

LISTENING TO SONIC EXPRESSIONS WITH MEDIA-ARCHAEOLOGICAL EARS

[Keynote at the conference *Sound Art Matters*, University of Aarhus, June 1-4, 2016]

[Introduction]

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[Introduction]

[According to the "Y" model, artistic and scientific research operate in distinct but parallel lines, derived from the same epistemological challenges.]

The following argumentation, instead of contributing to so-called "sound studies", rather turns the notion of sound upside down in order to reveal, below its apparent auditory phenomena, its epistemological essence which is an enunciation of specific *tempor(e)alities*. Therefore "implicit sonicity" will be addressed, not simply to make verbally explicit what is already articulated in sound art, but rather to reveal the hidden epistemological implications of sound itself. While sound as acoustic vibration is a physically material event, in its temporal form ("implicit sonicity") which affects the human sense of time it is volatile and immaterial. How does sound as matter relate to its immaterial timing?

[In a fundamental sense, sound *matters* as time-critical articulation. The concept of "sonicity" as epistemological approach is rather related to media-archaeology than to the acoustic any more. Sonicity happens as non-material oscillations even without being heard as acoustic "sound" any more.]

An answer to this truly Bergsonian question has been given by Gaston Bachelard, in his book *The Dialectics of Duration* from 1950, in the called "Rhythmanalysis":

"Rhythm is imprisoned in sound boxes. When we see rhythm preserved in a radio aerial, we cannot stop the image of a reciprocal action between the geometric and the temporal from intruding into our thought. It is therefore on our best interests to regard things as truly the products of stationary waves. Periods are spatio-temporal function. They are the temporal face of material things. As it vibrates, a thing reveals both a temporal and a material structure."¹

[In respect to the compositional rhythm, there is *mousiké* in Bernd & Hilla Becher's photographic image series, as explicitly expressed by the artists in an interview: "the music is already composed", and the "sound is the raw material". The difference here is between "composed" (dramaturgical) time which is music, and actual (materially embodied) time which is sonicity. Bernd and Hilla Becher's serial aesthetic of photographic monuments visually correlate with the archival rhythms of "minimal music" as composed by Steve Reich. There is something like an archival *mousiké* here, in relation with that time that Jonathan Kramer identifies in Minimalist music: stasis und movement, repetition and difference.²]

The *almost immaterial* sonicity of electro-magnetic waves make "sound matters" not simply a phenomenon in acoustic culture but a fundamental event of being-in-the-world.

[Previous workshop at Aarhus University, 23rd of May, 2014: "Media archaeological ways of hearing: techno-mathematical analytics", researching the micro-temporal processes that constitutes acoustic and sounding media reality. Focus on the sounds of the machines themselves, and accidental media time. Topics: the non-narrativity of sound; symbolic and non-symbolic representation (data vs. signals); auditory memory; cultural semantics of "music" (discourse) vs. technical knowledge of sound (non-discursive). Sound is articulations of specific tempor(e)alities.]

This involves the asymmetrical relation between "sound" (as signal event) and "music" (as cultural code) - which is turned upside down in "digital" media sound which is the truly techno-logical mathematization of sonic matter - and thereby a re-entry of the "musical" structure.

1 Gaston Bachelard, *The Dialectic of Duration* [FO 1950], Manchester (Clinamen) 2000, 78

2 Jonathan Kramer, *The Time of Music*, New York (Schirmer Books) 1988)

According to Norbert Wiener's seminal cybernetic definition, information - measured in *bits* - is "neither energy nor matter". Is the current interest in sound therefore a "post-digital" nostalgia for vibrational matter? Different from "music" in the Pythagorean tradition, sound can not be reduced to an aesthetic, political or discursive construction. The agency of emancipating sound from music is media-epistemological indeed: It has been signal recording technologies and media theories (*avant la lettre*) which heightened awareness of the physicality of sound as vibrational event (both mechanical and electro-magnetic). In terms of ontological unrevealing, it is techno-logical analysis (such as spectrography and Fast Fourier Analysis) which matters as a better "understanding" of sound than human hearing itself.

Spectral analysis of sound transforms the signal from the time domain into the frequency domain. The analytic science has become aesthetic practice in "spectralism" as compositional technique in contemporary music³, where the experimentation of micro-times is being replaced by mathematical patterns.

