AS SLOW AS POSSIBLE? On machinic (non-)sense of the "sonic present", and on digital indiffera/ence towards "time"

[Extended pre-version of lecture for conference *Slowness*, Association for the Study of the Arts of the Present, Amsterdam, 24-27 May 2018]

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AS SLOW AS POSSIBLE? On machinic (non-)sense of the "sonic present", and on digital indiffera/ence towards "time"

Introducing tempor(e)al sonicity

Ontological reflection on the essence of "time" has been the domain of philosophy, art, poetry and aesthetics in cultural history so far. If such discursive vocabulary of "time" is replaced by corresponding technical terms, the totalizing term implodes into a delicate multitude of techno-mathematically differentiated operations. In that sense, the verbal *ekphrasis* of the "slowness" theme is substituted by techno-mathematical *termini technici* like signal delay / *delta-t*, and (a)temporal storage as suspending the transmission channel. From the media-archaeological point of view (in contrast to phenomenology), electronic media do not even make a difference between time scales which appear to the "inner time consciousness" of humans like "slow" or "fast". This opens a structural analogy between "musical" and electronic temporalities attractive, where a high or low tone are not primarily experienced in terms of speed but as numeric frequencies. "Slowness" becomes just a metaphor when applied to the technological sense of time.

With the background concept of "implicit sonicity" as temporal form, the lecture will refer to Norbert Wiener's cybernetic interpretation of the organ tone, John Cage's composition *Organ²/ASLSP*, sounding matter (acoustic earthquake monitoring), Fourier's implicitely "sonic" analysis vibrational events and its cold calculation, electro-acoustic time stretching, the reciprocal relation between storage (beholding the end) and transmission ("tradition" as time channel), the temporality of Arctic temperature (frozen vibrations, frozen voices)

"Harmonical Analysis" of a Gigue and the limits of the organ (Wiener)

The privileged human organ for time-critical perception is binaural hearing. "Interaural time differences arise because of the distance between the two ears. Since the speed of sound is relatively slow <...> there is a significant interval between the time a stimulus arrives at one ear and then the other."[1]

For human sensation therefore, the surrogate for the missing sense of time is hearing. A machine has no understanding of "sound" which is a phenomenological category only for humans, processed neuronally (at that point, phenomenonolgy clashes with media archaeology). An operative mechanism knows implicitely "sonic" timing since it consists of rhythms, pulses, numerical frequencies; just like analog recording media "know" time signals.

With an ultra-slow turntable on record player, the pick-up reveals sound no more, rather the granularity of the recording medium itself such as shellack. The noise of the apparatus itself becomes audible when signal processing slows down, like in Hiroshi Sugimoto's long-time exposure photographies of movies results in pure white noise of the theatre screen. Recording medium registers movement with indifference (recall Daguerre's humanless photography of rue du temple in Paris).

For human ears, there is no sound any more below 16 Hz. even if sound as mechanical vibration *is* "slow" a priori, compared to visual presence based on high frequency, "radio"-like electro-magnetic waves. The speed of light results in almost immediate "live" signal transmission - whereas acoustic sensation, based on slow run-tíme in mechanically elastic matter,, becomes recognizable as time event for humans at all. From that slowness, the sense of time arises.

The slow run time of acoustic waves even led to the reversal of the cause-effect relation of combat noise in technological warfare - reversed time. When in Second World War a German A4-rocket hit London, the articulation of its acoustic near-coming already lagged begind the destructive event itself. No longer is a danger previously being announced; the sonic barrier is broken.

A less phenomenal but more epistemic form of slowing down sound is its mathematical analysis, when the focus is not on its musical content as cultural aesthetic form, but rather on its medium message as sound matter. Norbert Wiener's lecture at University in Göttingen 1925 expressed some paradoxa of Harmonic Analysis: „the breaking up of complicated motions into sums of simple oscillations"[2]. Thereby, implicit sonicity (*mousiké epistmé)* becomes the model case of processual media knowledge. „Vibrations can be characterized in two independent ways, namely, according to frequency, and according to duration in time“ (Wiener ibid.).

[Only in extremely slow frequency, the numeric character of harmonically analysed sound becomes audible, as becomes apparaent in the lowest register

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1 Purves (ed.) 2008: 162
2 Wiener 1964/1976: 544

of an organ ranging 16 cycles per second. In human perception, sound transforms into a series of discrete impulses; in revers, it such a tone is truck only one twentieth of second, there is no sound emanating at all, rather violent air pulses. As notified by Norbert Wiener, the lowest register of an organ „it will not sound to the ear like a note but rather like a blow on the eardrum“ <545>, as pulse sequence, rather telegraphy than telephony: „the complicated mechanism of the reflection of impulses which is necessary to make an organ pipe speak in a muscial manner will not have a fair chance to get startet“ (Wiener ibid.).

But this only counts in phenomenological reasoning. The technical medium, on the contrary, is never lost in the illusion of a continuous tone, but always "understands" it for what is physically is: a sequence of repetitive signals inbetween pulse and waveform.

