

MICRO-DRAMATURGICAL TEMPORALITIES OF MEDIA THEATRE. On the difference between performative and operative reenactment in the performative arts and in the apparatus

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[Abstract]

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**[Abstract]**

This text confronts the study of *performative* arts with the analysis of the *operative* "media theatre" that dramatically unfolds *within* technologies and *inbetween* humans and machines.

Parallel to the long cultural tradition of performative arts with its temporal dialectics between the ephemeral and the lasting, runs the transmission of technological remains (audiovisual archives as well as hard- and software itself). Both modes of inheritance converge in the option of "reenactment", though in different ways; it takes flexible forms of access to media-cultural past.

With a focus on sonic signals, the argument unfolds both in media-archaeological perspective (the manual, "hands-on" experimentation of time with machines, with the case studies of reenacting past radio and the technical recording of oral poetry), and in an effort to derive epistemological insights from such practice, such as the appeal of "presence" from "historical" media (e. g. the "anatomy" of Friedrich Kittler's modular sound synthesizer, and so-called "Historical Performance Practice" applied to Electronic Music).

Finally, emergent new practices of technological reenactment for digital objects will be discussed, reaching from sonic "ghosts" in MP3 compression up to truly computer-archaeological *emulation* as new epistemic category generated in the epoche of digital culture. Media theatre is addressed both as operative *algorithmic reenactment* and media archaeological *reenactment of algorithms*.

## **Lasting signals, storage media remains**

Next to the *performative*, body-based arts (ancient Greek *mousiké techné*), in human culture a parallel world of *operative*, machine-based arts (literally *techné*) has emerged, whose scene of appearance is appropriately called "media theatre". Media theatre is not body-based theatre augmented by media technologies, but turns this perspective upside down: Media archaeology identifies the drama within the technological event itself.

The argument will be specified with respect to sound technologies: analog instruments like the ancient monochord, electro-acoustics like the analog synthesizer, and computer-based music with its possible emulation. In recording technologies, the remains and the remaining of the transitory (signals) are both material (hardware) and immaterial (magnetic latency). If *techné* and *ars* are not limited to human scenic arts but extend to operative media as well, a new kind of techno-cultural memory arises: the apparent oxymoron of an "enduring ephemeral", in the name of information, undoing material historicity. Transcendence of materiality and material ephemerality is a cultural effort well known from religious performance. With photographic inscription and its *punctum* (Roland Barthes), light itself became a „historiographical“ index, media-phenomenologically even transcending history by its affect of immediacy on the human temporal sense: preserving the past as present. But still this is not really immaterial but bound to a chemical storage medium. *Temporal* transcendence of materiality is a faculty of operative media technologies only. Once the signals which are chemically fixed (photography), mechanically engraved (phonograph) or magnetically embedded (magnetophon, videotape) on material carrier have been transformed into digital, immaterial information, they can be virtually lossless „migrated“ from one storage computing system to another. Permanence and archival endurance thus is not achieved in the traditional way any more (which has been monumental fixation, *stasis* so far), but by dynamic refreshing - the "enduring ephemeral"<sup>1</sup>.

## **Manual experimentation of time with machines**

"Operativity" is essential for the definition of technical media. If the cultural and discursive knowledge of technology is not limited to illustrations in texts and books, to distant observation in museums and to pure documentation in archives, there is a need for platforms where technical objects can be

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<sup>1</sup> Wendy Chun, *The Enduring Ephemeral, or The Future Is a Memory*, in: Erkki Huhtamo / Jussi Parikka (ed.), *Media Archaeology. Approaches, Applications, and Implications*, Berkeley / Los Angeles / London (University of California Press) 2011, 184-203

operated "hands on" in their primary materiality. Let us draw here an analogy between musical instruments and electronical media since both are "time-based" in their essential function. They come into being only as "time objects" (*Zeitobjekte* in Edmund Husserl's phenomenology). A primary scene of "hands on media" has been the experimental use of the one-string instrument as measuring device - the ancient *monochord* with which the Pythagorean calculation of harmonic sound ratios once started. Different from the historicism of cultural time where the knowledge system of one époque is clearly separated from its subsequent époques, the same physics of the oscillating string of a monochord appealed to the inquisitive ear equiprimordially for Pythagoras in ancient Greece and for Marin Mersenne in the early modern period. Admittedly the discursive horizon of knowledge is actually different; depending on the historical index, things resonate differently in humans and yield different concepts. However, the medium event is always one and the same; it constantly induces scientific or aesthetic curiosities, through which humans respond to technological relations in new variations.