Sound ~~art~~ matters: Implicit "sonicity"

["Ist zuerst die musikalische Struktur da oder zuerst der Klang? Ist der physikalisch reale Klang eine Verkörperung der musikalische Struktur oder ist die musikalische Struktur die Vergeistigung des Klanges? <...> Der Klang ist dann nur Medium <...>."4]

Does aesthetic experience come to existence only in human perception?⁵ For the media-archaeological ear, the musical structure does not already unfold in silent decoding of the score (as claimed by Theodor Adorno), but only as actual enactment, in its operative implementation in structurable matter.

"[M]usical time is the organization or the set of forms 'imprinted' <...> on sonorous matter, on sound."⁶ Is sound

3 See Hugues Dufourt, *Musique spectrale: pour une pratique des formes de l'énergie*, in: *Bicéphale* no.3 (1981), 85-89

4 Gottschewski 1994: 196

5 On *Rezeptionsästhetik*, see Roman Ingarden, *Vom Erkennen des literarischen Kunstwerks*, Tübingen 1968

material, and music conceptual? If music is sounding matter shaped in symbolically ordered time, it is: *drama*.

Coded writing of music is "symbolical" time; "real" time takes places in analog signal recording; "imaginary" time is the discourse of history suggesting coherence where is, in fact, fragmentation - time shards.

Only when a musical score is decoded and *incorporated* into human performers or *implemented* into signal processing machines, it can be articulated as sound. "Music" is the semantic content of "organized sound" (according to Edgar Varèse and John Cage); the message of a vibrational medium is the experience of time,

just as in technological operations: "Media mediate change and are therefore the material form of time."⁷

[Philip Glass 1974 on Repetitive respectively Minimal Music: "So bleibt zu hoffen, daß man dann in der Lage sein wird, das „Jetzt“ der Musik wahrzunehmen, frei von jeder dramatischen Struktur, als ein reines Medium des Klangs."⁸]

In discussing the essence of the *tone*, G. W. F. Hegel defines it in its temporal essence: "Ein Verschwinden des Daseins, indem es ist"⁹. - a disappearance of being, while it exits.

The commonality of sound, vibration, light, and technical image lies in their equal condition as time-critical frequencies. The existence of sound *in* and *as* time is twofold: its explicit tempor(e)alities in human perception and its implicit dynamics as epistemic object.

6 Jean-François Lyotard, *God and the Puppet*, in: ders., *The Inhuman. Reflections on Time* [*L'Inhuman: Causeries sur le temps, Paris 1988], Stanford, Cal. (Stanford University Press) 1991, 153-164 (153)

7 Sean Cubitt, *The Practice of Light*, Cambridge, MA (The MIT Press) 2014, 257, as quoted in the introduction to Timothy Barker, *Television In and Out of Time*, forthcoming in: Andrew Hoskins (ed.), *Digital Memory Studies. Remembering through digital and social media*, London / New York (Routledge)

8 Zitiert nach Programmheft der Aufführung der Berliner Kammeroper von *In the Penal Colony*, Musik Philip Glass, Hebbel-Theater Berlin, November 2002, 7

9 G. W. F. Hegel, *Enzyklopädie* (1830), § 459 (= Werke, Frankfurt/M. 1970, vol. 10, 271)

The privileged alliance between technological events and musical sound is based on their common denominator which is its temporal processuality. This is evident in a central electro-technical device: the resonant circuit, otherwise significantly called "tuned" circuit. Such an electric circuit consists of an inductor and a capacitor in mutual connection. "The circuit can act as an electrical resonator, an electrical analogue of a tuning fork, storing energy oscillating at the circuit's resonant frequency."¹⁰ Resonant circuits are used either as sender (for generating signals), or as receiver (for picking out a signal at a particular frequency from a band of carrier signals), particularly in radio technology, up to the mobile media in digital wireless communication.

