BETWEEN PHYSICS AND INFORMATION: AUDIO RECORDINGS FROM THE PAST AND THEIR TEMPOR(E)ALITIES

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Technical recording vs. symbolic transcription

Since the invention of the phon(aut)ograph, the analogue audio-recording media have built up a signal-based memory of sound alternative to the symbol-based archive of musical notation. A collection of wax cylinders or gramophone records is rather a "counter-archive"[1] of sonic memory in the sense of Henri Bergson's and Edmund Husserl's emphasis on the human form of temporal experience as affective rather than clock-like integration. Signal-based records constitute a different kind of memory than the alphabetical scores which constitute the traditional "audio" archive.

Long time ago, an early Greek adaptor added single symbols for vowels to the known Phoenician alphabet for the purpose of making not only the rough content but the very musicality of oral poetry explicitely recordable. But even this advanced notation inspired by the Muses is still symbolic, like the score transcriptions which Béla Bartók provided for Milman Parry's recordings of songs by Yugoslav singers of tales on aluminium disc. What these discs were able to record, though, was not only oral poetry itself but the non-musical articulations as well, a surplus. Bartok himself comments:

There are many "conversations" in addition to the songs incorporated in the recording, talks between collector and singer concerning data connected with the song, with the singer, with the circumstances referring to the performance of the song, etc. When you listen to these "conversations" you really have the feeling of being on the spot <...>.[2]

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[1] See Paula Amad, Counter-Archive. Film, the Everyday, and Albert Kahn's Archives des la Planète, New York / Chichester (Columbia University Press) 2010, 153. The phonographic equivalent of Kahn's cinematographic project have been the Archives de la Parole, foundet by the linguist Ferdinand Brunot in 1911 at Sorbonne University, Paris

[2] Béla Bartók, Parry Collection of Yugoslav Folk Music. Eminent Composer, Who Is Working on It, Discusses Its Significance, in: The New York Times, June 28, 1942

This acoustic supplement extends even to non-intentional, non-semantic evidence, such as noise or bird-singing in the background or the singer's coffing during performance - information which might be important for a realistic interpretation of the circumstantial conditions of oral poetry.

Thus acoustic media both keep and reveal a *mémoire involontaire* of past acoustics which was never intended for tradition - a noisy memory, unaccessable for symbolic notation in the traditional sense.[3]

Different from transcritpions into scores, technical signal-recording of musical articulation allows for the electro-physical measuring of recorded events by "sampling". This enables a non-hermeneutic analysis of cultural articulation on the sub-philological, sub-alphabetic level.

Entropical and negentropical sound memory

Inspired by Ernst Kantorowicz's study on *The King's two Bodies*, we become aware that analogue recording media consist of two bodies as well. There are two complementary approaches to the conservation of analogue audio carriers. The one cares for preserving the physical, especially chemical and electro-magnetic properties of the concrete media body - since all media technologies are hardware in the first place. The other, sometimes opposing approach is to preserve media-based memory as information, up to the extreme point of view that the material body might be abolished after its essential transcription into its pure binary information units. "We no longer collect the carriers, clay tablets, books or floppies, just the information."[4] But to which degree does the archival authority of an audio record still depend in its material physical embodiment? Is it no longer important by which carrier one generation passes on its information to the next?

Soon after the emergence of photography as the oldest analogue signal-based medium in the technical sense, in 1859 Oliver Wendell Holmes pointed out the symbolic trade between information and materiality:

From now on, form is separated from material. In fact, the material in visible objects is no longer of great use, except when being used as a model from which the form is constituted. Give us a couple of negatives of an object worth seeing ... that's all we need. Then tear the object down or set it on fire if you will ...

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[3] On notational systems see Nelson Goodman, Languages of Art. An Approach to a Theory of Symbols, Indianapolis (Hackett) 2nd ed. 1976

[4] Tjebbe van Tijen, We no longer collect the Carrier but the Information, interviewed by Geert Lovink, in: MediaMatic 8 No 1/1994; translation: Jim Boekbinder

the result of this development will be <...> a massive collection of forms that <...> will have to be <...> placed in great libraries.[5]

Indeed, once the mechanically engraved sonic signals on material carrier (phonograph) or magnetically embedded (magnetophon) has been transformed into binary code, it can be (virtually lossless) "migrated" from one computing system to another.