Is cultural tradition diachronic by necessity?<sup>2</sup> Technological devices, as tight couplings and configurations of material knowledge, keep an inherent functional "system" memory which can be reactivated each time it is set in operation again. The monochord in fact allows for a sonic time-tunneling by short-cutting the apparent cultural-historical distance which separates the present from antiquity. If we consider the monochord as an operative medium, it becomes a way to demonstrate an alternative approach to get in touch with media-implicit knowledge from the past. The mathematical principles of even such simple techniques enable a tight coupling between the present and antiquity, establishing an operative circuitry. Whenever we lay hands on the monochord, we share at least a bit of that past knowledge that is actually not past when it sounds.<sup>3</sup> The best method to understand a medium is by its reengineering and its functional reenactment. Charles Sanders Peirce describes such *diagrammatic reasoning*: "Similar experiments performed upon any diagram constructed to the same precept would have the same result."<sup>4</sup> Thereby we share Pythagoras' sono-mathematical experience by operating the monochord with our hands today. Collingwood equally reminds of the endurance of Pythagoras' geometric discovery concerning the square on the hypotenuse. It is just that the present mind must be somewhat *tuned* in the right cognitive mood.<sup>5</sup> We are certainly not in the same historical, that is: contextual situation like

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2 See John Miles Foley, *Traditional Oral Epic. The Odyssey, Beowulf, and the Serbo-Croatian Return Song*, Berkeley / Los Angeles / Oxford (University of California Press) 1990, 3

3 See Vivian Sobchak, *Afterword: Media Archaeology and Re-presenting the Past*, in: Huhtamo / Parikka (eds.) 2011: 323-33

4 Charles Sanders Peirce, *Collected Papers*, vol. II: *Elements of Logic*, Cambridge, Mass. (Harvard UP) 1932, 350

5 R. G. Collingwood, *The Idea of History* [\*1946], rev. ed. Oxford et al. (Oxford University Press) 1993, 217f.

Pythagoras, since the ways of listening and the psycho-physical tuning are different. But with our audio-tactile organs (ears and fingers) "on" the monochord, we experience a time-machine in a different sense: It lets us co-originarily participate at the discovery of musicological knowledge. As has been argued in Martin Heidegger's *Time and Being* (and later resumed in Jacques Derrida's *Grammatology*), the repeatable is the original.<sup>6</sup>

In the Italian *renaissance* of knowledge from antiquity, Vincenzo Galilei performed a number of experiments to investigate the nature of musical harmonics<sup>7</sup> as a kind of media-based archaeology of the acoustic, employing the lute not as a musical instrument but as a piece of laboratory equipment. Once human hands are involved with experimentation time, the past can be reenacted. On the diagrammatical level, the reenactment is time-invariant; on the operative level of implementation, the materiality of the medium itself - even if it imposes certain vetoes due to the historicity of the instrument - the epistemological operation remains intact *in principle* (archaeologically). When a researcher set out to replicate Galilei's experiment using a lute built in the 17th century, the present condition of the instrument required the use of some substitutions for the materials originally used by Galilei in his experiment; "however, these did not affect the basis tenets of the experiment"<sup>8</sup>. In the processual event of the reenacted experiment one shares the same temporal field. Hermann von Helmholtz was sceptical about the possibilities to truly reenact a musical experience in the past; we are dependent on historical information indeed.<sup>9</sup> But media-archaeological experimentation (simulation as opposed to historicism) allows for access to the invariant elements of knowledge in time indeed.

In computational media, though, the sound of the archive is not activated by manual replay any more but by emulation with almost no human intervention. The software simulator of the archaic British EDSAC electronic computer (designed for museological reenactment) allows for an explicit "analogy between a computer program and a musical score - once described as 'frozen music'

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6 Martin Heidegger, *Sein und Zeit* [1927], 16th edition, Tübingen (Niemeyer) 1986, 385: "Die Wiederholung ist die ausdrückliche Überlieferung, das heißt der Rückgang in die Möglichkeiten des dagewesenen Daseins."