In an experiment from 1889, David Lodge placed two resonant circuits next to each other, each consisting of a Leyden jar connected to an adjustable one-turn coil with a spark gap. When a high voltage from an induction coil was applied to one tuned circuit, creating oscillating currents, electric sparks were excited in the other tuned circuit only when the circuits were adjusted to resonance. Not by coincidence engineers borrowed the terms to describe the micro-temporal event of oscillatory electro-magnetic discharge from musical science. "Lodge and some English scientists preferred the term 'syntony' for this effect, but the term "resonance" eventually stuck."¹¹

What McLuhan once daringly termed "acoustic space", is more fundamental than what the human ear can hear, indeed. As the radio producer Tony Schwartz wrote in his book *The responsive chord* in 1974:

"In discussing electronically based communication processes, it is very helpful to use auditory terms [...] like *feedback ... reverberation ... tuning* [...]."¹²

"Sonicity" inbetween vibrational force and electro-magnetic waves

In *The Audible Past* , Jonathan Sterne differentiates sound as perceptual quality from mechanical vibration as

10 http://en.wikipedia.org/wiki/LC_circuit (accessed 23rd January, 2015)

11 Wikipedia *ibid.*

12 Garden City, New York (Anchor books), 23

physical event: „As a part of a larger physical phenomenon of vibration, sound is a product of the human senses and not a thing in the world apart from humans. Sound is a little piece of the vibrating world“¹³ and „somewhat human-centered“¹⁴.

<= Modifikationen HABIL-PAPENBURG-PARA-AUDITIV>

[Klang existiere demnach nur in Bezug auf bzw. sogar erst durch ein wahrnehmendes Subjekt. Vibration hingegen habe auch unabhängig von der Wahrnehmung des Subjekts Bestand.]

But some conditions must be given "for something to become recognized, labeled and valorized as audible in the first place"¹⁵.

[Shelley Trower: die Materialität der Vibration stellt das Subjekt/Objekt-Schema infrage. Vibration selbst ist kein materielles Objekt, aber an Materialität, etwa an die Materialität eines Körpers oder eines physikalischen Mediums, gebunden.]

Vibration encompasses both a „dissolution of matter“ as well as „sensory experiences of things which vibrate“¹⁶; it mediates between subject and object. „Vibration, not itself a thing or matter, can move simultaneously through subjects as well as objects, bridging internal and external world“¹⁷.

[Trowers Vibrationsforschung geht also nicht vom wahrnehmenden Subjekt aus. Vibration überschreite die subjektive Wahrnehmung, sei aber für die Subjektgenese entscheidend und existiere in einem extrasensorischen Bereich, einem Bereich des „acoustic unconscious“ (ebd.: xx).]

Vibration operates before being translated into sense-data called sound, light, heat, "let alone language or image or sign"¹⁸.

[Damit überschreite und überfordere Vibration das wahrnehmende Subjekt und eröffnet ein Verhältnis von Sensorischem und Extrasensorischem.]

13 Sterne 2003: 11

14 Sterne 2012: 7

15 Veit Erlmann, xxx, 2010: 18

16 Shelley Trower 2012: 7

17 Ibid.: 9

18 Trower 2008: 135

[Vibration als Gegenstand von kultur- und medienwissenschaftlicher Forschung ist also keineswegs auf Hörbarkeit beschränkt. Als Vibration ist Klang als etwas konzipiert, das nicht auf das Ohr zentriert ist. Eine Konzeption, die für die hier zu entwickelnde Untersuchung der paraauditiven Dimension von Klang und der Ästhetik des lauten Klangvolumens, einen wichtigen Impuls verspricht. Vibrationsforschung schließt das Extrasensorische ein und macht eine „purely audiological conceptions of sound“ kritisierbar (Friedner/Helmreich 2012: 76). Das sich durch die Vibration eröffnende Forschungsfeld kann mit ganz unterschiedlichen Akzenten untersucht worden: medientheoretisch mit Bezug auf Hochfrequenztechnik (Kittler 1993), auf zeitkritische Medienprozesse (Ernst), auf „Schwingungen des Realen“ (Siegert) oder auf Takt und Frequenz (Balke 2011 et al.). In den so genannten „Deaf Studies“ wird über die Vibration das Klischee von tauben Menschen als Augenmenschen aber auch ein „earcentrism“ der Sound Studies kritisiert (Friedner/Helmreich 2012 und Mills). Die Vibrationen des Infraschalls verbinden Sound Studies mit ihrem Anderen – den Deaf Studies. Infraschall markiert „a zone in the frequency spectrum where hearing and deaf scholars have recently been meeting in order to unsettle the earcentrism of Sound studies and the visually centered epistemology of much Deaf studies“ (Friedner/Helmreich 2012). Vibrationen sind in der Musik- und Klangforschung auch als ästhetisches Phänomen untersucht worden. Dann kann von „frequency range aesthetics“ die Rede sein (Gopinath/Stanyek 2014, Marshall 2014, Rehding 2014).]