[see as well Norbert Wiener, The historical background of harmonic analysis, in: American Mathematical Society Semicentennial Publications vol. II, Semicentennial Adresses, Amer. Math. Soc., Providence, R. I., 1938, 513-522; quoted here after: idem, Collected Works with Commentaries, vol. II, ed. P. Masani, Cambridge, Mass. / London (M. I. T. Press) 1979, 56-68]

With an organ, there are mechanical limits of playing a piece "as slow as possible": With a "quarter note (lasting 1/8th of a second) to be played on some instrument, at the very low frequency of 5 oscillations per second, not even one oscillation will be completed, and the air will be pushed, not set into vibrations."[3] In a fast jig (a lively piece of music in the style of a baroque dance) the notes are of short duration: "A fast jig on the lowest register of an organ is in fact not so much bad music but no music at all."[4]

[Norbert Wiener, I am a Mathematician, Cambridge, Mass. (MIT Press) 1964; first edition Garden City, N. Y. (Doubleday & Company) 1956; transl. into German Düsseldorf / Vienna (Econ) 1962; reprint Frankfurt / M. and Hamburg (Fischer) 1965, here: 88 f. on "Gigue", in chap. 5 "Die Zeit meiner Auslandsreisen", 76-91]

While the ideal sine tone extends from infinity (past) into infinity (future) - an *aevum* in terms of medieval scholasticism -, its embodiment in the real world can only be an approximation, an enduring intonation "as long as possible".

There is an epistemic defreezing of ultra-slow sinusoidal waves ("tide", German "Zeit") in paleogelogy. Geo-archival temporality is slow motion, almost immobile memory; it is "time-critical" in its long-time sense, since not perceivable by human even within the time frame of "history" (as explained in Fernand Braudel's three time-layers model in *La Mediterrannée*).

Only slowness makes the sonic vibration countable - while at the same time, the audible disappears. Marin Mersenne, in an excess of the ancient

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3 P. R. Masani, Norbert Wiener 1894-1964, Basel / Boston / Berlin (Birkhäuser) 1990, 116

4 Norbert Wiener, I Am a Mathematician. The Later Life of a Prodigy, Doubleday, Garden City, New York 1956, 106. quoted after Masani 1990: 116

monochord, extremely slowed-down the vibrational string, by a tight rope expanded between the walls of a courtyard in order to make its swinging visible, thus: countable, mathematizable in dynamic ways - as opposed to therather visually oriented, Pythagorean geometry of spatial integer number ratios of musical intervals.

Sonification of / as time: drone

Jakob Kirkegaard's audiovisual installation *Aion* (DVD), 2006 took place in the deserted rooms of a nuclear reactor area, unfolding four abandoned spaces inside the Zone of Exclusion in Chernobyl, Ukraine.

Radio-active waste itself is physically treated in terms of "half lives", that is: slow decay of energetic states.

"It deals with a sonic and visual experience of time, absence, and change - in an area haunted by an invisible and inaudible danger, amidst the slowly decaying remains of human civilization. The sound of each room was evoked by an elaborate method" which stems from Alvin Lucier's seminal magnetophonic installation *I'm sitting in a room*: "in each room, Kirkegaard made a recording 10 minutes and then played the recording back into the room, recording it again. This process was repeated up to ten times. As the layers got denser, each room slowly began to unfold a drone with various overtones."[5]

Philipp Glass´ minimalistic music compositions: "The constant beat and yet subtly shifting rhythmic cycles over a seemingly static harmonic structures gives the listener a heightened sense of time and, instead of long development sections, progression is achieved through the increasingly complex repetitions and overlapping lines"[6] - from time-based art forms (music, dance, theatre, literature) to time-basing media arts

Drone music as minimalist musical style "emphasizes the use of sustained or repeated sounds, notes, or tone-clusters – called drones. It is typically characterized by lengthy audio programs with relatively slight harmonic variations throughout each piece compared to other musics. La Monte Young, one of its 1960s originators, defined it in 2000 as 'the sustained tone branch of minimalism'".[7]

If reverberative sonic feedback and its technical re-recording is accelerated, it becomes a *drone* (with the resonant circuit within a radio being its pures form). "Musicall speaking, the physics of a broadcast is a type of drone."[8] Drone sonicity suspends time by its very iterative structure. Drone music is

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5 http://fonik.dk/works/aion.html, accessed July 2010
6 Christopher Bowers-Broadbent, Booklet to Compact Disc Philipp Glass, Music for Organ, xxx
7 http://en.wikipedia.org/wiki/Drone_music; accessed July 2012, referring to La Monte Young, "Notes on The Theatre of Eternal Music and The Tortoise, His Dreams and Journeys", 2000, 27; www.melafoundation.org
8 Bill Viola, The Sound of One-Line-Scanning, in: xxx

reverberative, "sustained sound", a transformation of sonic temporality into space, like the moving still ("Photofilm") in cinematography.