7 As described in: Vincenzo Galilei, *A Special Discourse Concerning the Unison*, trans. in Claude V. Palisca, *The Florentine Camerata. Documentary Studies and Translations*, New Haven / London (Yale University Press) 1988, 203-205

8 Claude V. Palisca, *Was Galileo's Father an Experimental Scientist?*, in: Paolo Gozza (ed.), *Number to Sound. The musical way to the scientific revolution*, Dordrecht / Boston / London (Kluwer) 2000, 191-199 (195)

9 Hermann von Helmholtz, *Die Lehre von den Tonempfindungen als physiologische Grundlage für die Theorie der Musik*, Braunschweig (Vieweg) 1863; reprint of the 6th edition (Braunschweig 1913): Hildesheim / Zürich / New York (Olms) 1983, 411

needing only an orchestra to melt it"<sup>10</sup>.

### **Reenacting radio**<sup>11</sup>

For apparently antiquated technologies, media-philological understanding requires an actual reenactment *of* and *by* the actual medium. If the essence of technical media lies in their implementation, then they are radically committed to operative temporality. The classical archaeological and historical method conceives of both intentionally and unintentionally recorded sources as tradition, including written sources, material remains, and abstract remains (institutions, infrastructures, etc.). But with the invention of modern technologies of recording events as signals, such as photography, film, and tape recordings, a new kind of remains is constituted: the age of non-symbolic technical reproducibility. This is where active archaeological reenactment comes literally into play, operated by technologies themselves, as genuine media theatre.

It is possible to *operatively* replicate and thus equiprimordially revive Ferdinand Braun's nineteenth-century crystal radio receiver in the present indeed, using commercially available electronic components. We can still follow Braun's design principles today, even though they were established more than a hundred years ago and engineering is now many developmental stages ahead.<sup>12</sup> In the moment of this radio reception, its history is itself sublated in the implementation of media. What is lost is not the techno-operative message but only the performative content of the radio medium. We know almost nothing about early radio culture in terms of its actual programs - at best fragmentary recordings by means of other media, such as optical sound tracks, wax discs, and audiotapes.

The performative (humanly produced) content of "radio" broadcasting from the past has been lost to large degrees. But McLuhan teaches to shift attention from the apparent semantic content of a medium to its true media-theatrical, operative message which is radio's technical articulation. To a certain degree, the infra-structure of radio technology (its apparatus, its broadcasting infra-structure) has remained intact over generations, in an almost time-invariant endurance. Its single electronic components like the vacuum tube have been techno-

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10 Martin Campbell-Kelly, *Past into Present: The EDSAC Simulator*, in: Raúl Rojas / Ulf Hashagen (eds.), *The First Computers. History and Architecture*, Cambridge, Mass./ London (MIT Press) 2000, 397-416 (399)

11 For the following arguments see W. E., *Chronopoetics. The temporal being and operativity of technological media (series Media Philosophy)*, translated by Anthony Enns, London / New York (Rowman & Littlefield) 2016

12 Wolfgang Schreier, *Die Entstehung der Funktechnik*, Munich (Deutsches Museum) 1995, 33

evolutionarily, but not functionally been replaced: by the transistor first, finally by semi-conductors in Integrated Circuits. Ancient radios equipped with electron tubes, like from the late 1930s, are in principle still ready to receive signals with a connection to electric current and a sufficient antenna cable. Unlike an authentic medieval document in an archive that reports news from a by-gone era, however, these radios do not broadcast programs from the late 1930s. This era was stable with regard to its technical infrastructure: a technological interval that on a principle level experienced no history, no transformation, but rather the persistence of Hertz's electromagnetic laws of radio. This era only now comes to a close through the reallocation of international broadcast frequencies in favor of digital broadband.

### **Guslari on wire**

Media archaeology is aware that media culture, when dealing with the past, is confronted with technological memory, not with humans; that we are not speaking with the dead but un-dead media still operate. Whereas the scripture-based classical archive is a static array of records on the grand scale and letters on the microscale, which can be activated only by the act of human reading line by line, the Edison phonograph is the first form of a truly "performative" archive in motion<sup>13</sup>, since its recording (notably the early ethnographic field recordings around 1900, leading to the Vienna Phonograph Archive and the Berlin Phonogramm Archive) is based on a rotating, technically moving apparatus both in recording and in re-play.