[In der Auseinandersetzung mit elektronischer Tanzmusik und mit postkolonialen Formen populärer Musik wie HipHop und Dubstep hat Steve Goodman eine „ontology of vibrational force“ beschrieben (Goodman 2010). Goodman verortet die Ontologie der vibrationalen Kraft zwischen einem „naive physicalism“, der das Sonische als „quantifiable objectivity“ reduziere und einem subjektzentrierten „phenomenological anthropocentrism“ (Goodman 2010: 82). Demnach wäre der vibrationalen Kraft nicht durch eine für sich „Objektivität“ reklamierende physikalische Messung beizukommen. Zum anderen ist die Vibration nicht auf die Erfahrung einer Vibration durch ein Subjekt reduzierbar.]

According to Steve Goodman, the "vibrational force" is an "in-between of oscillation, the vibration of vibration, the virtuality of the tremble. Vibrations always exceed

the actual entities that emit them. Vibrating entities are always entities out of phase with themselves."¹⁹

[The theoretical conceptualization of vibration carries itself a temporal index: In late 18th and 19th century, "new technologies and scientific theories heightened awareness of the physicality of sound as vibration"²⁰.]

[Habilitationsschrift Papenburg: Mit der Fokussierung auf der *Physikalität* von Klang als Vibration macht Trower deutlich, dass es nicht ausschließlich um eine diskursive „Konstruktion“ von Klang als Vibration – etwa in Abgrenzung zu Klang als Ton und Geräusch – geht. Medienarchäologisch stellt sich die Frage, unter welchen Wahrnehmungsbedingungen der Klang der Musik als Vibration wahrgenommen werden kann. Unter welchen Bedingungen werden Vibrationen damit thematisch? Bei Shelley Trower ist der Übergang von einer mechanischen zu einer elektromagnetischen Welt und die mit diesem zusammenspielenden Medien wie Radio und Telefon (Trower 2008: 134) Teil einer solchen Bedingung. Diese Technologien, aber auch die Wissenschaft des 19. Jahrhunderts „produced new forms of vibration [...]“ (Trower 2008). Elektronische Klangverstärkung ist eine weitere Technologie, die neue Vibrationen hervorbringt.]

Tactility is the mode in which sound can be experienced by humans as vibration – different from the electromagnetic field ("light") which does not mechanically enact pressure.

The English noun "sound", in German, splits into two different notions: a) *Schall* which is the physical acoustic air pressure which can be perceived by the human ear and hearing; b) *Klang* which names the periodic, harmonic sonic events.

[Taken at face value, sound is "mechanical disturbance from a state of equilibrium that propagates through an elastic material medium"²¹. But German language differentiates between *Schall*, *Klang*, *Ton*. In English, the semantics of "sound" embraces all this trinity.]

Sound excludes noise by definition – but noise is integral to communication theory. Sound therefore is too limited in its epistemological scope. The notion of "sonicity" includes noise as the stochastic alternative

19 Goodman 2010: 82

20 Trower 2012: 2

21 Encyclopaedia Britannica, 2003

to music in Iannis Xenakis' sense and in terms of electronic music: subtractive sound synthesis creates "order from noise", filtering frequency bands,

like the Indian concept of an all-encompassing "drone" ambience which is continually present throughout and from which music can be extracted - different from the traditional Occidental additive notion of sound from single harmonic proportions or waves.

Additive music builds sonic events up synthetically, with its base being silence, whereas the subtractive musical concept actually begins from sound. Here, all the notes and possible notes to be played are present before the musicians even start playing.²²

Sonicity refers to the specific temporal knowledge which is implicit within sonic instruments of analysis and synthesis²³ on the one hand, and to graphically or mathematically derived sound on the other.²⁴ This even extends to the concept of non-struck sound like the theoretical fiction of vibrational forces called "ether".²⁵

At that point, the semantic associations of "sonicity" might start to get misleading. In 19th century discussions on the nature of electro-magnetic phenomena, acoustic terms have been borrowed, e. g. Maxwell's notion

