie, Frankfurt/M. et al. (Peter Lang) 2007, 52
recognition is dynamically co-emergent, not a function of a single hidden command organ like an oscillating clock.

This is the moment for Gottfried Leibniz' theory of pre-established harmony which explains how all wordly substances, though autonomous in themselves ("windowless", as defined in his *Monadology*, § 7), still "seem to causally interact with each other because they have been programmed by God in advance to 'harmonize'". But different from Leibniz' philosophical approach, it is by measuring and modelling media only that this can be technomathematically imagined, like the van der Pol oscillator simulating the relaxation moment in neuronal cells with a gas-filled (neon) tube (Thyratron) and slowly charged capacitors which then abruptly discharge.

Is there an incommensurability between phenomena of synchronization between humans, and technological synchronicity? Truly time-critical insight is a function of the measuring media itself: a net of electrodes allows to register the activity of numerous neurons at the same time, resulting in the impression that neurons "fire" in coordinated pace, as "synchronous oscillation". Such neurological insight into the primordial synchronization of "firing" impulses itself is a function of high-sensitive measuring media; the detection of such a time-critical mechanism, at the limits of laboratory experimentation, requires algorithmic and information-processing mathematical modelling, which makes all the difference between emerging synchronization and synchronicity. The gap opens with "posthuman rhythmatics" in contemporary popular music culture. Edgar Varèse, in 1936, predicted machines which could generate any arbitrary sound and beat or micro-durational pause - fractions of time in all ratios and exact repetition, which is the essence of Lev Termen's *Rhythmicon* indeed.

In terms of analysis, the human-machine-constellation is a synchronizing in a different sense, for example the laboratory measuring of human nerve reaction times by the microtime-critical Hipp chronometer in nineteenth century physiological laboratories. Once the human is coupled to the measuring instrument, he or she is synchronized with its inherent temporality; the temporal content of the resulting data looks human, but the message of such time-data is the chronopoetics of the machine itself.

---

231 Wikipedia entry on "pre-estalished harmony", accessed September 27, 2017
232 See György Buzsáki, Rhythms of the Brain, New York (Oxford UP) 2006, 138 (fig. 139)
234 Barbara Hobom, Auf der Suche nach der universellen Sprache des Gehirns, in: Frankfurter Allgemeine Zeitung no. 284, 6 December, 2006, N2
235 "[...] das alles in vorgegebenen Zeiteinheiten, die ein Mensch nie einzuhalten vermöchte": Varèse, as quoted in: Kodwo Eshun, Heller als die Sonne. Abenteuer in der Sonic Fiction, Berlin (ID-Verlag) 2xxx, chap. 6
236 See Andrey Smirnov, xxx
Synchronization From a Media-Archaeological Perspective

Media archaeology, in its reactualization of cybernetic systems theory, analyzes signal transduction both in humans and in machines, while at the same time paying attention to discontinuities and asynchronicities inbetween them.

While performative "embodied cognition" differs from operative technical implementation, time-critical processes within human cognition, and within technological systems, can be correlated indeed. Human-machine interfaces increasingly interlace both signal events. Once humans are coupled to processual media, they are coupled to their tempor(e)alities; synchronisation is a forceful coupling in the time-domain.

The media-archaeological approach does not apply neurophenomenological analysis but an object- and process-oriented ontology of synchronization from within the technical apparatus. For technologies, there is no "time", since there is no phenomenological perception and "inner time" self-consciousness. Instead, we find a variety and "kosmos" of temporal operations which unfold, the temporeal.

Technological reification of time-keeping has resulted in the commodification of temporality itself. With cinematography as technical operation, in Bergson's criticism of what Heidegger later would call "vulgar time" in reference to the mechanical clock, only the representation of time has become reproducible, while disavowing any relation to temporality as such. In that sense, synchronisation is a coupling and has nothing "temporal" in itself which exists only in the the Kantean sense as mental condition (a priori) for the human possibility of perception.

Clock-based technical synchronization itself needs to be synchronized: "Through isochronic oscillation the pendulum can exist as the autonomous embodiment of natural or physical time", while the radio controlled clock needs to be periodically synchronized with a reference clock elsewhere. "The quartz oscillators used in digital electronics (which are used for synchronization rather than timekeeping) can drift [...]" (Reding / Palasti).