As opposed to an "archival" transcription of, for example, oral poetry by alphabetic or musical notation, its recording by phonograph or gramophone creates a presence in latency, a different temporality, since these sources can be re-played with equiprimordially: Repetition with difference on the macro-temporal time axis, but identical reproduction of its inherent temporal event, invariant towards "history". Bela Bartok once transcribed Yugoslav folk music of gramophone recordings (both from aluminium disc or later from electromagnetic wire recorder) in the Milman Parry Collection at Harvard University<sup>14</sup>, thereby translating the physically real articulation into the symbolical regime which increases "information" in terms of order and selection, but loses additional information like the individual intonation, the temporal subtleties and the accidents, the "noise" as the authentic trace of the unique performance event. We can listen even to the coughing when the *guslar* (singer) Avdo Medjedovic

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13 See Eivind Røssaak (Hg.), *The Archive in Motion. New Conceptions of the Archive in Contemporary Thought and New Media Practices*, Oslo (Novus) 2010

14 Bela Bartok, *Parry Collection of Yugoslav Folk Music*, New York (New York Times) 1942

starts to perform in one of the recordings.<sup>15</sup> Such coughing is phonographically registered as the interruption of the symbolic melodic order by the corpo/real - a memory which no alphabetic transcript or musical score can actually catch. Since the age of technical reproducibility of movement and sound, cultural memory has been liberated from restrictions to symbolical notation which leaves us with a bifurcated memory: the symbolical and the real. The coughing which interrupts the singer's performance actually corresponds with the cracks in the recording medium itself. Provided that there is still a player, the recordings can be originally replayed and decoded in completely new, variable ways. The acoustic event can be measured by oscillographical visualisation or spectral, techno-mathematical, non-cultural analysis.

In the Avdo Medjedovic movie - one of the first uses of sound film for ethno-musicological documentation indeed -, at 1:20 min. the sound recording abruptly ends in the middle of a verse line ("Ni bih ..." / "Nor would I ..."), while the sound of the recording rotating disc takes over rythmically: Now the medium speaks. A few seconds later (1:37), the visual filming abruptly breaks down as well. With that rupture, the real of the medium is at work, and physically breaks into the symbolic cultural scene. But when we watch or listen to such a record, an anthropological mis-reading happens: We tend to forget about the recording apparatus and concentrate on the body and voice of the singer, looking at him as if he was still alive, being touched by his performance which is in fact nothing but a technological re-play.

Let us contrast this emotional audiovisual record by focussing on such a recording as a technological event. We are being reminded constantly that there is no human voice but a machinic voice, in the sense of the transduction of body-based voices into a electronically reprocessed voice. The frequencies, even the timbre of the voice, miraculously, is still the same in both "media". The phonographic recording of Yugoslav *guslari* turns improvised oral poetry into a fixed inscription. But at second glance, the electromagnetic recording preserves a unique feature of the oral performance (different from its alphabetic, immobilizing transcription) which can be derived from how French language calls the recording device: *écriture magnétique*. Electromagnetic recording, by its very physical immateriality, only comes into existence as part of a dynamical process, the *inductive* act of re-play (writing different from printing). In his preface to Albert Lord's *The Singer of Tales* Harry Levin remarks: "The Word as spoken or sung, together with a visual image of the speaker or singer, has meanwhile been regaining its hold through electrical engineering."<sup>16</sup>

When around 1950, Parry's former assistant Lord returned to the

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<sup>15</sup> See and listen: <http://chs119.harvard.edu/mpc/gallery/avdo.html>

<sup>16</sup> Albert B. Lord, *The Singer of Tales*, Boston (Harvard University Press) 1960, xiii

scene to repeat some of Parry's first aluminium disc recordings with the same singers, in the meantime, technology had advanced: Lord used a magnetic recording device based on steel wire. The wire recorder is not a phonograph, which - as its very name still suggests - is part of the tradition of "writing" technologies; instead, the wire recorder registers sound in non-mechanical ways, in the dynamics of the electromagnetic field. Electromagnetic recording and reproduction is not a continuation of writing in a new form, but a different existence of "memory". When a singer is replayed in electronic form in "high fidelity", the technology itself seems to efface itself in a way which apparently lets the originality and individuality of the singer shine through the apparatus, as dead as he might biologically be. The cultural, human aspect is being expressed in the most un-human medium; the circle of vibrations and frequencies in technology and poetry is complete. Thus the coldest media archaeological device is the best way to memorize unique moments of human culture, such as oral poetry.

What oral poetry performs is actually close to the neurological mechanism of memory, assisted by the hexametric verse as mnemotechnique, combined with the archive in Foucault's sense, i. e.: a generative grammar. Even the same singer does not repeat the same epic when performed (time-shifted) next time. In "re-generation", the prefix "re-" refers to memory, and the "generative" refers to *l'archive*.