22 See Bill Viola, *The Sound of One-Line Scanning*, in: xxx 1990, 44

23 In that sense, John Durham Peters writes of "sonic revelations" of the vibrational qualities of the human eardrum by Hermann von Helmholtz' artefactual resonators (Resonatoren): Helmholtz, Edison, and Sound History, in: Lauren Rabinovitz / Abraham Geil (eds.), *Memory Bytes. History, Technology, and Digital Culture*, Durham / London (Duke University Press) 2004, 177-298 (185)

24 Derivation is meant here in its sense of mathematical differentiation as well where the derivative of a sinusoidal function describes its rate of change near a chosen input value. On the close ties between mathematical abstraction and phonocentricity in early Indian science see Moebus / Wilke 2011, 227

25 The term "sonality" has been proposed to name such concepts: see Oliver Moebus / Annette Wilke, *Sound and Communication. An aesthetic cultural history of Sanskrit Hinduism*, Berlin / New York (de Gruyter) 2011, 12 and 705

of the "electrotonic state"²⁶. It had been Christiaan Huyghens' "undulation theory" which equalled light to acoustic waves, resulting in the literally "media"-theoretical fiction of an ether.²⁷ But the equation of electro-magnetic "waves" with elastic mechanical vibrations is just a heuristic model to gain metaphorical evidence (*Anschaulichkeit*) of an otherwise directly imperceptible event.²⁸ Maxwell cautions on the (otherwise useful) analogy between light and the vibrations of an elastic medium.

["so müssen wir doch dessen eingedenk bleiben, dass sie nur auf einer formalen Aehnlichkeit zwischen den Gesetzen der Lichterscheinungen und denen der elastischen Schwingungen beruht."²⁹]

From bodily sound ... to the all-embracing sonic?

The epistemological challenge is in the cultural dilemma of articulated sound (be it oral poetry, spoken language or music). On the one hand sound is very material (physical air pressure which hits, even violates the human ear); the Berlin Club Transmediale (CTM) 2015 festival theme *Un Tune* therefore has been exploring sonic articulations in terms of direct bodily effects and other sensory stimuli.³⁰

This shifts the focus from the symbolic and cultural semantics of music to questions of physical sonaffective forces. Sound moves in between musical meaning ("what does it attempt to portray?") and media communication ("what effects do sound and frequencies have upon us?").

26 "Elektrotonischer Zustand", in: James Clerk Maxwell, *Ueber physikalische Kraftlinien* [= Ostwalds Klassiker vol. 69], 5

27 Criticized by Albert Einstein, *Äther und Relativitätstheorie*, Berlin (Julius Springer) 1920, esp. 9f

28 Josef Maria Eder, *Photochemie (die chemischen Wirkungen des Lichts)*, Hallen (Wilhelm Knapp) 1906, 11

29 James Clerk Maxwell, *Ueber Faraday's Kraftlinien*, ed. L. Boltzmann, Leipzig (Akadem. Verl.-Ges.) 1898, 5 [Reprint 1995]

30 See <http://www.ctm-festival.de/festival-2015/theme>

"Sound matters. It mediates between the real and the virtual, connects the physical reality of acoustics with the mental reality of the muses."³¹

But even if the affective potential of sound is clearly a focal point, "yet it constitutes only one aspect of an investigation into the distribution, modulation, and perception of frequencies"³².

Let us therefore liberate sonicity from sound. With the traditional distinctions between noise, sound, and music being increasingly blurred in artistic practice, "the concept of 'the sonic' <...> as an overall category <...> transgresses the limits of the musical and the acoustic"³³ and opens into "the spectrum between bio-acoustical field recordings, brainwave entrainment, binaural beats, biofeedback, psychoacoustics, noise, and sub-bass vibrations"³⁴. Such vibrations are delicately moved matter.

Material sound versus electro-magnetic sonicity

Even if sound is - to human perception - the most immaterial matter, still it is different from the electro-magnetic waves which touch the human eye as really immaterial "light". Sergei Eisenstein was wrong when he asked "to remove the barriers between sight and sound"³⁵. In terms of harmonic relationships there might be a symmetry between the visual and the auditive, but in terms of (electro-)physics there is an epistemological asymmetry between mechanical, violent vibrations and electro-magnetic "waves". Optophonic "listening" to the "sound" of visual patterns by sonification rather obscures this fundamental difference.

