TIME-CRITICALITY

[partly extracted by Jussi Parikka for journal *Cultural Politics*]

Time-critical media
Sonic micro-temporalities: being "tuned" to Being
The time-critical image: electronic television
From time-based narrative to time-critical action
Archival storage becoming time-critical technical memory

["Ernst's focus on micro-temporality" (Morten Riis)]

Time-criticality of computing and computing (with) time
Time-to-live and ping-to-death: Internet temporality

Time-critial media

Technological media have a distinct quality: They are in their medium-being only in operation ("under current"). This specificity 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 electrically coded into telegraphy.[1]

It was Gotthold Ephraim Lessing who in his tratise on the comparative aesthetics of poetry and visual arts *Laokoon* in 1766 identified what the called the "pregnant moment" in the representation of action. In electronic television the exact synchronisation, thus timing, of signals becomes crucial for 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 object of epistemological attention in the economy of knowledge. When culture is rather counted than narrated, time-criticality needs to be focussed by process-oriented (thus dynamic) media archaeology.[2]

Time-criticality in its media-technological context does not refer to a philosophical or critique of contemporary politics or ethics

---

1 See Axel Volmar (Hg.), Zeitkritische Medien, Berlin (Kulturverlag Kadmos) 2009. See as well Wolfgang Ernst, Chronopoetik. Zeitweisen und Zeitgaben technischer Medien, Berlin (Kulturverlag Kadmos) 2012

2 See Wolfgang Ernst, Zeit und Code, in: Daniel Tyradellis / Burkhardt Wolf (eds.), Die Szene der Gewalt. Bilder, Codes und Materialitäten, Frankfurt/M. et al. (Peter Lang) 2007, pp 175-187; same author, Takt und Taktilität. Akustik als privilegierter Kanal zeitkritischer Medienprozesse, in: Derrick de Kerckhove / Martina Leeker / Kerstin Schmidt (eds.), McLuhan neu lesen. Kritische Analysen zu Medien und Kultur im 21. Jahrhundert, Berlin (transcript) 2008, pp 170-180

but rather to a special class of events where exact timing and the temporal *momentum* is "decisive" for the processes to take place and succeed at all. 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.[3] 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 antiaircraft prediction in Second World War.[4]

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 shrank 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 hightly 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-tempor(e)alities. The acknowledgement of the unity of perception-in-action implies the notion of time-critical signal processing, encompassing both electronic and technomathematical systems.[5] 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.[6] 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.

---

3 See the chapter "Zeitkritische Medienprozesse" in: Wolfgang Ernst, Chronopoetik. Zeitweisen und Zeitgaben technischer Medien, Berlin (Kulturverlag Kadmos) 2012, 17-36

4 See Siegfried Zielinski, Archäologie der Medien. Zur Tiefenzeit des technischen Hörens und Sehens, Reinbek (Rowohlt) 2002, 43

5 See Norbert Wiener, Cybernetcis or Communication and Control in the Animal and the Machine, Cambridge, Mass. (M.I.T. Press) 1948

6 See, for example, J. D. North, Application of Communication Theory to the Human Operator, in: Colin Cherry (Hg.), Information Theory. Papers read at a Symposium on 'Information Theory' held at the Royal Institution, London, September 12th to 16th 1955, London (Butterworths Scientific Publications) 1956, 372-389

Sonic micro-temporalities: being "tuned" to Being

Under the sublime conditions of digital culture (de-materialisation, hypertemporal, instant access) there is a re-entry of sound which has always been the most immaterial (physical) matter. "Electric speed is approximately the speed of light, and this consitutes an information environment that has basically an acoustic structure."[7] One reason for media theories to shift focus from visual studies to "acoustic space" (Marshall McLuhan) is that the human ear is especially sensitive to micro-temporal changes of pattern and rhythm. 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.