### **Flexible access to the audio-visual past**

With an extended notion of performance, we arrive at all kind of arts which use audio-visual recording media for storage. From this results an archival challenge. Let us refer again to the epistmeological notion of *archive* as expressed by Foucault: Which rules govern what can be expressed and remembered (that is: stored) at all? It not only human archivists any more, but in a higher degree than ever it is technologies on which the readability of such documents rely. The archival record has become an electromagnetic latency. Dynamic access needs a flexible tool which allows for the coexistence of different orders without destroying the structure (database). From the question of how to archivize performance results the performative archiv: forms of reenactment. Not only the target, but as well the very mediality of the archive has been extended. The answer lies in discovering and reflecting upon (and techno-mathematically realizing) new options of flexible access.

The archive thus gets in motion; the storage of kinetic objects results in new types of retrieval which are based on differentiation along the temporal axis. The archivization of audiovisual arts results in a performative archive where the message of the medium is no longer the alphabet. Dynamic access

replaces the static classification of the traditional catalogue, just like statistical probabilities have replaced particular knowledge in information theory, and pattern recognition replaces alphabetical identification towards open forms of adapting knowledge.

### **The Presence of "Historical" Media in Implementation**

Electronic media place the concept of the past itself in a new temporal field. In the "replay" of a sound recording from the twentieth century, the clear perceptual distinction between the archivally organized traces of the past and the documents of the present is replaced by the immediate presence of the signal event. The experience of listening to this recording is no longer an experience of distance, as it appeals to the ears in the present at the level of the signal. When a magnetic charge is converted back into sound by the tape recorder, the signal actually takes place in the present—from the perspective of both human listeners as well as the machine itself. A gap that is hardly reflected in the philosophy of history thus opens up between the senses, which immediately perceive such signals, and cognition, which is constantly aware of their "history." In 2008–2009, the Institute for Media archaeology in the Austrian town of Hainburg organized a museum exhibition of "Magical Sound Machines."<sup>17</sup> This exhibition featured historical audio media that could be brought into operation for a short time, which enabled an entirely different experience of frequencies and dynamics at the level of acoustic archaeology than the supporting documentation was able to convey in writing. It is only through their sonic implementation that archaic sound generators prove to be actual media; the presentation thus focused on the temporary reactivation of the apparatus (particularly in the commissioned compositions of contemporary composers), which shifted the museum's emphasis from historicization to realization. For the purpose of conservation, such electrotechnical artifacts cannot be repeatedly reactivated, but once the sound event is reproduced it can be digitally sampled so that it remains available in the future. The sonic information thus becomes timeless information, which is free of the materiality of a specific storage medium. This makes previous media history subject to ahistorical contingency.

### **Anatomy of Kittler's modular sound synthesizer and Historical Performance Practice in Electronic Music**

The past *is* present in its traces and is *made* present through reenacting its traces. For technological objects, the focus here is rather on operativity rather than *where* matter. Surprisingly,

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17 Institut für Medienarchäologie (ed.), *Zauberhafte Klangmaschinen. Von der Sprechmaschine bis zur Soundkarte*, Mainz (Schot), 2008

it is a trained archaeologist, Michael Shanks, at Stanford University who is co-editor of a volume on performative arts called *Archaeology of Presence*.<sup>18</sup> Indeed, past media can be "re-presented"<sup>19</sup> not by sheer materiality; they rather require operative reenactment, operative presence. To what degree can textual and hermeneutic metaphors which have been familiar to humanities and performative arts be applied to electro-material culture? The circuitry design of an electronic media set is not a "text" but an *operative diagram* when set in function, in correspondence with the Peircean notion of "diagrammatic reasoning" which is close to the archaeological method in its epistemological sense.<sup>20</sup>

In the years around 1980 late Friedrich Kittler had engineered a modular sound synthesizer which nowadays endures as strange artefacts in the midst of his collected papers. Therefore research artist Jan-Peter E.R. Sonntag has directed an explicit "anatomy" of this three-dimensional circuitry architecture, to answer the question if there is something like an idiosyncratic style or even authorship in Kittler's handling of actual electronics. This is hardware-oriented media hermeneutics in the tradition of what the archaeologist Eduard Gerhard in 19th century once called *monumental philology*.