[The "documentary" of the organ installation at Halberstadt on DVD is partly "Photofilm", partly chrono-photography.]

The technique of the so-called *freeze frame* is important not just to cinematic negotiation with time, but in a more general sense when it comes to objects which do not consist of elementary units but only by repetitive action.

For Bergson, even the appararent material object is a manifold, consisting of micro-tonal elementary vibrations.

For the visual representation of Kirkegaard's experiment, "two of the four rooms employ a recording technique parallel to the sonic layering. A video camera was placed on one particular spot in the space and it recorded non-stop from there. This recording was then projected and recorded with another camera tine and time again. In this process, some of the rooms turned darker, others turned brighter – they reveal themselves on the screen, they dissolve into white light or they disappear into darkness. For the two other rooms video feedback was used to under- and overexpose the image. Jacob Kirkegaard's AION is a sonic and visual installation that considers time, absence, and change inside the Zone of Exclusion in Chernobyl, Ukraine" (ibid.).

If the present is mirrored by itself, like in Dan Graham's closed circuit video Installation *Presence Continuous Past* (1974), a slow delay (in fact eight seconds) results in an irritation of the present itself.

The affordance of electromagnetic recording induces aesthetic and epistemological experimentation such as AION. "Kirkegaard's "sonic time layering" refers back to Alvin Lucier's work "I am sitting in a room" [1970] in which Lucier recorded his voice and repeatedly played the recording back in the space in which it was recorded"; the sound Kirkegaard recorded in Chernobyl in October 2005 and folded upon itself is a way to make the nuclear sublime audible.

When decades after the Tschernobyl nuclear desaster event Kirkegaard explored the phenomenon of radiation by sonic time-layering, this was a sonification of the temporal sublime itself, "recording, mirroring and layering the silence of four radiating spaces he aims to unlock a fragment of the time existing inside the zone". Sound, primarily, is a sonification of time, whose existence is extricably bound to such reverberative (wave form signals) or repetitive (discrete pulses) events.

As Slow as Possible / Organ²/ASLSP (Cage)

- Cage's ORGAN^2/ASLSP in its 8 page score notation itself is timeless, since it is enocded into the symbolical regime. Such a musical score is usually interpreted as duration of single tones or chords on an enduring, equally sustained pitch; the violin key provides for pitch in terms of standard chamber pitch ("Kammerton") "A".

- Cage's score notation remains symbolic, but the extended bars indicating the endurance (Bergsonean *durée*) of single notes already rather remind of a kymographic registration of the real time signal.[9] Jules-Étienne Marey, in his *Methode graphique* (1868), had already compared his graphic method to the musical notation.

In the experimental film (JC{639}) by Sabine Groschup (A 2006 / 2012) on the performance / operation of Cages composition at St. Burchardi Church in Halberstadt, the sequencing of the film units have been chosen by chance in Cage's spirit. With its 639 year of endurance beyond human perception, such a composition looses ground with / in the entropic arrow of time as irreversible direction. The cultural, artistic approach to *As SLow aS Possible* allows for loose coupling of associations invoked by Cages composition and its actual Halberstadt site specific organ installation by John Cage Organ Foundation (aslsp.org), while there is a tight coupling of philosophical reasoning and actual technologies in re-thinking its challenge in techno-epistemological terms.

In an autobiographic lecture, Cage once professed his intention that such an *oeuvre* will transform into a non-personal event - suspended from both the composer (Cage) and the individual organists. The life span of a single organist, by extending the rehearsal to 639 years, by necessity is replaced by the expected life span of an organ as technical *organon*.

Several hundred years of performance had been proposed for Cage's composition by Heinz-Klaus Metzger, and actually formulated by Hans-Ola Ericsson as criterium at the Trossingen music academy *Tage für neue Orgelmusik* conferences in 1998. Within the experience of actual interpretations of Cage's ASLSP for piano (1985) and ORGAN²/ASLSP (1987), the question arose how long is "as long as possible" for organs? The debates revolved around the "decisive" - in fact time-critical "question of what would be the most convincing criterion for calculating the duration of ORGAN²/ASLSP"[10]. While the sound of a piano stroke decays, "what happens when the sound of the organ can be sustained as long as desired?" (Bossert ibid.). Metzger, in his lecture, "brought up the fact that he could / even imagine a performance lasting several hundred years" (53 f.), beyond human experience of time - which is the true media time perspective, media-archaeological chrono-poetics.

Cage's notation of ORGAN²/ASLSP is not necessarily addressed to human time consciousness at all, but rather requires the media-archaeological non-sense of time.

The enduring organ tone correlates with technical sounds emanating from loudspeakers. Electro-acoustic avant garde circuits like the Theremin fundamentally transformed the temporality of Western music. Sound of synthesizers is pure electric alternating current; it does not pass away like the natural tone, but persists, stays, keeps, lasts.