Media archaeology is less about the human use of technologies or instruments but about the co-agency of the machine. Some neurons in the human brain tend to "fire" in periodic frequencies and require synchronization in cognitive perception; that induces their modelling by technical oscillators. The moment humans are coupled to a machine / instrument, they become subject (like coupled clock oscillation: Huyghens) to their proper media time (Eigenzeit).

239 Mackenzie 2001: 244
This escalates with vibration / oscillating mechanisms which induce resonances within the human sense of time.

The human coupling to humans is performative; the machine coupling to machines is operative. A notorious enactment of the sublime borderlines between synchronicity and asynchronicity is the "phasing" technique applied by Steve Reich in his piece *Piano Phase* from 1967. This chronopoetics results from magnetic tape recording and its options for subtle time axis manipulation, while failing when this composition is performed by human pianists. Syn- and Desynchronosiation between even the most skilled musicians is always fuzzy, delayed synchronicity. Entrainment analysis between two players itself is a function of time-critical techno-mathematic motion tracking and capturing, with software platform tools like Eyeweb reiterating Marey’s chronophotographic measuring of movement more than a century ago. The difference itself is a technological escalation: the option for real-time analysis enabling immediate feedback and modeling for performers as co-agency instead of belated reading of recordings. *Nota bene*, a synchronization algorithm measures data resulting from sensors, not movement as it occurs - the Bergsonian critique of cinematography.

[Media-archaeological artefact collections do not simply preserve machine elements but maintain them in a (re-)enactable state. Technical devices are in their media situation only when being in action, that is: when they are signal processing.]

In the media-archaeological perspective on synchronization, there is no *a priori* pre-cognitive notion of time, but rather an inductive departure of analysis from actual technologies; the despotic signifier "time" is replaced by a multitude of operative terms for signal events, such as "resonance" (from the mechanical tuning fork to the electronic resonant circuit); for digital systems. In computing, what is known as the motorical rhythm in humans, is replaced by the clocking of cycling units as precondition for storage-programmed algorhythmics (Miyazaki).

**Chrono-Technical Violence: Synchronization**

There is a privileged (all the more deceiving, though) affinity between the human auditory channel, and the frequencies of nerve cell signaling, to technological signal processing. That means, from the engineering perspective, for discussing electronically based communication processes, it makes sense "to use auditory terms [...] like feedback ... reverberation ... tuning". "Sonicity" is a neo-logistic term for such an implicit message of "sound" as epistemological object which is primarily not its acoustic content but temporal signal form. From here results the analogy between sonic and media-technical articulations; their common denominator is arbitrarily structured, "dramatized" processuality.

241 Schwartz 1974: 23
This corresponds with the cybernetics assumption that synchronization in communication between machines (technical and mathematical) and animals can be (self-)controlled (Maxwell's "Governor") by time-critical negative feedback processes, as indicated by the subtitle of Norbert Wiener's 1948 publication *Cybernetics or Communication and Control in the Animal and the Machine*. The automatism of feedback differs from asynchronous "editing" of neuronal or technical memory such as film, sound, and video tape which "replaces the linear sequence of events in time with events juxtaposed in a time relationship established by the communicator" (ibid.).

Classical cybernetic systems theory fell victim to epistemically seductive analogies between timings in technical media and in the human brain, like "clocking"; neurophenomenology rather accentuates the difference between technical und cognitive "timing".

[In the neurophenomenological investigation of the aesthetic experience of music (Helmholtz 1863), temporal structures from neuroimaging data can be analysed most efficiently when using a neurodynamic approach, whereas at present structure- and function-oriented neuroscientific approaches are dominant.242]

Simultaneity *unequal* synchronization.243 On the discursive level of symbolical time, the cultural concept of (global) history is a literary, narrative synchronization in the historiographical writing operation), an arbitrarily "agreed-upon chronology".244 Synchronicity, when applied to neural analysis itself, is a technological term, an artefact, since in the human brain or nerve oscillations, if at all, there is never exact clocking. Neuro-science and neuro-informatics separate.

Apart from the phenomenological analysis (Husserl / Bergson) of human cognition (and man-machine communication), there is the phenomenon of "emerging synchronization" within technological communication. In media theory, it is appropriate to call such processes "musical" in its archaic sense (ancient Greek *mousikē*), a symptom of which is the frequent use of implicitly "musical" terms for micro-temporal communication by engineers and mathematical theories of technical communication.