Fig.: "Anatomy" of Friedrich Kittler's modular sound synthesizer, directed by Jan-Peter E.R. Sonntag

But pure analysis does not suffice for media technologies; the operative testimony of an electro-acoustic synthesizer from the past is its actual re-generation of sound. This links to Historical Performance Practice known from classic music rehearsals, and continues into the Electroacoustic Studio. The key word of operative media archaeology is not static reproduction, but rather dynamic reenactment. In contrast to sculptures and paintings, media art is operative and therefore a time event. Musicology employs the term "historically informed performance" in connection with the imperative to play instruments that are specific to particular historical periods. This aesthetic depends on the concept of early music, which for most musicologists refers to works composed before 1830. Ironically it thus ends at the time Michael Faraday just discovered electromagnetic induction, which was to become the condition of possibility for electroacoustic

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18 Gabrielle Giannacci / Nick Kaye / Michael Shanks (eds.), *Archaeologies of Presence. Art, Performance and the Persistence of Being*, London / New York (Routledge) 2012

19 See Vivian Sobchack, Afterword. *Media Archaeology and Re-presenting the Past*, in: Erkki Huhtamo / Jussi Parikka (eds), *Media Archaeology. Approaches, Applications, and Implications*, Berkeley / Los Angeles / London (University of California Press) 2011, 323-333

20 See M. I. Doran, *Archaeological reasoning and machine reasoning*, in: J.-C. Gardin (ed.), *Archéologie et Calculateurs*, Paris (Éditions du CNRS) 1970, 57-67

music in the future. The German Museum (*Deutsches Museum*) in Munich houses the legendary Siemens Studio for Electronic Music (1959-1969) which has been housing a couple of prominent composers. Does a faithful performance of early electronic compositions - analogous to the concept of "historical performance practice" - require them to be replayed in this museum studio? To what extent does electronic music depend on the original analogous instruments, and to what extent can these instruments be emulated as digital software? The historicity of early electronic music is not bound to an irretrievable original performance, like a piano piece from Mozart's era. Electronic music is not to be found in the studio production as progressive implementation, but rather in the final recording and composition on multi-track tape, as this is how it was first performed. If these tapes are available today, then a techno-historical equiprimordiality of re-performance can take place. One way of clearing a path to the past is the symbolic approach of writing-mediated historiography, but the other is the chronotechnical approach, which is grounded in material remains. The latter approach includes the media archaeology of the synthesizer. At the media art festival *Ars Electronica* in Linz in 2009, Elisabeth Schimana performed her composition "Hell Machine" (*Höllmaschine*) on the same synthesizer that Robert Moog once constructed for composer Max Brand. This reactivation initially required hard work on the electrotechnical material, which is media archaeology in a manifest sense. While traditional historical instruments, like a grand piano from Beethoven's time, are mostly preserved in order to perform a corresponding historical composition, the message of an electro-acoustic artifact from the past lies in the primacy of the present. Schimana thus created her current composition specifically for the antique synthesizer: "What is in such a machine that has not yet been experienced?"<sup>21</sup> Electronic apparatuses of the past, conceived as media, are not in a historical condition, but rather in the mode of latent presence. Media archaeology seeks to unleash the potential sublated therein.

### **What remains: sonic "ghosts" from MP3 compression**

In digital media culture nowadays, audiovisual "big data" need to be compressed for storage and transmission. This leads to a different kind of signal "discard" and "residual media"<sup>22</sup>. To focus attention of this digital sacrifice, research artist Ryan Maguire applied a kind of acoustic "garbage archaeology" (Ratje) by re-

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21 Elisabeth Schimana posed this question during her presentation in the colloquium *Medien, die wir meinen* at Humboldt University, Berlin, February 10, 2010.

22 See Charles Acland (ed.), *Residual Media*, Minneapolis (University of Minnesota Press) 2007. See further Caleb Kelly, *Cracked Media: the sound of malfunction*, Boston, Mass. (MIT Press) 2009

collecting the sonic rubbish<sup>23</sup> left by the compression of "musical" data. The MP3 codec implements a lossy compression algorithm based on a perceptual model of human hearing which determined which sounds were perceptually non-important and could therefore be erased. What does such rejected data sound like? Patrick Maguirre has developed techniques to recover such lost sounds. The material left behind by MP3 data compression is worth listening for itself. "White, pink, and brown noise, when compressed to the lowest possible MP3 bit rate, sounds very different from the original random signal" (Patrick Maguirre).<sup>24</sup> Maguirre has produced an audio "[...] comprised of lost mp3 compression material from the song *Tom's Diner* which had been used as one of the controls in listening tests to develop the MP3 encoding algorithm: "Here we find the form of the song intact, but the details are just remnants of the original. The video is the MP4 ghost of a corresponding video [...]. Thus, both audio and video are the 'ghosts' of their respective compression codecs."<sup>25</sup>