Archival endurance in preserving the sonic heritage thus is not achieved in the traditional way any more (which used to be monumental fixation), but requires repetitive dynamic refreshing. In the early days of digital computing technological storage devices like the mercury delay line and the Williams Tube resembled the human memory mechanism in its predominantly "regenerative" character "between the passing and the repetitive"[6]. From this derives a fundamental change in the philosophy of how to secure media-archival data for future use: "If our machines' memories are more permanent, it is because they are constantly refreshed so that their ephemerality endures" <Chun 2007>.

In fact this repetition of the identical differs from the variable mechanism of oral tradition already, such as Homer's epics across the "dark" centuries without writing.[7] Bartok further comments on occasion of his transcriptions of phonographic recordings:

Folk-songs are a living material; and <..> subject to perpetual changes, preserving constancy only of certain general formulae. <...> the same poem has been recorded from different singers, in order to show what are the <...> traits depending on the individual singers, and what are the permanent ones, beyond the personality of the singer. <Bartok op. cit.>.

Material media are marked by their individual degree entropy and characteristic probabilities of physical endurance. The *Eigenzeit* of physical media differs from the software-based media by embodying fundamentally different temporal regimes. Bartók optimistically commented the media memory conditions of the phonographic recordings of oral poetry made by Parry:

The records are mechanically fairly good <...> . Aluminum disks were used; this material is very durable so that one may play back the records heaven knows how often, without the slightest deterioration. Sometimes the tracks are too shallow, but copies can be made in almost limitless numbers.

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[5] Quoted from: Wolfgang Kemp, Theorie der Fotografie I (1839–1912), Munich 1980, p. 121

[6] Abstract of the paper given by Wendy Hui Kyong Chun, The Enduring Ephemeral, or the Future is a Memory, to panel 6: Media Theory in Cultural Practice, *re:place 2007. The Second International Conference on the Histories of Media, Art, Science and Technology,* November 15th to 18th, Berlin (Haus der Kulturen der Welt) 2007

[7] See Astrid Erll, Odysseus' Reisen. Remediation und transkulturelle Erinnerung, in: Sonja Klein / Vivian Liska / Karl Solibakke / Bernd Witte (eds), Gedächtnisstrategien und Medien im interkulturellen Dialog, Würzburg (Königshausen & Neumann) 2011, 125-143

But physical recording media are subject to macro-temporal entropy - known as the chemical deteriorisation of Edison cylinders and magnetic tapes. Digitized signals at first sight resemble the tradition of music notation, but are endowed with operational activity; they are algorithmically executable. Symbolic techno-archival permanence is almost time-invariant, sublated from change, leading to ahistorical immediacy in the moment of re-play.

Phonography *versus* magnetophon: Electronics makes a difference

In May 2011 two Black Boxes could finally be rescued from the ground of the Atlantic sea two years after the Air France aeroplane crash: the data recorder and the voice recorder keeping the last words of the pilots in the cockpit but as well the background noises which retrospectively signal the unfolding desaster. The recordings proved to be miraculously intact. Both data recorders consist of memory chips which keep their magnetic charge, different from mechanically vulnerable previous recording media. Whereas mechanical records still represent the culturally familiar form of physical impression (writing), electro-magnetic latency is a different, sublime, uncanny form of insivible, non-haptic memory. The voices and sounds emanating from such a black box are radically bodiless, generating a different temporality than the familiar historio-graphical time.

Sound recording does not simply unfold as evolutionary course of technology in history, but the phonographic record on the on hand, the magnetic record on tape on the other, and finally the digital recording represent fundamentally different materialities and logics (literally techo/logy) in terms of their ways of registering time-variant signals, time-based forms of reproduction and their "archival" being in time. The electronic tube, especially the triode, once liberated technical media from mechanical constrains, thus: from erasure over time; still the tube or transistor are subject to decay over time themselves.[8] Negentropic persistence against entropic time[9] ows its ahistoricity rather to its different form of registering the physically real acoustic event not by signals, but by binary symbols.