**Audio-Visual A/Synchronicities**

Phase-delayed signals, consisting of piezo-electric modules, served for the micro-synchronisation of PAL colour television RGB signals (von Bruch's "color

clock"), just like the Acoustic Delay Line has been developed for the short-term maintenance of data words in the first electronic computers.245

This intra-technological delay differs from human sensory synchronization such as the audio-visual perceptual gap since the early times of sound film resulting from the different signal run times of acoustics and light. The media-archaeologically formative epoch of television broadcast technology, before magnetic video recording, just knew "live" transmission; in the meantime, the Marconi Company (GB, 1957) developed the Marconi Telerecording, a recording from screen by film camera with fast intermittent mechanism, while sound was recorded on a synchronised tape recorder with perforated recording material (double tape). In the Dolby Digital cinema system, digital sound information is coded in the space between the celluloid film perforation - while the parallel optical analogue wave form is still continuous. Digital sound recording corresponds with the discreteness of cinematographic projection again which, according to McLuhan 1964, rather relates to the machanical age than to electronics. But with the digitalization of the sound film, it becomes "silent" film again. A differential synchronicity arises (an oxymoron); in traditional sound film, the acoustic track is 21 frames in advance of the actual image, for compensating the gap between acoustic (delayed) and visual signal run time in the moment of cinema projection.246

In his physiological laboratory equipped with time-critical measuring media, Hermann von Helmholtz detected that the run-time (speed of propagation) of signals in the motoric nerves of a frog counts around 24 meter/sec. This speed reminds of a synchronization problem within humans, when technical audio-visual synchronicity leads to irritation when confronted with physical signal run times in real nature; a lightning stroke is seen more immediate than the accompanying thunder is heard. For the temporal domain of human perception, the media psychologist Herta Sturm once experimentally explored that while every day perception which always includes a slight temporal delay of reaction involving a kind of inner speech ("subvokales Ansprechen"247), electronic media force their audience into immediate affective response. Immediate media interfaces deprive humans of their natural chance of delayed perception. What occurs within this half-second? With electronic signal immediacy, humans are deprived of this chance of delay248. The almost missing micro-temporal gap, is comparable to the essential "time of non-reality" (Norbert Wiener) in digital switching between zero and one.249 There is asynchronicity in signal processing

246 See Siegfried Kracauer, Theorie des Films, Frankfurt (Main) 1960, 158, on "Synchronismus - Asynchronismus"
247 Hertha Sturm, Wahrnehmung und Fernsehen: Die fehlende Halbsekunde. Plädoyer für eine zuschauerfreundliche Mediendramaturgie, in: Media Perspektiven 1/84, 58-65 (61)
regarding humans on the one hand and electronic machines on the other, a
difference in phase delay of signal transfer between technology and human
physiology.

[Quasi-technical timing can be detected within human neuroprocessing itself, a
kind of chrono-engineering. Pre-emptive activity is what apparently is
stimulated in the pre-frontal cortex of the brain which does not simply react to
incoming sensations but time-critically tends to anticipation, which is familiar
from the difference between "live" and "real-time" signal transmission within
communication media). The a-subjective and the a-human within humans
(Gilles Deleuze) is a chrono-technical one.]

**Time-Critical Media Operations as Implicit Chrono-(Syn)Sonicty**

Technical con-temporaneity differs from the human or social one. The
synchronization in opto-electronic communication between the electronic
Cathode Ray Tube camera and the corresponding receiver tube in television is
time-critically delicate; otherwise there could be no mass media effect.

In cultural history, posting letters, phonographical recordings and
cinematography has resulted in asynchronous communication, always in delay
between sender and receiver, while simultaneous telephone and radio, in
analogue days, have been - in implicit sonicty - "the mechanization of post-
literate acoustic space". The specific "live"modality of broadcast media is
synchronicity, ubiquity and differs from the temporal modes of digitally coded
communication media which are based on intermediary storage on the micro-
temporal level - therfore always delayed against the punctual "now".

Electro-technical synchronization in television image transmission and reception
has been replaced by digital signal processing and transfer in realtime; the
"live" transmission of images of the American bombing of Bagdad during the
Iraq war in the 1990s by the TV channel CNN: "indissociable d'une nouvelle
temporalité de la technique d'une autre rhythmé" which is, in fact, not
musical but a function of algorithmic pixel calculation.