While audio-visual attention to "the ghost" of MP3 files appears somewhat metaphysical, the laws of media applied here are rooted in techno-mathematical precision.<sup>26</sup> Probably the phantasm of "haunted media" (Geoffrey Sconce) better applies to analog, that is: signal-based media recordings only, not to digital data processing any more.<sup>27</sup>

### **True Computer-Archaeological Reenactment: Emulation**

Reenactment is the reproduction of an event in a dramatic, that is: time-ordered form. The concept is also plausible for high-tech media theater, such as Heinrich Hertz's 19th century experiments with electromagnetic waves in the former lecture theatre of Technical University in Karlsruhe. In the era of digital media culture, the a-historical reproducibility of technical media yields entirely unique variants of reenactments. The Commodore 64 home computer from 1982, even if based on a low-clocked 8-bit processor with just 64 kilobytes of RAM, was graphics-capable and equipped with a sound chip. Its programs could be executed almost instantaneously, as the BASIC compiler made it possible to write

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23 On the re-cycling of cultural value, see Michael Thompson, *Rubbish Theory. The creation and destruction of value*, Oxford UP 1979

24 See (or better: listen to) Ryan Patrick Maguirre's video *moDernisT*, created by salvaging the sounds and images lost to compression via the MP3 and MP4 codecs, from: <http://theghostinthemp3.com>; accessed January 4th, 2016

25 <http://theghostinthemp3.com>; accessed 4 Jan. 2016

26 See Jonathan Sterne (2012); *MP3: The Meaning of A Format*; Duke University Press

27 A thesis expressed by media historian John Durham Peters; see: *Speaking into the Air. A History of the Idea of Communication*, Chicago / London (Univ. of Chicago Pr.) 1999

byte values directly into storage cells and execute them with the speed of a machine language. How can computer games originally written for the C64 be reproduced again decades later? The restoration of a C64 along with its peripheral equipment, including datasette, joystick, and television monitor, is actually marked by signs of decay, as both the hardware and the bit strings stored on the magnetic tape of the datasette have become prone to error. Despite such historicism, it is nevertheless astonishing that such a computer is still able to yield screen events and that it can still be used interactively after decades. The logic of hardware and software (microcodes in their fixed wiring and RAM and ROM data) proves astonishingly invariant with respect to techno-historical time and to the ageing of the electrophysical components. The medium is still able to position humans in the temporal relations that it operatively prescribes.

When antique computer hardware is simply exhibited on a museum shelf, its essential time- and *bit*-critical processes remains excluded. Its software belongs to the class of generic objects. "In archaeological terms the operational continuity of contemporary culture cannot be assured."<sup>28</sup> The solution lies in transforming the material aspects of computer culture itself into software - that is, digitally *emulating* the computer hardware of the past. This results in a media culture that practices its own *unreification* - "logical replication as distinct from physical replication."<sup>29</sup> Operational media are actually materially embodied, but they themselves no longer represent "things." It is the principle of the Universal Turing Machine that allows it to emulate all other machines with time-critical symbol operations. A new computer in the present *is* in the condition of a C64 when it emulates it, resulting in a new type of a-historicity. However, this only applies *per definitionem* to the logical, i. e. the symbolic level (the "archive" of statements); in order to become a real simulation, the current computer must take into account the earlier timing of the C64's electrical engineering as well, for the purpose of "high temporal fidelity." This requires consideration of the algorithmic sequence of changes in condition (logical, mathematical-dramatic time) as well as the concrete microtemporal intervals that add up to the overall behavior of the system. The result is the resurrection of a previous computer in the techno-mathematical world of its successors - a unique kind of temporalization. PegEm, the current emulation of the historic Pegasus computer once developed by the British Ferranti Ltd. in the late 1950s, admits that its simulation is limited: "Although no particular attempt was made to simulate correct timing, the similarity of the logic module to the actual hardware means that the various instruction times bear a reasonably correct ratio to each other."<sup>30</sup> The emulation models the logic of the Pegasus, but

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28 Doron Swade, *Collecting Software: Preserving Information in an Object-Centred Culture*, in: *History and Computing* 4.3 (1992), 209

29 *Ibid.*

30 Christopher P. Burton, *Pegasus Personified: Simulation of an Historic Computer*, in: *Computer Conservation Society*,

only the time behavior makes a replica exact: "The aim was to roughly model the gross timing behaviour of the original machine."<sup>31</sup> The computing cycles and time base of early computers must be handed down in order to be able to revive them in their temporal existence; current processors as "hosts" must take this into consideration in reverse engineering and media-active archaeology.<sup>32</sup> Such technological anamneses are driven above all in the form of so-called retro computing, which practices anything but historical computer nostalgia.