It was with the invention of the escapement-drived mechanical clock (not by coincidence within the context of Benedictine monasteries which are based on strict temporal discipline) that the sensation of micro-periodical oscillations entered the occidental chronosphere.[8] In early 19th century oscillation became even an epistemological term.[9] As Hans Christian Ørsted remarked, if we imagine a monochord string making its slowest vibrations, we 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 tone"s; in the end the speed of the vibrations becomes too great even to be perceived by the ear.[10]

The remarkable affinity between musical (or rather sonic) temporality and frequency-based technical media time is rooted in time-critical moments: First on the level of sonic performance and technological operativity, and second in the a-historic *momentum* of experiencing time in listening to music and in experiencing

---

7 Letter to Barbara Ward, 9 February, 1973. McLuhan 1987: 466

8 See Wolfgang Ernst, **Ticking Clock, Vibrating String: How Time Sense Oscillates Between Religion and Machine, forthcoming in: Jeremy Stolow (ed.), Deus In Machina: Essays on Religion and Technology in Historical and Cross-Cultural Perspective, Fordham University Press**

9 See Bernhard Siegert, Passage des Digitalen. Zeichenpraktiken der neuzeitlichen Wissenschaften 1500-1900, Berlin (Brinkmann & Bose) 2003

10 **Hans Christian Ørsted, Experiments on Acoustic Figures [1808], in: Selected Scientific Writings of H. C. Ørsted, trans. and ed. by Karen Jelved, Andrew D. Jackson, and Ole Knudsen, Princeton (Princeton Univ. Press) 1998, 280 (brought to my attention by the musicologist David Trippett, Cambridge, UK)**

presence-generating devices (chrono-phenomenological *aisthesis*).[11] Sound is transient; German *verklingen* expresses the dying-out of sonic events ("unsounding"). Musical articulation always had to take place in time, as a temporal unfolding; even John Cage's composition for piano *4'33* minutes of silence is chronologically defined (with its first public performance with David Tudor at the piano counting time without playing any tone).[12] In a McLuhanite sense, the acoustical channel itself thus becomes the message.

Martin Heidegger's use of terms from the sonosphere does n o t 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.[13] Heidegger "understood" (German: *vernahm*) the *implicitely sonic* 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.[14]

G. W. F. Hegel's lectures on aesthetics identified sound as a disappearing of being in the act of being. In cultural history, sound has been among the most fugitive and transient, thus: time-critical forms of articulation, until arrival of the phonograph allowed for its reproduction at will (as expressed by Edison 1878[15]). All of the sudden, sound lost its time-criticality.

At the same time, the technical recording of sound for the first time allowed to discover the time-critical essence of sound itself. While Pythagoras in ancient Greece arrived at his theory of musical harmony by subdividing a string (his monochord) by lenghts, literally kymographic media ("wave-inscribing") like Edouard Léon Scott's phonoautograph allowed to measure the same acoustic event (an octave, for example) as vibrational event, as a compositive of fundamentals and overtones. Since Edison's phonograph recorded vibrations and not symbolic scores (phyiscal acoustics instead of cosmological aesthetics), the measure of musical harmonies by length was technically replaced by time as an

---

11 On "the ontology of vibrational force" and "microsonic turbulence", see Steve Goodman, Sonic Warfare. Sound, Affect and the Ecology of Fear, Cambridge, Mass. (MIT Press) 2010, 81-84

12 See John M. Cage, Silence. Lectures and Writings, xxx (Weleyan University Press) 1961, 8

13 "Das Wesen des Menschen [...] schwingt in dem Bezug des Seyns zu ihm. Diese Schwingung meint die unentschiedene Fülle des Entscheidbaren durch das eigene Innestehen des Menschen im Da-sein.“ (GA 70, 125)

14 Rainer Bayreuther, "Heidegger und die Musik", demnächst in: Heidegger-Handbuch, hg. v. Dieter Thomä], chapter 2.2 "Auf dem Weg zu einer Akustik des Seyns": 'Stimmung', 'Schwingung', und 'Harmonie' nach Sein und Zeit", 2013

15 See Lisa Gitelman, Always Already New. Media, History and the Data of culture, Cambridge, Mass. (MIT Press) 2006, 25ff

independent critical variable.[16]

The memory technique in oral poetic performances (singers of tales) relies on senso-motoric synchronisation and feedback, sometimes significantly coupled with a string instrument (Homer in Greece, *guslari* in ex-Yugoslavia). "Aucune activité de la matière ne peut échapper au rhythme" (d´Udine[17]). "La diffusion nerveuse est comparable à la propagation du courant électrique à travers un réseau de fils conducteurs."[18] Embodiment as form of *kinesthetics* epistemologically activates the assumption that both machines (technical or mathematical) and animals are governed by analogous feedback-processes. Coupled to time technologies, e. g. the businessman 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.[19] This analysis brings together disciplines which are usually separated in the academic faculties: humanities, engineering, cultural studies, mathematics, neuro-sciences, media studies.