There is auto-synchronization in the circuitry of human / machine couplings,
such as the Bosnia-Montenegrrean guslari singers of epic verses are coupled to
the one-string instrument (the gusle) not for the purpose of instrumental
amusement of the audience but for servo-motoric feedback in creating the just-
in-time prosodic rhythm of oral poetry. Software such as *The Amazing Slow
Downer* allows for time-warping and -stretching of reference Jazz-musical
recording without altering the pitch (beats per minute). This allows the
students to re-inhabit the master solo, to play in synchrony with the (recorded)
master, in the same frequency (be it in-phase or anti-phase synchrony). What
has been the Harmonizer in Kittler's electronic times for time axis
manipulation, nowadays is achieved by computational synchronicity; predictive

---

Kadmos) 2009, 267-282
250 McLuhan, "Five Sovereign Fingers Taxed the Breath" (1954), xxx
Entretiens filmés, Paris (Galiliée / INA) 1996, 83
analytics is algorithmically counter-calculating the present in real-time, like the Stealth Fighter computationally counter-corrects the physical distortion of the airplane shape which is necessary to deceive the enemy radar beams.

So-called time-based media in the traditional sense comprise literature and theatre, then gramophone, film and television. Media archaeology sharpens this notion by focussing on time-critical processes as well, where micro-temporal events are crucial for the overall process to happen at all: succeeding synchronization in telecommunication, and clocking within computer data circulation.

The term contemporaneity denotes rather the coming together of different times than simple being-in-the-same-time; technical synchronisation is forced contemporaneity. In early image telegraphy, the speed of transmission itself had not been decisive, but rather the synchronization of sender and receiver\textsuperscript{252}, such as in time-critical electro-mechanical television signal generation and reception of moving images.

The time-criticality of synchronism is the moment when a technology is not simply an escalation (literally: further "step") of a cultural technique any more but becomes epistemogenic. In English, isochronism signifies "equal in time, or performed in equal time", while synchronism refers to "occurring at the same time, or having the same period and phase"; the difference is between ontological and operative times. In electro-mechanic archaic television, this resulted in the Automatic Tuning-Fork Synchronizer and the Toothed-Wheel or Phonic-Wheel Motor\textsuperscript{253}; nota bene, once more, the use of "sonic" terms in engineering.

There is a difference between physical "presence" experienced by players in computer games (such as in LAN-parties), virtual "presence" (which is realtime calculation for sensomotoric synchronism as condition of the immersion experience in the game) and psychological "presence" in computer games.\textsuperscript{254} When humans are loosely coupled to a gaming device, they are just contemporary with the machine action.\textsuperscript{255} But tightly coupled to a computing device in gaming especially, and in ubiquitous computing generally, they become synchronized, subject to techno-mathematical time. In reverse, the machine is programmed in order to adapt to the human asynchronous rhythms, by means of the "interrupt" option which momentarily suspends machine action, waiting for the human input like the radar monitor equipped with a light pen at the CRT of the Whirlwind computer.\textsuperscript{256} But temporal complexity within

\textsuperscript{252} See Christian Kassung / Albert Kümmel, Synchronisationsprobleme, in: Albert Kümmel / Erhard Schüttpelz (Hg.), Signale der Störung, München (Fink) 2003, 143-165
\textsuperscript{253} Collins 1932 / 1991, chap. VII, 205
\textsuperscript{255} See Friedrich Kittler, entry "Flipper", in: same author, Baggersee, Munich (Fink) 20xx
\textsuperscript{256} See Pias 2002, xxx
computing results in functional asynchronicities, such as the different rhythms (clocking) of cycling units.

There is implicit "musicality" in electro-technical timing-as-synchronization; time-critical media operations unfold in implicit chrono-sonicity. The very term "synchonicity" (like Aristoxenos' chronoi as time units of poetic prosody) already admits that there is no single transcendent parameter "time". "There is not 'the time', but only clock readings"; instead of a despotic transcendent signifier called "time", times exist only as multitude. Once singular "time" is conceptually replaced by the description of discrete moments (Zenon "arrow flight" paradox, Aristotle's definition of chrónos), time measurements dissolve (in accordance with Bergson's criticism) to position measurements. When "time" implodes, instead we discover, from media-epistemological perspective, the richness of micro-tempor(e)al multiplicities which unfold within high-technological processes.

The very term "synchronization" points to the artefactual character of technical timing where "time" is not externally attributed to it as a referential quality, but generated from within a concrete technology's eigentime.