The difference between mechanical and electro-magnetic audio recording is not just a technical, but as well an epistemological one. While the phonograph belongs to what Jules-Étienne Marey once called the "graphical method" (analog registering of signals by

[8] "Magnetophon und tönendes Buch [sc. Schallfilm] zeigen - im Gegensatz zur akustisch-mechanischen Schallaufzeichnung - keine mechanische Beanspruchung und Abnutzung des Werkstoffes. <...> Ein nicht unwesentlicher Gesichtspunkt ist schließlich die archivalische Eignung, die Zeitbeständigkeit der Phonogramme. <..> Am Schlechtesten schneiden abermals die Edison-Phonographen ab: weder Walzen noch Matrizen sind so dauernd und zeitbeständig, wie man es von einem archivalischen Quellenstoff erwarten muß." <Ibid.>

[9] Entropy in the second law of thermodynamics (Ludwig Boltzmann) states that the energy circulation of any closed system tends to an uniform equilibrium. In technomathematical communication theory (Claude Shannon), the term has been reversed to measure the degree of information.

curves), the magnetophone is based upon the electro-magnetic field which represents a completely different type of recording, in fact a true "medium". What used to be transitive, invasive writing into a storage medium like the wax cylinder has been substituted by the electro-magnetic field, but writing nowadays re-turns as digital encoding in different qualities. Sampling and quantizing of acoustic signals transforms the time signal into frequencies as analysis and as a condition for re-synthesis (Fourier analysis and synthesis). The Technical Committee of the IASA in its standard recommendations from December 2005 points out that digitization of analogue sound carriers from the past does not necessarily mean a loss of information about the signal, but can in fact grasp the physical signal as information much more precisely than former analog recording where non-linear distortions of the signal in the process of technological transcription frequently take place. The Nyquist / Shannon theoreme already fixes that with a sufficient sampling rate the original signal can be truly reconstructed; for archival needs a radical over-sampling up to 192 kHz does not just keep the blunt sound information, but the memory of noise (scratches) as well.[10] Nevertheless, digitalization means a radical transformation in the ontology of the sound record - from the physical signal to a matrix (chart, list) of its numerical values. Media culture thus turns from phonocentrism to mathematics.

A counter-archive? Acoustic archaeology

Let us distinctively differentiate between the so-called "social" respectively "collective memory" of sonic events and the actual media recording of sonic articulation from the past. For an archaeology of the acoustic in cultural memory the human auditory sense does not suffice. Let us, therefore, track the sonic trace with the genuine tools of technical media. One such way of "acoustic archaeology" is to play a musical partition on historic instruments. But the real archaeologists in audio archaeology are the media themselves - not mass media (the media of broadcasting), but measuring devices which are able to de-cipher physically real signals and to represent them in forms alternative to alphabetic writing, resulting in sinusoidal articulations in time, operative diagrams such as being indicated by the oscilloscope.

Media-active archaeology can be applied to past sound, generating a different kind of audio-archive.

When listening to "ancient" recordings from Edison wax cylinders, nowadays being restored with technomathematical software as digital re-production of sound, we might ask with Michel Foucault (in a slightly different context[11]): message or noise?

Today, opto-digital reading of early Edison cylinders allows for

[10] See http://www.iasa-web.org/IASA TC03/ IASATC03.pdf

[11] Michel Foucault, Message ou bruit? [*1966], in: same author., Dits et Écrits I, Paris 1994, 557-560

listenting again to otherwise unaccessible sound recording; the opto-digital *close reading* of sound as image, though, dissolves any meaningful unit into discrete blocks, which are accessible for human analysis only by operative techno-mathematical diagrams. This is a truly analytic, media-archaeological form of deciphering the sound of the past.

In addition, though, it requires an open, media-archaeologically tuned ear to make knowledgable use of that option as an alternative to the cultural emphasis on musical semantics. To the media-archaeologically sharpened mind, sonic articulation visible on a computer screen will never be confused with a "live" sound since such a mind is conscious of the algorithms of which such an animation is a technomathematical, processual function.

At that point, the archival operation extends from restauration and conservation to re-animation and thus becomes a true media-archaeological operation. In a novel called *Time Shards*, the science fiction author Gregory Benford imagines a research laboratory which reconstructs "fossil voices" out of the grooves of mediaeval pottery.

In media-active archaeology, the technological apparatus itself turns out to be the archaologist proper. Patrick Feaster and David Giovannoni succeeded in re-sonifying phonautographic diagrams preserved from pre-Edision times, beginning with Léon-Scott's recording of a sound folk tone of 435 Hz in the year 1859. This self-referential (and auto-poietic) memory of sound technology itself is as worth to be preserved for eternity as any other more articulate cultural sound (the ethno-musical sources). With a dela of 150 years science fianlly realized that with optical "reading" of such acoustic signal lines sound can be algorithmically re-synthesized, and all of the sudden the children's song "Au clair de la lune, Pierrot répondit" (recorded by Lèon-Scott on April 8, 1860 in Paris) resounds again.[12]

What has been metaphorically described as the pick-up of sound images by a "virtual, digital gramophone needle"[13], in fact is something media-epistemologically different, a picking-up of a completely new kind: digital sampling.