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9 Photo in: Sabine Groschup / Georg Weckwerth (eds.), (JC{639})#1-89, including DVD version, Künstleredition 2013, 82

10 Christoph Bossert, What Prompted the Halberstadt John Cage Organ Project?, in: DVD edition booklet Groschup / Weckwerth (eds.) 2013, 41-59 (53)

"Aionic" time differs from the "kairotic" time-criticality of the key attack at any "tone change" event. Every tone will be enduring for years but will be ending; this ending though can not be experimented within human time life spans and thus appears like eternal. The sonic drone installed in Burchardi church since 2001 is a way to make *sublime time* audible.

The Buchardi church ASLSP organ installation actually hits the dilemma of Fourier analysis, its supposition of an ideally eternal periodicity of sine tone oscillations, which in any actual embodiment by mechanical or electronic instruments is subject to nonlinear distortions. Any key "attack" (well termed a "transient") actually - even if abruptly - evolves and disappears in time. An organ needs a key as relay or switch, to trigger the air pressure impulse; thereby the transient momentum of time-critical control is combined with principally endless duration.Any event (narratively defined by a beginning and ending) unfold temporality, while an endless oscillation is timeless, a transformation of temporality into a pattern.

Every tone change in the Halberstadt organ installation is itself abrupt, not slowed down itself. There is an inherent paradox in the tone change of the performance extended to 639 years: "Anyone who is present for a sound change in the Burchardi church is confronted with the fleetingness of the moment when a pipe falls silent or with the sudden entrance of a new tone. On August 5, 2011, two deep tones entered with this kind of suddenness. But these tones will resound for so long that they will have exceeded the lifespan of many of those present at this sound change when they fall silent again."[11]

The reverberant room acoustics of a cathedral already reminds of the *delta-t* in acoustics. According to Charles Babbage's *Ninth Bridgewater Treatise*, a sound never disappears completely; even the originary "big bang" in universal time can faintly the traced by ultra-senstitive measuring technologies of traces of graviational waves in Fourier analysis. Such reverberations are now actually sonified by physicist Karsten Danzmann, turning the "big bang" acoustic metaphor into sensible perception.

[Michael Praetorius, Syntagma Musicum, Bd. II De Organographica (1619), illustrates the first Halberstadt (dome) organ introducing the 12-tone Octave key manual from 1361. From that year derives the calculus for the time-reversed extension of the Cage composition from 2000 onwards.]

It is the sonic appeal which allows humans to comprehend the ontological concept of existence as being-in-time. Thereby music begins to leave the geometric space of Greek mathematics and dives into the eventful dimension of media time. In his *Syntagma Musicum* (1614-1620), organist Michael Praetorius related the symbolic order of the length of notes to the mechanical beat of the wheeled clock.[12] With the metronome of Johann Nepomuk Maelzel (Vienna 1814), musical beat found its own medium, setting the terms on which the micro-time of physical acoustics would later become comprehensible

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11 Bossert 2013: 57

12 Grete Wehmeyer, Prestississimo. Die Wiederentdeckung der Langsamkeit in der Musik (Hamburg: Kellner, 1989), 15

through electro-technical measurement, “the necessary greater exactness [of which] is obtained by the electric current itself"[13].

["Die Aufführung begann am 5. September 2001 mit einer Pause, zu hören war nur die elektronisch <sic> betriebene und angeschaltet Windmaschine unter dem Blasebalg <bellow>."[14] What if the electric current supply is interrupted? The answer will be authentic Cagean "silence".]

From DVD, Cage's composition actually sounds like loudspeaker music originated by an electro-acoustic synthesizer. Any electronic / digital recording actually transforms the sculptural dimension (plasticity) of single sounds overlaying in space. This can only be experienced by personal attendance to the Burchardi Church installation, walking around the organ, approaching single pipes with shifting binaural ears, by an ambient walk in the church space, experiences variable resonances, and actual beat frequency (*Schwebung*) between two lowest pipes by slight deviation of pitch.

[As personally authentified (less autopsy, but autacustemics) experience which I owe to organist Karin Castell (board of trustees John Cage Organ Foundation) for pointing my attention to the Cage birthday reading event (Rainer O. Neugebauer) at Halberstadt, September 5th, 2017]

There is a decisive difference between Cage's first composition of ASLSP for piano as percussion instrument like the ancient monochord (1985), where the duration of single chord stroke is limited by the vibrational force (volatile, with "sense of ending"), and the mechanism of an organ (aerophone) which allows for principally eternal duration: "Solange Luft durch ihre Pfeifen strömt, ertönt auch Musik"[15] - which makes the organ a sister to the electro-acoustic synthesizer, approaching the ideal wave form, which in Burchardi chruch is only occasionally interrupted by the "tone changes" by single successive humans as event - a chronopoetic cultural shift of emphasis from human time experience to media tempor(e)ality.

In the Halberstadt installation, an incommensurability between the sensorial physical experience of acoustic space and the textual description of the enduring event arises.