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 articial medium ("electric light"). Television consumption (which had been the occasion for McLuhan's study) increasingly structured human attention different from the trdaitional 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 environmental ures like the presence or absence of daylinght and more by rhythms in the data streams that occupy an ever greater share of our attention."[20] So the "algorhythmic"[21] 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.

---

16 See Friedrich Kittler, Gramophone - Film - Typewriter, Stanford (Stanford UP) 1999, 35ff

17 As quoted in: Marcel Jousse, Le Style oral rythmique et mnémotechnique chez les Verbo-moteurs, in: Archives de Philosophie vol. II, Cahier IV: Études de Psychoogie Linguistique, Paris 1925, 10

18 Jousse 1925: 17

19 See as well J. C. R. Licklider, Man-machine symbiosis, 1960

20 Such is the thesis of Josh Berson, as expressed in his lecture on "Circadian Selves", February 11th, 2013, at IxDA Munich. See http://www.ixdamunich.de/2012/12/18/february-11th-circadian-selves-a-presentation-by-josh-berson (accessed February 20th, 2013)

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

Culturally, a familiar way of information processing is the human-machine communication and its time-critical escalations in computer games. Such action/re-action 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.[22] 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 feed-back. 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 characteristic temporal activity patterns; their forms, however, mainly come from the re/cording method."[23]

The temporal constellation which has replaced the narrative, dramatic aesthetics of (tragical or happy) ending, in human-computer interaction in general is the mode of *interrupt*. Thus, *kairotic* time replaces *chronos*. Such interactive events between computer and human unfolds 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.

The time-critical image: electronic television

Video artists like Nam June Paik have articulated media temporality and materiality, transcending simply time-based performances (like theatre) towards an archaeology of time-critical processes, i. e. media practices where micro-temporal action is decisive for the success of the event at all.

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.

---

22 See Claus Pias, Computer-Spiel-Welten, Munich (sequenzia) 2002

23 Teuvo Kohonen, Self-Organization and Associative Memory, Berlin / Heidelberg / New York / Tokyo 1984, 90f

"A single frame of the Paramopunt 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."[24]

A time-critically sharpened reading of McLuhan's medium = message theorem leads to new ways of approaching the temporal bias of technical media which is not only a macro-temporal *bias of communication* in a Harold Innis-mode of media theory, "but an intensive microtemporality that forces us to consider the notions of cultural memory combined with an understanding of the technical memory as an active process instead of a stable, permanent memory."[25]

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.[26] This time-critical souvereignty 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.[27] 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 temporal processualities and eventalities.

---

24 McLean 200: 211f

25 See Jussi Parikka, Operative Media Archaeology. Wolfgang Ernst's Materialist Media Diagrammatics, in: Theory Culture & Society (forthcoming)

26 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

27 **"Zeit ist damit auch die Herausforderung einer Medienwissenschaft": Stefan Rieger, Kybernetische Anthropologie. Eine Geschichte de**r Virtualität, Frankfurt/M. (Suhrkamp) 2003, 143

From time-based narrative to time-critical action

Whereas narrative once was the dominant art of time, temporal dramas are now being organized by technologies.[28] Walter Benjamin 1936, in his essay *Der Erzähler*, states that experience, when cut of from epic tradition, can not be communicated any more in a narrative way. When heterogeneously juxtaposed, information has to be consumed at once - whereas narrative is extensive interpretation.[29]. 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 need; it is not a transcendental, but a cultural *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 techical memory

Traditionally being part of symbolic temporalities (called history) and itself being an active agency of tempo-realities, 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-