Let us recall the primary scene of sonic media memory. Almost immediately after its invention, the Edison phonograph was announced in the journal *Scientific American*. It obviously

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[12] Hear http://www.firstsounds.org/sounds/1860-Scott-Au-Claire-de-la-Lune-09-08.mp3

[13] Harald Haack, Die erste Klangaufzeichnung. Eine Audiografie, *online* http://newsbattery.blogsport.de/2008/05/07/die-erste-klangaufzeichnung-eine-audiografie

triggered phono-archival phantasms (in the Romantic tradition of the historian of the French Revolution Jules Michelet, who in early Nineteenth century believed to hear the murmurs of the dead in the archives):

That the voices of those who departed before the invention of the wonderful apparatus <...> are for ever stilled is too obvious a truth; but whoever has spoken or whoever may speak into the mouthpiece of the phonograph, and whose words are recorded by it, has the assurance that his speech may be reproduced audibly in his own tones long after he himself has turned to dust. <...> A strip of indented paper travels through a little machine, the sounds of the latter are magnified, and our great grandchildren or posterity centuries hence hear us as plainly as if we were present.[14]

Natural language is evasive, liquid, in itself unrecordable beyond the bodily range, but technical media (different from alphabetic phonetic writing which "freezes" the human voice into a range of a very limited symbolic code) are able to de-freeze recorded voices in almost all frequencies by re-play. After two millennia of supremacy of the phonetic alphabet there are new kinds of cultural technology in sound recording.

There is a record in the Vienna Phonograph Archive of emperor Franz Joseph I of Austria-Hungary written deep into the wax cylinder (a recording from Bad Ischl, 2nd August 1903). At this point, you probably expect me to play this recording. There is a reason why I don´t, since I want to prove that sound recording has already developed a true media memory which differs from the remembrance of its content. The experiment is very simple: Please imagine yourself the phonographic recording of His Majesty´s voice. I am sure that whatever you think the timbre of his voice sounds, you will acoustically hallucinate as well the scratching, the noise of the recording apparatus.

True media archaeology starts here: The phonograph as media artefact does not only preserve the memory of cultural semantics but stores ist own past *technical* knowledge as well, a kind of frozen media memory embodied in engineering and waiting to be listened to by media-archaeologically tuned ears.

Let us get one step further with our experiment, and I´ll quote emperor Franz Joseph´s actual statement. Significantly, this statement - which is one of the first voice recordings preserved at all - tuns out to be the pure message of the medium. When a new technical medium emerges humans are very aware of its technicality (which afterwards, when it becomes mass media, tends to be forgotten in favor of so-called "content"). The emperor expresses his joy to literally "incorporate" his voice into the Vienna

[14] Anon. (The Editor), A Wonderful Invention - Speech Capable of Indefinite Repitition from Automatic Records, in: Scientific American, November 17, 1877, 304. See chapter 6 "A Resonant Tomb", in: Jonathan Sterne, The Audible Past. Cultural Origins of Sound Reproduction, Durham / London (Duke University Press) 2003, 287-334 (297f)

phonograph archive.[15] Indeed we are able, today, to listen to human voices which exterminated hundred years ago, by applying laser reading of the wax cylinders which do not destroy its source in the act of re-play. But once more, what we hear is not only the message (the emperor's enunciation) biut as well noise (the phonographic scratch). That is what the medium tells us. The noise of the wax cylinder itself which the record articulates whenever it is being re-played is not discursive (cultural) but media-archaeological information of the physically real event. Let us listen to this attentively and not exclude it hermeutically like in the proverbial Cocktail party effect of auditory communication between humans.

With the micro-physical *close reading* of sound, the materiality of the recording medium itself becomes archivally productive. Complementary to musicological hermeneutics the media-archaeological ear listens to the poietics of signals.

Different from passive symbolic writing systems like the phonetic alphabet which still require the human mind and imagination to become "alive", the power of signal-based technical media lies in their ability to actively (re-)create real presence. Let us quote once more from Bartók's comment on his transcriptions of recordings of Yugoslav oral poetry from the 1930s: "It gives you a thrilling impression of liveliness, of life itself" <op. cit.>.