[In the "sound track" of the DVD with partial recordings of tones from the Burchardi Church organ, in terms of the Sampling Theoreme, computation actually re-produces equi-originally the coming-into-being of sound by reverberative oscillations.]

In media archaeological aesthetics, for the *analytic* purpose of "close reading", technical processuality is made archaic by monumentalizing the signal event

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13 Hermann von Helmholtz, On the Sensations of Tone as a Physiological Basis for the Theory of Music (Whitefish, MT: Kessinger Publishing, 2005; orig. 1863), 398. See also Scherer, “Musik und Echtzeit,” 362

14 Wulf Herzogenrath, Zeit - Klangdauer - Ewigkeit: John Cage in Halberstadt (2001-2640), in: DVD edition booklet Groschup / Weckwerth (eds.) 2013, 60-65 (64)

15 Herzogenrath in DVD booklet, 63

(for the sake of the moment), slowing down it down, even freezing it, like xxx Gordon's slowing down of Alfred Hitchcock's *Psycho* to 24 hours, showing two frames per second,

just like Léon-Scott created his "phonautograms" as graphic inscription of speech for slowed-down, close analysis of the signal event.

[The ticking clock as sound from the "off" in the DVD is a count-down.]

What if, instead of extending the duration of the compositon, the tonal pitch itself is radically "slowed down", replacing Bergsonean endurance (*durée*) by decreasing the frequency- as (s)low as possible, in accordance with Stockhausen's tonal analysis of "as time goes by ..."[16].

[The acronym of the Association for the Study of the Arts of the Present (ASAP) can be deciphered "as slow as possible". The "Arts of the Present" in terms of ancient Greek "art" leads to *techné*; to techno(logo)chronocentrism.]

This corresponds with the rather neglected (but visible exposed) slowing down of the bellow action provoding the air pressure for the organ pipe to generate tones at all (which has actually already been replaced by constant air pressure provided by an electric motor) from - tone to pulse to scratch.

The organ tone comes close to Fourier Analysis since it is ideally "timeless"

In his publication of 1822, Fourier insists that his mathematical decomposition of a complex sound into its single sine waves is mighty enough to describe not only slowly varying processes like temperature but extremely volatile phenomena - such as the most ephemeral cultural articulation which is sound.

Seen under a time lense, any sound is repetitive already. Its non-transient periodic repetition makes it almost timeless.

Electro-acoustic time-stretching / -compression

With electro-acoustic timestretching software device, "[t]he timeline typically stratifies the on-screen workspace into a metric grid, adjustable in terms of temporal scale" - be it hours, minutes, seconds, musical bars or frames per scene. Such a functional timeline, "zooming in and out, from the microsonic field of the sample to the macrosonic domain of a whole project, provides a frame for possible sonic shapes to be sculpted in time"[17]

Sonic timestreting, in spite of stemming - since Gabór's "acoustic quanta" sound grains - from the highly quantified, metrical and mathematical realm of the digital time-discretness criticized by Bergson, opens up alternative temporal possibilities which are different from linear progression and - in an unexpected dialectic return - more evocative of Bergson’s conception of *durée*

16 Karlheinz Stockhausen, "Wie die Zeit vergeht ...", in: xxx
17 Steve Goodman, entry "Timeline (sonic)", in: Matthew Fuller ed., Software Studies: A Lexicon, Cambridge, MA (MIT Press) 2008, 256-9 (256)

itself.[18] Within the realm of techno-mathematical "discrete time sampling" (Goodman), "durational time" ironically emerges out of the most discrete micro-temporal segmentation.

In his composition *9 Beet Strech*, Leif Inge slowed down Beethoven's "Nineth" by granular synthesis to (online) 24 hours, applying real time pitch shifting technology.

[It has been the option of transposing a male voice into a female one in realtime without Mickey Mouse effect that once induced Friedrich Kittler to advance from electro-acoustic synthesizer wiring to coding a microchip in time-critical Assembly language.]

Jem Foiner composed a piece for millenia (*Long Player*), while in reverse combinatorics, Benjamin Heidersberger's *Pentatonic Permutations Player* discretely calculates the time of the universe itself: an algorithmic piano composition that started 14 billion years ago and will continue another 16 trillion years, tagging every moment of time. After the last permutation the piece will stop.[19]

Different from the time-stretched Cage organ installation at Halberstadt, once tones within the signal time domain have been computationally sampled, they do not exist in time at all any more, rather in its reversal, the frequency domain, which makes it accessible to numeric algorithms.