28 Paul Virilio, Technik und Fragmentierung, in: Karlheinz Barck u. a. (Hg.), Aisthesis. Wahrnehmung heute, Leipzig (Reclam) 1990, 71-82 (71). See as well Dieter Thomä, Zeit, Erzählung, Neue Medien, in: Mike Sandbothe / Walther Ch. Zimmerli (Hg.), Zeit - Medien - Wahrnehmung, Darmstadt (Wiss. Buchges.) 1994, 89-110

29 See Walter Benjamin, Der Erzähler, in: ders., Gesammelte Schriften, Frankfurt/M. 1972ff, vol. II.2, 439ff

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"[30] - 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 bottle-neck 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 proverbal 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 [...]."[31] Time-criticality here refers to both the external (techno-contextual) and the internal (techno-imminent) sphere.[32] 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.

---

30 Glossary, in: Edward B. Magrab / Donald S. Blomquist, The Measurement of Time-Varying Phenomena, New York et al. (Wiley) 1971, 314

31 Kent C. Redmont / Thomas M. Smith, Project Whirlwind. The History of a Pioneer Computer, Bedford, Mass. (Digital Press) 1980, 180

32 On immanence in technical revolution, see Gilbert Simondon, Du Mode d'Existence des Objets Techniques, Paris (Aubier) 1958, chap. I "Genèse de l'objet technique: le processus de concrétisation", 19-49 (über die Elektronenröhre. Übersetzung ins Englische (Ninian Mellamphy): On the Mode of Existence of Technical Objects, London (University of Western Ontario) 1980; *online* http://accursedshare.blogspot.com/2007/11/gilbert-simondon-on-mode-of-existence.html

Contemporary time-criticsm thus focuses on technomathematically implemented algorithms.

["Ernst's focus on micro-temporality" (Morten Riis)]

[= Extract from: Morton Riis, Machine Music. A Media Archaeological Excavation, Aarhus 2012; PhD dissertation at The Royal Academy of Music, Aarhus Department of Aesthetics and Communication, Aarhus University, 72f]

"Ernst focuses on the micro-temporality, which combines technical memory with cultural / memory as an active process and not just a stable permanent memory. For example, the television image is continuously being regenerated by the line update frequency and is not just a stable image. As well, the computer is not a static machine with static memory. Just observe the motion and dynamics of the hard drive. Hence, computers' 'digital memory is not only a static being of memory but is in need of constant repetition and regeneration also in the technical sense as such early memory technologies as the mercury delay line and the Williams tube demonstrate.' But when talking about digital memory from the mechanical point of view, punch cards, rotating cylinders etc, then these types of memory is most likely compared to books and written text, stable memory. They don't need constant repetition and regeneration in order to function as archival objects, which could indicate that the key difference between the mechanical 'digital' and the 'digital' digital lies somewhere in the notion of the temporal. So when Ernst refers to digital media as reducing everything to numbers and the resulting historical short circuit between the digital present and Pythagoras's mathematical world order, this claim can be regarded as being somewhat true. But taking into account the concept of time-criticality and micro-temporality, concepts that alter and redefine our digital present, the realm of understanding Ernst's own media archaeological investigations begins to dissolve itself - or at least becomes questionable. This happens because of the historical moebius-loop stemming from a symbolic understanding of the digital; completely disregarding the micro-temporal physicality. Accordingly, where is the temporality in Pythagoras's music of the spheres in the above mentioned example? This symbolic focus is somewhat paradoxical, because Ernst exactly distinguishes between Lacan's notion of the real and the symbolic (the use of Lacan in media theory originally stems from Kittler); 'It is the real that is the object of the media archaeologist and his
method, not the symbolic (except the algorithmic logic of digital culture) nor the imaginary.'"