Apart from the apparent "content" (result) of any synchronized action, its McLuhanesque "message" is that there is no time at all, which is only semantically attributed to transcendent signification which exits in culture as symbolic order only. When time comes into existence only by measuring (Aristotle), it is enforcing the symbolical on the real. The difference between symbolical time-ordering (such as narrative) and physical time is essential; different from thermodynamic (Boltzmann), informational entropy (Shannon) needs no term like "time" at all.

Resonance and "Syntony"

[In his book on synchronicity, psychoanalyst Carl Gustav Jung defines the acausal connection of two or more psychic and physical phenomena, resulting from the archetype as arché: a dynamic which - like Leibiniz' clock-driven "prestabilizing harmony" - governs human existence.

A self-performative form of synchronization is resonance. Martin Heidegger's use of terms from the sonosphere does not refer to explicit acoustics (as physical sound event) or to music as conceptual art form in culture, but rather to the implicit, epistemological meaning of sound as vibrating space. In the end of the 1930s, Heidegger defined human existence in resonance with ontological being. Heidegger "understood" (German vernahm) the implicitly sonic

260 "Das Wesen des Menschen [...] schwingt in dem Bezug des Seyns zu ihm. Diese Schwingung meint die unentschiedene Fülle des Entscheidbaren durch
nature of such vibrations - not in its acoustic sense, nor as an auditory listening experience. He had to make use of sonic vocabulary as a substitutional way of expressing the microtemporal structure of the "event" of being.\textsuperscript{261}

"The resonance principle is not totally new or unique to electronic communication. It has always been an element in painting, music, sculpture, and, to a limited degree, even in print. However, resonance is not a more \textit{operational} principle for creating communication because much of the material stored in the brains of an audience is also stored in the brain of a communicator - by virtue of our shared media environment."\textsuperscript{262}

The decisive technical configuration in the emerging epistemology of "radio" communication has been Heinrich Hertz' spark oscillator in correspondence with a "resonator". David Lodge later sonically called this electro-magnetically induced synchronization of distant objects "syntony", which in radio engineering resulted in the technical term \textit{resonant circuit}.\textsuperscript{263}

Electrotechnical synchronization takes place on several levels. Simple electric tuning is achieved by the \textit{Schwingkreis} (resonant circuit), but "sympathetic electric resonance" is an "effect obtained when the electric oscillations which surge in a circuit send out electric waves of a given length and these strike a second circuit that is tuned to exactly the same frequency as the first one, so that electric oscillations will be set up in it"\textsuperscript{264}. Damped and sustained oscillations" can be detected: "the energy of the oscillations that are set up in the aerial wire at the transmitting station is converted into electric waves. When these strike the aerial wire of your receiver they are converted back again into electric oscillations. The receiver detects the oscillations that are set up in it, not the electric waves, though it is called an electric wave detector [...]."\textsuperscript{265}

\textbf{Radio "Time Signals"}

In the difference between the "synchronous" and the "simultaneous", the latter corresponds with McLuhan's notion of "acoustic space". Radio and wireless telegraphy reshaped each other. In World War One, at the Russian front, men listened to the spark acoustics of telegraphy as "radio entertainment". All electro-physical signals are (already) time-functions. In the media-archaeological "pre-history" (\textit{epoché}) of radio before it became a broadcast medium, radio gas been a technology of synchronization: with the radio time signal, the medium message is its content as well, when listened to as
das eigene Innestehen des Menschen im Da-sein." Martin Heidegger, GA vol. 70, xxx, 125

\textsuperscript{261} Rainer Bayreuther, entry "Heidegger und die Musik", in: Heidegger-Handbuch, ed. Dieter Thomä], chapter 2.2 "Auf dem Weg zu einer Akustik des Seyns": 'Stimmung', 'Schwingung', und 'Harmonie' nach Sein und Zeit", 2013

\textsuperscript{262} Tony Schwartz, The Resonant Chord, xxx 1974, 25

\textsuperscript{263} See xxx Aitken, Syntony and Spark, 1976

\textsuperscript{264} A. Frederick Collins, Experimental Television, Boston (Lothrop, Lee & Shepard) 1932; Reprint Bradley, IL (Lindsay) 1991, 205

\textsuperscript{265} Collins 1932 / 1991: 216
communication - before, as a program format radio, this "figure" was pushed back to the "ground" (McLuhan). In 1912, the International Time Conference in Paris inaugurated the network of signalling stations with the Eiffel tower as center. Watchmakers once listened to its radio time signals.266

There has been a re-entry of synchronization within time-keeping itself. With telegraphy in Switzerland, a message could be transmitted in "less than no time" - at least in terms of local sun-dial time. Since mid-19th century Bern local time became federal time in Switzerland: time sent as telegraphic signal ("Einheitszeit"), used in coupling with railway logistics. For other contexts, local time remained partly intact.