Ableton Live sound editing software allows for rhythm manipulation. When a rhythm was played by a real drummer, this beat feels human exactly by not being always just in time. In order to layer other rhythms of clips with this one, Warp Markers allow to bring various loops into sync with one another" Quote from *online* presentation of audio editing software Ableton Live

In reverse, other software allows to re-humanze electronic drum machines[20] - turning algorithmic music back to rhythm.[21]

- "In time series analysis, dynamic time warping (DTW) is an algorithm for measuring similarity between two temporal sequences which may vary in time or speed. [...] DTW has been applied to temporal sequences of video, audio, and graphics data"; any data which can be turned into a linear time series can be analyzed with DTW. It is a partial time shape matching application. "Sequences are 'warped' non-linearly in the time dimension to determine a measure of their similarity independent of certain non-linear variations in the time dimension."[22]

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18 See Henri Bergson, Creative Evolution (1907) trans. Arthur Mitchell (Mineola, NY: Dover Publications, Inc., 1998), 4
19 What it sounds like: https://soundcloud.com/benjamin_heidersberger/ppv_20161019mp3
20 See Eshun, xxx, and the project draft xxx by xxx Zoeller
21 See Shintaro Miyazaki, xxx
22 http://en.wikipedia.org, entry Dynamic time warping, accessed August 5, 2014

Beholding the end

By his neographism *différance*, Derrida defines the deferral of meaning in any processes of signification, a continual postponement of signification whilst the signified can never be achieved.[23] A musical performance tends to defer its very ending, for which the Halberstadt installation of Cage's piece for organ is an excessive instantiation. In technical terms, this is true for signal transmission and processing as media time.

Under the programmatic title *Beholding the Big Bang* (2009), Arthus Ganson constructed a time keeping machinism which starts with 200 cycles of an indented wheel per minute; this movement is sucessively translated and slowed down by sucessive wheels. The last wheel, though, which will be addressed only in thousands of years, is immutable, closely imbedded in a concrete block.[24] Does the first wheel, through its very materiel embedding in the whole system, have a *dissipative* sense of the ending from the beginning, just like the groove on a vinyl record, from the beginning, is already transiently linked to its ending in a repetitive loop?

Mechanical time keeping itself is slowed down by friction: the moment of contact between the suspended pendulum and the actual clockwork. Damping of the clockwork signals (like in any mechanical vibration) occurs unless they are neg-entropically kept constant by negative feedback circuitry. There is always a loss of energy in oscillations. This *momentum* asks for description "in strictly thermodynamic terms, as a dissipative system"[25]. Only since Huygens, "through isochronic oscillation the pendulum can exist as the autonomous embodiment of natural or physical time"[26]. The motions of the pendulum and the moments of its contact with the escapement build "a cycle which converts potential energy to kinetic energy, and energy to information" (Mackenzie ibid.). In information theory, though, Boltzmann entropy is replaced by Shannon entropy, undoing the time arrow.

Very Low Frequencies: The temporality of Arctic temperature

The slowing down of technical signal processing, and even the "freezing" of the moment, is in alliance with a media-archaeological momentum. In its incubation phase, photography demanded long-time-exposure which made architecture, fossils and sculptures its favourite objects, ignoring animal motion

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23 See https://en.wikipedia.org/wiki/Diff%C3%A9rance#Temporal_delay, accessed 30 August, 2017

24 Exposed at: Labyrith::Freiheit, 2009, Festung Franzensfeste, Italy; documented in the catalogue, Bozen (Athesia Verlangsanstalt) 2009, 128f

25 Adrian Mackenzie, The Technicity of Time. From 1.00 oscillations/sec. to 9,192,631,770 Hz, in: Time and Society, Bd. 10, Heft 2/3 (2001), 235-257 (255, note 16), referring to: I. Stengers / D. Gille, Time and Representation, in: Power and Invention. Situating Science, Minneapolis / London (University of Minnesota Press) 1997

26 Mackenzie 2001: 244

- until with new chemical means of fast light impression (gelatine), this eternity escalated into the proverbial photographic "click" which turned photographical timing upside down, resulting even in chronophotography itself.

Florens Chladni, in his *Akustik* around 1800, made visible the "Klangfiguren" by freezing them into print. Slowing a high-frequency technical process down which is not immediately accessible to the human senses is truly process-oriented ontology. The rhythms and tempor(e)alities unfold as the *chronopoetics* within the machine. There are oscillations which can not be received by the human ears but rather represent the "implicit sonicity" of technical timings. Beyond (or below) the acoustic "content", the real "message" of such processuality is its time-figures. In ancient Greek music theory, Aristoxenos (in his fragment on *Rhythm*) coined the term "chronoi" (times, in the plural) for such sonic articulations in micro-time.

Slow motion in geology and cloud computing

Geological temporality is slow motion; its almost immobile memory is time-critical in a long-time meaning; it is not perceivable by human ("historic") time sensation. Polar ice is a function of long-time climate change which takes place in macro-temporal oscillations; cooling of the earth temperature leads to increasing galciers, heating in reverse to their melting into water. Such a periodicity differs from historical time in that there is no evident unidirectional arrow of time (progress, evolution) involved - no teleology.

While research on global climate change is based on long-time measured time series, meteorology aims at short-time prediction - which in a "memoryless", almost ergodic atmosphere is a challenge for discrete hydrodynamic computation. The techno-mathematical answer is Fast Fourier Transform, changing from the time domain (continuous "temperature") to the frequency domain (discontinuous data "clouds").