Time-criticality of computing and computing (with) time

According to Martin Heidegger's *Sein und Zeit* (1927), it is the knowledge of death which inscribes a temporal vector into the human sense of being, so-called "existentials". This cognitive horizon anticipates death always already. Humans live with the implicit awareness that their death is already future in the past, a dynamically deferred *futurum exactum*. This pattern escalates dramatically within electronic media, turning Heidegger's question from an ontological one into an analysis of micro-temporalities which take place there, critically. The mechanical clock already, with its mechanical "escapement", literally has a sense of the vantage point (the flight) of time. Heidegger's ontological archaeology of temporality within human being stays decisively anthropocentric, explicitely opposed to reified time as embodied in a trivial machine: the mechanical clock. But with the cultural mastering of electro-magnetism (electronics) a form of processing temporal moments came into the world which unfolds a temporal *kosmos* of its own, its very own chronosphere which needs (analogous to Heidegger's analysis) an analysis of its media-*arché* which does no derive origins but re-veals groundings, uncovering the eventuality, which is: temporality and finiteness of being. Let us perform this time-critically, on the micro-temporal level of electrophysical media. The Heideggerian analysis of being-as-time thus becomes translatable into computing. Once a computing mechanism is in the physical world, it is subjected to temporalities. This is the subsymbolical level of physically implemented mathematics. Media-ontological analysis reveals no static being, but the essential processuality of media-time (their operativity) - somewhat close to Charles Sanders Peirce's triadic semiotics, with its accent on *infinite semiosis* taking place in temporal dynamics. The operative being of technical media is incompatible with a motionless ontology.

In mathematics, Newton and Leibniz have developed a mighty tool known now as differential and integral calculation in order to cope - for the first time in occidental intellectual history - with temporal objects, notably speed and acceleration. Analogue computing has such a sense of physical time, different from numerical computing. Numerical mathematics rather constructs discrete algorithms to cope with continual mathematical problems in two ways: direct computing which after a finite temporal process delivers the exact solution, and approximation. Digital clocks in the technical sense do not drive indented wheels any more, but count by numbers. It was Aristotle, who in book IV of his *Physics* has defined time as a function of numerical measuring a movement. Heidegger opposed „vulgar" mechanical time - as objectified in the ticking clock - by „essential" time.[33] Countable time is a form of periodic measuring.

What separates the actual electronic computer from the Turing model as a literal "paper machine" is its implementation into not just symbolic, but physical operativity, that is: the speed of electron(ic)s. According to Moore's Law, not only the density but

33 Heidegger 1927, § 81

as well the speed of semiconductors in micro-chips doubles more or less every 18 month. The temporal *punctum* becomes decisive in electronic computing: "The *interval* is where the action *is*"[34]; unwillingly, McLuhan here graps the essence of binary data processing - the temporal gap in switching between Zero and One. It was the god-father of cybernetics Norbert Wiener who - remarkably within the discussion of analog *versus* digital computing during the New York "Macy conferences" coined the term "time of non-reality" for the switching time between zero and one.[35] The way digital computers *draw a distinction* (alluding to Spencer-Browne) itself is not simply a logical discrimination but takes a micro-temporal switching within flip-flop circuits. Like the signifier in structural linguistics (de Saussure's phonemes) is nothing by its own and is defined only by its differential oppositions, the difference is not geometrical, but a *différance* in Derrida's sense, that is: an act of temporal deferment. Even if this moment ideally tends towards the Dirac impulse (a *punctum* with ultimate amplitude but no temporal extension), it will always - once the logic design is implemented into physical matter - take its temporal delay *delta-t* which is time-critical when it comes to computing time. Different from pure mathematical symbol notation on paper, techno-mathematicality is physically operative, that is: within the time-critical regime.

It is significantly in a publication entitled *Faster than Thought* that the reason for the success of early vacuum-tubes based computers over electro-mechanical machines is being explained: "All the operations [...] carried out by these valves could equally well be achieved by the use of ordinary switches and variable resistances, but for one thing - time. Valves can be switched on and off almost instantaneously."[36] Still, any logical or numerical switching of discrete information consume a minimal interval of time with which it literally has to count. Even quantum mechanics implies the discrete behaviour of physical nature in regard to available energies and time: "The switching of a single quantum information bit requires a minimum amount of time. The Margolus-Levitin theorem states that switching time is inversely proportional to the energy expended."[37]