The Time-Critical Electronic Television Image

The earliest known recording from a television program - the revue Looking In, performed by the Paramount Astoria Girls on the BBC Baird television system (30 lines) in April 1933 - has been recorded by an enthusiastic amateur on his Baird Phonovision system equipment on aluminium disc. Recently processed and restored by digital filtering, the key to clarity is the neuronal perception of movement itself. Any reproduction of one of the 30-line television broadcast as photographic stills in a printing medium gives a wrong impression of what had been actually seen. Here the time-critical comes in, since printed records (be it texts, be it images) miss a crucial element: time.

"A single frame of the Paramount Astoria Girls may be crudely recognisable, but when seen as a moving dynamic television image, the girls come to life before our eyes. [...] it has much more to do with what we perceive than what is there in pixels, lines and frames. What we are experiencing is not the detail that the eye sees, but the recognition of movement that the brain sees."267

Digital Synchronicities

The modelling of human neuronal synchronization, since the cybernetic brain-computing metaphor by McCulloch / Pitts and von Neumann, is grounded in the very materiality of digital computing. The fundamental unit of memory, the electro-magnetic relay, for electronic engineers, seemed "naturally adapted to the binary system" since they did not attempt to measure gradations of charge at a particular point but were "content to distinguish two states"268 - which

266 See Horace Hurm's Ondophone (1914), referred to by Gabriele Balbi / Maria Rikitianskaia in their lecture "The Age of Synchronization", at the conference Zeitregime und Geschichtswissenschaften of the Swiss online portal infoclio.ch, October 14, 2016, in Bern
makes all the difference to the time-functional classical black & white television scan line, and to analog computing. The flip-flop as truly binary device provides for the rhythm. Magnetic wires or tapes or acoustic delay line memories recognised "the presence or absence of a pulse or (if a carrier frequency was used) of a pulse train"\textsuperscript{269}. All of the sudden, beyond the phenomenological notion of the continuous endurance of time (Bergson), computer time actually \textit{sounds} different.

The core media-epistemogenic act in interfacing the physical world to numerical computing is analog-to-digital sampling. This signal processing basically consists of an \textit{a priori} synchronisation. By high-frequency clocking (the 44.1 kHz standard for audio, such as for Compact Discs), the signal is first of all time-discretely sampled, before being evaluated ("quantised") in terms of information (measured in bit-depth).

In such concrete chronopoetical scenarios, media archaeology identifies the digital "shaping of time" (George Kubler). The sample-and-hold mechanism (before the signal actually gets digitally quantised) "stores" its records only for a fraction of a millisecond. Condensers figure among the smallest electro-physical storage elements, and combined with transistors they function as micro-memories here. The electronic sound slice is a temporal being in such electronic circuits, not punctual, but a suspended instant of time as voltage.

\textit{"Social" media synchronization}

For radio amateurs, head-phone signal reception had been strictly individual, while synchronization of collective reception has a strict electronic condition: the vacuum tube (later transistor) for amplification of acoustic dynamics to operate loudspeakers.

In times of "social media", the traditional synchronisation of society by radio or TV broadcasting (the simultaneous reception in mass media culture) is replaced by \textit{temporary} synchronisation of mobile communication devices ("Flash mobs").

The so-called Community Memory project in the San Francisco area has been an early attempt to place computer terminals in public places, to get access to documents centrally stored in a main frame computer (the SDS 940). This telephone-line, Modem- and computer-based social network emerged in the 1970s, as an early application of a Time-Sharing operating system. What has been "social interaction" among individuals in sociological terms becomes cold synchronization.\textsuperscript{270} The media-archaeological condition for enabling such \textit{online} social synchronization has been the magnetic core memory in the central main frame computer. This binary grid is no metaphor on neuronal data processing

\textsuperscript{269} Burks et al. 1961 / 1976: 227
\textsuperscript{270} See Stefan Höltgen, "All Watched Over by Machines of Loving Grace". Öffentliche Erinnerungen, demokratische Informationen und restriktive Technologien am Beispiel der "Community Memory", in: Ramón Reichert (ed.), Big Data. Analysen zum digitalen Wandel von Wissen, Macht und Ökonomie, Bielefeld (transcript) 2014, 385-403 (386)
any more.