Against the geological metaphor, there are not "multi-layered temporalities" any more, but no more "time" at all (in accordance with the concept of the "post-contemporary"[27])

Frozen vibrations

In media archives around the globe the films rolls themselves are frozen down in order to withstand time. It takes around twelve hours to dehydrate stored film material in archives of the moving image before they can be viewed in a non-destructive way. The archive here not a metaphor for icy memory, but becomes "cold" media memory itself. Freezing slows down entropic degradation.

Electro-magentic events (like light) occur at regular intervals millions of times, "but what if they repeat merely 10 times, five times, or only once? Identification of the definining limit cycle is elusive with so few cycles. <...>

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27 See Avanassian / Malik, xxx, Berlin (Merve) xxx

Occasionally, it is virtually impossible to draw a line between a true but transient oscillator and system with properties prone to oscillate: resonators"[28].

Vibrational matter is analyzable into its parameters: amplitude, period, frequency, duration, resonance which is all technical terms substituting the imprecise transcendent signifier "time". Repetition is a challenge to time since it both affirms and questions this dimension. In Aristotle's definition, time comes into existence only by counting.

A machine has no "sensation" of tone (in the phenomenal sense defined by von Helmholtz 1864) but a clear awareness of sonicity as vibrational act of periodic wave forms.

Bergson explains that if one does not have sufficient capacity to retain at once the 400,000 million vibrations per second of the electro-magnetic field which defines (roughly) the chromatic band of red - "but one could take the case of a sound-vibration too, simply it is less impresive in terms of the frequency and thus less pedagogical"[29]; if, then , one is condemned to capture only one vibration at once, it will take 25,000 years (about) to register red. And of course, this won't 'look red', but be 400,000 million simple shocks. "This is the case, says Bergson, for the 'pure' material point [...]" (Lyotard ibid.).

Highly electronic media can clearly analyze what to humans appear like a continuous tone into its sincle wave or pulse trains. "The question is that of the beating or the oscillation which generates what we call sound. For the naked monad which receives only one beat at a time, there is no synthesis of the succession, and thus no beating. It hears only one wave, and it does not know that *it is only* one wave. Shall we say that if forgets those which have passed? No more than the billiard ball forgets the shocks it has reveiced from other balls"[30]; the answer in human cognition is the perception of a melody by means of a temporal horizon: pro- and retentions as defined by Husserl.

Slowing down high-frequent oscillations from the ultra-temporal to the sub-temporal level of perception is an equivalent to cooling down temperature. An organ pipe with low frequency dissolves into discrete pulses at around 16 Hz (Norbert Wiener 1948). John Cage composed a music piece for organ (originally written for piano in 1985) called ORGAN²/ASLSP, with the acronym ASLSP expressing "as slow as possible". In its installation at the Burchardikirche in Halberstadt, it is meant to last from 2000 (start) to 2639.

Storage of vibrations and their processual present are just two extreme formulations of one kind of event.

The human optical sense only perceives a fraction ("light") of the electromagnetic spectrum, while high sensitive instruments extend human

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28 Buzsáki 2006: 142
29 Jean-François Lyotard, God and the Puppet, in: idem, The Inhuman. Reflections on Time [*L'Inhuman: Causeries sur le temps, Paris 1988], Stanford, Cal. (Stanford University Press) 1991, 153-164 (161). See as well Karl Ernst von Baer, xxx, in: Axel Volmar (ed.), Zeitkritische Medien, Berlin (Kadmos) 2009
30 Lyotard 1991: 161

capabilities and detect radiation across the entire spectrum, from gamma to radio waves. EM temperatures happen in the Ionosphere (indirectly audible in Short Wave Radio) and cosmic background radiation.

Frozen voices: Making the temp*orality* of sonic world-signals symbolically calculable

Early science fiction, *Baron Münchhausen's Adventures*, chap. 5, tells about the defreezing of trumpet signals (which are physical vibrations of a medium indeed) literally frozen in winter like water waves at the shore, defreezing. They defreeze at a warm oven as sound[31] - sonic time in latency. The signal structure of defreezing is the sinusoidal wave indeed, the *tide*. This links is to literally the epistemological key term "Zeit" itself. "Unfreezing the captured vibrations"[32] in François Rabelais' *Gargantua et Pantagruel* (1532).[33]. A boatsman tells about a frozen lake where the noise and cries of a battle have cristallized in the icy air, waiting to be released in warmer springtime[34] - a fictitious, though plausible anticipation of phonographical sound recording and replay.[35] Charles Babbage, in his *Ninth Bridgewater Treatise* (1837), considered the air as an implicit sonic "vast library" of any vibration ever articulated, a superimposition of sine waves in eternity which can not only be mathematically analyzed (Fourier) but actually be retraced (like Patrick Feaster achives it for "lost sound"[36]). Babbage's speculation is acoustemic.[37]

Imagine the phonographic record of Martin Heidgger's speech *Die Kunst und der Raum* at St. Gallen starting to be slowly activated on a record player, defreezing infra-sonic vibrations, accelerating to uncanny articulations, until a deep recognizable voice slowly emerges from one and the same signal storage medium

While Fourier analysis of heat waves ideally presupposes timeless signals, in reality (that is: implemented into physical / technical matter), oscillations are subject to increasing decay; they "die away <...> for which reason they are called transient"[38].