31 Martin Carlé / Anastasia Georgaki, Re-configuring Ancient Greek Music Theory through Technology. An adaptive electronic tuning system on a reconstructed ancient Greek barbiton, in: Michèle Castellengo / Hugues Genevois (Hg.), *La musique et ses instruments / Music and its instruments*, Sampzon (Éditions Delatour France) 2013, 333-380 (335)

32 CTM 2015 theme

33 CTM 2015 theme

34 CTM 2015 theme

35 Sergei Eisenstein, *the Film Sense*, New York 1969, 87

Sound & matter versus the electronic audio signal

All kind of "waves" are a form of energy transfer without physical transport. Still there is a radical difference between mechanical and electro-magnetic waves.

<siehe MEDZEIT-WS-15; Zitate Hans Kleffe, Der gefangene Schall, Kinderbuchverlag Berlin (DDR), 1983, 16>

Acoustic vibrations are among the most immaterial articulations of materiality.

Not only can physical matter can be forced to vibrate, but - as pointed out by Henri Bergson - matter itself consists of vibrations, that is: implicit sound.³⁶

Matter thus resolves "into numberless vibrations, all linked together in uninterrupted continuity, all bound up with each other, and travelling in every direction like shivers through an immense body"³⁷.

But "sound" relates to "matter" only in the acoustic sense of mechanical vibrations. The oscillations of the electro-magnetic field are a different kind of sound. Let us therefore undo the tight sound/matter coupling, in favor of a more processual, time-critical notion of sound as signal event.

When propagated in a physical medium channel like air or water, sound is the most ephemeral form of matter; itself it has no solid materiality but is matter unfolding in time. Matter here becomes a temporeality, like an analog electronic image which the video artist Bill Viola once described as "The Sound of one-line Scanning".

"Phonovision" was the name given to gramophone records as storage medium of the earliest electro-mechanical Baird-Television picture series.

[Appropriately, a conference on the preservation of early video art at the Ludwig Forum in Aachen (24. / 25. September, 2015) has been called *Video Matters*.]

- When physically propagated sound is being technically transduced, this is not simply a linear translation, but it changes its essence from sound to signal. Within a telephone line, or when stored as magnetic charges on

³⁶As emphasized in the Mauricio Lazzarato, Video Philosophie, Berlin (b-books) 2xxx

³⁷ Henri Bergson, Matter and Memory, London (George Allen & Unwin) 1950, 276

tape, a media-epistemological "transsubstantiation"³⁸ of sound has happened, since as such the audio event becomes accessible to signal processing.

The so-called audio signal, beyond its possible origin in the physical world, may have come into existence by electronic generation exclusively - in electro-technical *autopoiesis*.

The real essence of sound such as in Electronic Dance Music or Drum and Base is not primarily bodies but electrons in periodic motion. As (still) human composition or mix or mastering, it is still *musical*, while the *sound* itself has been de-corporalized completely, neither be connected to a human performer or voice nor to a mechanical instrument any longer. What started with the electronic live recording and studio editing, now has become the message of the electronic and algorithmic (that is, techno-logical) medium itself.

A primary difference between the Paris studio of *musique concrète* (Pierre Schaeffer) and the Cologne WDR radio of Electronic Music (created by Herbert von Einem) is not simply an aesthetic but a media-epistemological one: Recording and manipulation of originally physical sound *versus* electronic sound generated by tone oscillators from the beginning, in pure sonicity.

<siehe § "Paris (Schaeffer) vs. Cologne (Stockhausen): Body-performative electro-mechanical kinetics vs. circuitry-operative electronics", in: SOUND-MATTERS>

Only in electronics, the almost pure sine wave as elementary unit exists (which fascinated young Stockhausen).³⁹ In its physically impossible form, the *ideal* sine wave has a technological existence indeed: within the digital computer as mathematical function expressed in executable code.