---

34 Marshall McLuhan, Letter to Barbara Ward, 9 February, 1973, in: Letters of Marshall McLuhan, selected and edited by Matie Molinaro / Corinne McLuhan / William Toye, Toronto / Oxford / New York (Oxford University Press) 1987, 466

35 See Claus Pias (ed.), Cybernetics - Kybernetik. The Macy Conferences 1946-1953, vol. 1: Transactions / Protokolle, Zürich / Berlin (diaphanes) 2003, 158f

36 B. V. Bowden (ed.), Faster Than Thought. A Symposium on Digital Computing Machines, London (Pitman Publishing) 1953; here quoted from the paperback edition 1971, 42

37 Oswald Berthold, Computational Universe, typescript of his lecture within the seminar of Horst Zuse at the Technical University of Berlin, Oktober 10th, 2009. See as well Seth Lloyd, Computational capacity of the universe, in: Physical Review Letters, vol. 88 (2002)

Time-to-live and ping-to-death: Internet temporality

In times of Internet protocols McLuhan's thesis that the pace of electronic media changes the patterns of temporal perception requires a somewhat closer reading. What he has described metaphorially has become literally true. Time-critical processes take place in its most media-archaeological sense, that is: on the basic layer of bit transfer in the, the *physical layer*. This layer represents the interface of symbolic transfer to the material (or electro-magnetic) channel of communication (such as copper cables, wireless directions, light waves lines) and thus embodies very concretely the interlacing of logi(sti)cs and matter which is already implied in the term "technology". It is on this layer that the voltage level of what is meant to represent a logic "zero" and a logic "one" is being defined. The function of this bit transfer layer is in the transformation of signals within a physical transfer channel into information in order to be passed further to level two of the OSI system.[38] This identification of signals happens within the time-critical field, such as signal frequency and signal duration, sychronous or asynchronous clocking, and the decision on serial or parallel data transfer.

In communication networks topological systems are being appropriately expressed by hypertextual links, whereas time-critical processes rarely become apparent. The answer to this is the finding of a new term which does not nominate a new medium but declares the temporal mode of a mode its decisive media-theoretical criterium. "The real-time web is a set of technologies and practices which enable users to receive information as soon as it is published [...], rather than requiring that they or their software check a source periodically for updates."[39] The communicative practice of *instant messaging* belongs to this temporal field; im McLuhan's sense the message of the medium here is immediacy serving to create the illusion of a pseudo-copresence. This recent form of web economy is being defined by communication within the time-critical realm; cyberspace as *docuverse* is being replaced by an extremely speed-up information processing in cybertime.[40] The Internet thus turns out not to be just a topological extension of a generalized archive, but equally as a chrono-technical expression of time.

---

38 Christoph Neubert, Elektronische Adressenordnung, in: Stefan Andriopoulos et al. (Hg.), Die Adresse des Mediums, Köln (DuMont) 2001, 34-63 (41)

39 http://en.wikipedia.org/wiki/Real-time_web (Stand: 20. Januar 2010)

40 "Früher ging es um die Schaffung von Räumen <...>, heute geht es um die Zeit selbst, um Chronos, um die Kunst der *longue durée*": Geert Lovink, Was uns wirklich krank macht, in: Frankfurter Allgemeine Zeitung No 140, 21st June 2010, 27 (referring to the media theory of Franco Bernardi)

To reveal the time-critical *message* of the Internet use, a close look at time-critical operations on the physical and logistical level of the Internet is required, such as the "Ping" signal. Each data packet into which a document has been sliced is being observed individually; its transfer happens independent from its preceeding or successive packages. This procedure is radically time-critical since is takes place within the so-called Time To Live-field which defines the maximal temporal duration in seconds an IP packet is allowed to exist in the Internet. A counter is progressively being reduced during this routing; in case the TTL-counter reaches zero before the packet has reached its destination, it is being annihilated.[41] Media time is not endless. In TCP/IP as fundamental network program, techniques of synchronisation meet a deadly economy of time. "Time to live" means that each data packet is assigned a given life span; "time to die" thus becomes a crucial signature of the information age.

41 Othmar Kyas, Internet: Zugang, Utilities, Nutzung, Bergheim (DATACOM) 1994, 65