The elementary unit of a technological being-in-time is the time-varying signal. A phonographically recorded acoustic signal, when not being moved, is not in its signal state but a graphic inscription (storage). It becomes an operative media diagram only when turned into a "time object" (Husserl) again[39], being

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31 August Gottfried Bürger, Wunderbare Reisen zu Wasser und zu Lande, Feldzüge und lustige Abentheuer des Freyherrn von Münchhausen, London 1786

32 Moore 2010: 291

33 Chap. 4, LVI

34 Siehe Moore 2010: 294f

35 August Gottfried Bürger, Wunderbare Reisen zu Wasser und zu Lande, Feldzüge und lustige Abentheuer des Freyherrn von Münchhausen, London 1786

36 See Feaster, xxx

37 As discussed by John Picker in *Victorian Soundscapes*

38 Buzsáki 2006: 142

"de-frozen" and transduced by the apparatus movement and the pick-up. The phonographic record waits for the mechanic player to defreeze its signals in a technological act of re-presencing.

For digital machines there is no "time"

The situation escalates with Shannon's techno-mathematical definition of information which is - more than ever - the enduring foundation of digital media communication today. In principle (*en archê*), the "bit" is timeless in its lossless, reproducibility and calculability. More than this, binary computation even generates new epistemic time objects, like "ergodic time", "Markov chains", and Norbert Wiener's poetic notion of "time of non-reality" which is the switching interval between two alternating voltage states: very tempo*r(e)al* in Lacan's sense, escaping traditional cultural techniques of symbolic time order called "history".

For digital machines there is no sense of "time" at all; the finite automaton only knows discrete "states". Therefore no sense of "slowness", but high-frequency, time-critical data processing within the microchips. The very term "realtime" is purely functional in the sense of just-in-time production; when addressed to human apperception, it means calculation not too slow to pass within the temporal window of the "present".

"Live" (for anaog media) and "realtime" (for digital media) technical signal transmission has become a metaphor for the speediness of transfer that accelerates discourses, people and society.[40] Slowing this speed down, delays or even gaps (temporal interrupts) in transmission have become a retro-effective luxury in experiencing the contemporary.

Whereas digital data transmission is much too fast to be perceivable directly to human senses, the archaic telegraph "dots and dashes", when connected to an acoustic mechanism, may serve as a way of slowing down, even sonifying the nature of coded signal transmission.

The analog wave form can be approximated by converting (sampling) the signal from the time domain into the frequency domain, which is numerical calculation, re-embodied by digital pulse processing - the very clock-time which both Bergson and Heidegger criticized for missing the essence of time itself.

In the Halberstadt installation of Cage's composition ORGAN²/ASLSP, every tone change counts as "event", even if their is no human consciousness which it takes to integrate a sequence of discrete tonal steps into the sensation of a temporal musicial horizon called "melody" by re- and protention (Edmund Husserl) since it exceeds the human perceptional time-window of "the present".

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39 On "temporal objects" ("Zeitobjekte") see Edmund Husserl, On the phenomenology of the conciousness of internal time (1893-1917), transl. John Barnett Brough, Dordrecht (Kluwer Academic Publishers) 1991, esp. 24: "jedwede Veränderung, aber auch jedes Verharren als solches betrachtet" - Henri Bergsons *durée* as well as John Cage's ORGAN²/ASLSP

40 Paul Virilio, xxx

Every tone change is staged as an event by a human operator. Why not turn the idea upside down and let an automatic player organ step-wise unfold the tone sequences, with a start / stop mechanism as an interface pre-positioned to the actual Burchardi chruch organ? Such a sequence, like any algorithm, is timeless in itself.

[Italien priest Angelo Barbieri, from the 1930s onwards, developed automatic player organs to enable such music during a Catholic service even in the absence of an organist.[41]]

The earlier work *ASLSP* from 1985 had been written for a piano competition. A typical performance of the piano version lasts 20 to 70 minutes; Cage opted to omit "of exactly how slowly the piece should be played". No two performances would be the same in its temporal interpretation - indicating the difference to technical chronometry where the time base needs to be assured.; different to recording by Welte Mignon Player Piano

resp. Conlon Nancarrow's punched card-based compositions *Studies for Player Piano*: allow for un-human timing / unfolding in time, mechanically (in principle) endless extensability = Lorenz 2012: 36

41 See Giorgio Farabegoli, Angelo Barbieri's Organs, in: The AMICA Bulletin (Automatic Musical Instrument Collectors' Association), vol. 50, no. 6 (Nov. / Dec. 2013), 261-275