38 According to the Catholic liturgy, the substance, or reality, of the Eucharistic offering (either bread alone, or bread and wine) is changed into both the Body and Blood of Christ. Thereby the presence of Christ exists in transubstantiated bread, even in small fragments, and transubstantiated wine, even in a single drop. See the entry "Transsubstantiation" in the *online* encyclopedia Wikipedia: <https://en.wikipedia.org/w/index.php?title=Transsubstantiation&oldid=696228320>; page status: 21 December 2015

39 See Tilman Baumgärtel, *Geschichte und Ästhetik des Loops*, demnächst Berlin (Kulturverlag Kadmos) 2015

Beyond the physical world of mechanical vibrations, the sonic articulation, on the electronic level, exists as signal only. In reverse, electrons - the essential elements of electronic media - are themselves accompanied by waves. Erwin Schrödinger intuitively recalled the oscillating monochord and thereby defined implicit sonicity:

[but as an "image" in Heinrich Hertz' sense of "denknotwendige Bilder"; Zitat xxx>

"Suppose the electron in the hydrogen atom is analogous to a string - tied at both ends - in a musical instrument. Such a string emits a very definite tone together with its overtones, but not the wavelenghts in between. With this idea in mind, Schrödinger <...> set up a wave equation for the electron"⁴⁰

- which is the only true "radio", as radiation.

Techno-logical understanding instead of human hearing

Hearing is based on the very touch of sonic waves; therefore the acoustic dimension of media may seem as the very extreme of tactility - an 'audio-tactile' space that McLuhan conceived as defining mode of media culture (McLuhan 1962).

In this space there is no fundamental distant view as in vision. The temporal equivalent to the audio-visual "proximity" or "tactile" is "immediacy".

All changes when sound becomes transduced into an electric signal and thereby modulates a radio high frequency carrier band. Electro-magnetic waves do not mechanically touch the human ear. All the sound is there but unhearable: the implicit sonicity of electromagnetic vibrations, closer to light (especially in Ultra Short Wave radio transmission).

That is why Claude Shannon, in his notorious diagram of communication engineering, makes a difference between the technical reception and the final "understanding" of a received message. The ear becomes an electronic receiver

40 Steve J. Heims, John von Neumann and Norbert Wiener. From Mathematics to the Technologies of Life and Death, Cambridge, Mass. / London (MIT) 1980, 103

[Zwicker: "Nachrichtenempfänger"]

with the brain being the final destination.

But the electro-magnetic event is not material any more but an epistemological challenge to re-think sound-as-matter. It can only be phenomenologically observed by its effects or needs mathematically to be diagrammaticized (Maxwell's equations).

[Differentiating sound and music]

De-materialization? Digitalized "sound"

Sonic events (from noise to music) are not perceived by the human ear alone. Technological analysis not only provided the means with which to better understand bodily and neuronal affects; they have a sonic understanding themselves.

But when sound carriers changed from technically extended writing (such as analog phonography) to calculation (in digital computing), this was not just another version of its materialities, but a conceptual change.

Since "Music" as cultural art form, in Western tradition, does not belong to the sonic realm, since it is primarily conceptual, from there stems its affinity to early computer music such as Lejaren Hiller's Illiac Suite composition.

[Eine Kombination aus LP und Buch, ediert 1984 von der IBM Deutschland: Computer-Musik, mit dem schönen Untertitel (Text von Heinz Josef Herbort): "Vertonung im Zeitalter der Prozeßrechner"]

Once the analog audio signal becomes digitized, the term "signal processing" becomes fully justified in terms of computing. Coded in binary values, the signal within computing devices shall not be called "audio" any more, even if it can - by digital-to-analog conversion - be emitted via loud-speaker for human ears as sound again. What phenomenologically appears like sound has inbetween (in the techno-logical media channel) gone through a complete substantiation.

In digital media, we have lost "sound".

The gap between the material recording of a sonic event and informational ephemerality principally started with the first coded inscription already: the alphabet. The binary code is the smallest possible of such alphabets, and its advantage stems from its distinctive signal-to-noise ratio in signal transmission and signal storage.

<see Pierce / Shannon, Philosophy of PCM>

Friedrich Kittler, in his writings on the entanglement of music & mathematics, reminds that one and the same alphabet has been used to notate verbal language, music and mathematics - a "unicode" which unexpectedly returned as alphanumeric notation with the digital computer. This recursion can not be described in terms of cultural history any more but calls for a different diagram of cultural timing.

Digitized signals at first sight resemble the tradition of music notation (the score), but in addition, they are endowed with operational activity: they are algorithmically executable. Symbolic archival permanence is almost time-invariant, sublated from change with time, leading to ahistorical immediacy in the moment of replay.

We are not tuning into the past any more in sonic temporality.