On the contrary, the media archaeologist, without passion, does not hallucinate life when he listens to recorded voices; the media archaeological exercise is to be aware at each given moment that we are dealing with technical media, not humans, that we are not speaking with the dead but operative recording keeps sound un-dead.

Media as active archaeologists

All of the sudden, audio recordings are not just archival objects any more, but media decoders become active archaeologists of past sounds themselves.

The frozen voices on the analogue, vulnerable storage medium of wax cylinders are currently being de-freezed by digital means. The Berlin Society for Applied Informatics has developed a method to gain acoustic signals from negative traces of galvano-copies from Edison-cylinders by opto-endoscopic „reading" - scanning visual information into sound.[16] Making stored acoustic waves actually sound does not demand rhetoric imagination but on the contrary a hermeneutically distant ear, an exteriority of interpretation

[15] "Es hat mit sehr gefreut, auf Wunsch der Akademie der Wissenschaften meine Stimme in den Apparat hineinzusprechen und dieselbe dadurch der Sammlung einzuverleiben."

[16] See Gerd Stanke / Thomas Kessler, in: Artur Simon (ed.), Das Berliner Phonogramm-Archiv 1900-2000. Sammlungen der traditionellen Musik der Welt, Berlin (VWB) 2000, 209-215

which only the *aisthesis* of the opto-technical scanner can provide.[17] Technical media provide a different option of reading: listening without (premature) understanding. The archaeological ear tries to mimick this ascetic confrontation of signals, resisting the narrative temptations.

With the media mystery of the recordability of the physically real of sound and images, humans get a multi-media mirror effect (in Lacan´s sense), sublating the clear-cut difference between presence and absence, present and past. Strange enough, we are able, today, to listen to music-ethnographical play-backs in almost exactly the same quality as the natives once could in the past. Only the media-archaeological operation of opto-digitally reading the inscribed traces makes the otherwise unaccessible sound recording audible again. Synesthetically, we can *see* a spectrographic image of sound memory - a straight look into the archive.[18]

New options of sound retrieval

The notion of the sound archive is in transition. As long as there have been symbolical, score-based archives only, the phantasma of recording the acoustically real (predominantly the human voice) has generated imaginary forms of memorizing sound in supplementary ways.

Re-animation has for long time been *re-reading* - a historians´ syndrom.[19] Stephen Greenblatt once openly declared his *new historicist* impulse: "I began with the desire to speak with the dead."[20] This prosopopoietic desire takes place even against the better knowledge that every dialogue with the past only echoes one´s own voice. The textual *gramophone* (written letters) inevitably belongs to the realm of the symbolic which is the order of the archive, different from the immediacy of the real physically indexial trace (rays of light on photography or tracks of sound on recording media). These new kind of technical memories are archives or libraries no more.

With the emergence of the phonograph, this new type of records was still subjected to forms of inventorization and administration which were developed in the long-time context of paper-based archives.

With the necessity of digitizing phonographic records in order to preserve them against physical, media-archaeological entropy, a

[17] See Jeffrey Sconce, The voice from the void. Wireless, modernity and the distant dead, in: International journal of Cultural studies Vol. 1, no. 2 (1998), 211-232

[18] See the spectrogram of a digitally reconstructed recording of Wedda songs from Ceylon 1907 on http://www.gfai.de/projekte/spubito/index.htm

[19] For this metaphor of the historian´s task see Karl Lamprecht, Paralipomena der deutschen Geschichte, Vienna 1910, 4

[20] Stephen Greenblatt, Shakespearean Negotiations. The Circulation of Social Energy in Renaissance England, Berkeley 1988, 1

new epistemological option emerges which demands media-theoretical attention.

(Multi-)Media archaeology points out the discontinuities which arose with the invasion of audiovisual records in traditional archives, libaries and museums in the twentieth century, resulting in a rethinking of the options of retrieval under digital media conditions - transcending the notion of the archive itself by the technical and cultural application of stochastic order out of media-immanent signal disorder, that is: search operations such as similarity-based sound retrieval. Let us thus have the digitization of analog sound carriers from the past not just be a necessity in order to preserve endangered cultural heritage, but re-think this digitalized records in terms of aesthetic and cognitive options opened by the mathematicized sonosphere itself, liberated from the traditional archival metadata restrictions towards a truly media-immanent naviation within the sounds of the past.