The practical reproducibility of historical media technology represents an escalation of the question of the temporal modes of high-tech media. Emulation means functional equivalence in a time-invariant form.<sup>33</sup> This distinguishes symbolic machines from analog electronic media; the current reincarnation of a historic radio is only able to realize its model when the actual components are equivalently reused. Technological simulation is defined precisely by its temporal indexicality. Since the era of the analog computer, the time-scale modeling of a physical process is familiar through electronic elements (time compression and time expansion); worldly time behavior was thus modeled by worldly means. However, the term "simulator operation" was reserved for a specific temporal mode: the representation of dynamic and electromechanical processes in the time window known as "real time"<sup>34</sup>; flight simulators are a prominent example.

### **Algorithmic reenactment and media archaeological reenactment of algorithms**

If the theatrical drama is defined as formal procedure of processing time and space<sup>35</sup>, then there is dramaturgy in machine agency as well. For computational media, this dramaturgy is truly algorithmic. Annie Dorsen has developed such a form of theatre co-created by algorithms, even envisioning a theatre without human actors. This is not post-dramatic theatre<sup>36</sup>, but true media

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<http://ftp.cs.man.ac.uk/pub/CCS-Archive/Simulators>

31 Ibid.

32 See Jens-Martin Loebel, *Lost in Translation*.

Leistungsfähigkeit, Einsatz und Grenzen bei der Langzeitbewahrung digitaler multimedialer Objekte am Beispiel von Computerspielen, Glückstadt (Werner Hülsbusch) 2014

33 The Windows-compatible run-time environment for the WINE operating system says it already in the acronym "Wine Is Not an Emulator." It does not emulate every processor instruction, but it is sufficient to allow the executed programs to run as fast as they did under the original operating system.

34 See Granino A. Korn and Theresa M. Korn, *Electronic Analog Computers (D-C Analog Computers, New York (McGraw-Hill) 1952, 9.*

35 As expressed in Adolphe Appia's *Die Musik und die Inszenierung* <sic!>, Munich (F. Bruckmann) 1899

36 "Drama heißt beherrscher, übersehbar gemachter Zeitstrom":

theatre: not beyond, but even from within the human body. The ultimate "de-personalization" by prosodic timing and rhythmic movement has already been Adolphe Appia's ideal for literally *automated* theatrical education.<sup>37</sup> Once theatrical space becomes mathematical, it challenges the traditional axioms of theatre like embodiment, presence, ephemerality, and human language in favor of formal languages.<sup>38</sup> Already in Samuel Beckett's one act play *Krapp's Last Tape* (1959), next to the human actor the real protagonist is the magnetic tape recorder which registers and replays the actor's autobiographical voice. While "performance's only life is in the present"<sup>39</sup>, operative acting is a multi-temporal fold. Traditional theatre counts a "time-based" art (as prominently argued in G. E. Lessing's 1766 essay *Laokoon*), but the "theatrical scene" of computation (true media theatre from within) dispenses with the familiar notions of the linear passage of time itself - even if in principle, the von-Neumann-architecture of digital computing still performs one step at a time. In times of Digital Humanities (which the term "algorithmicized Humanities" is more precise) code-driven media theatre becomes natural, rendering problematic the culturally familiar difference between performative *versus* operative media theatre. In an operative meaning, theatre is more machine related, in a performative meaning it is more body related; both converge in genuine Media Theatre which enacts retro-computing as present continuous past.

In Dorsen's media-theatrical piece, algorithms convert Shakespeare's *Hamlet* in real time into a computational co-presence that feels "out of joint" (to cite Shakespeare's piece itself), an almost *algorhythmic*<sup>40</sup> mixture: "That mix of rhythms turned into a jumble as language began to break down (in the last two parts of the show), giving the impression that the machine was breaking down" - algorithms going awry.<sup>41</sup> Such algorithmic re-production of dramatic speech is not as inhuman as it seems at first glance; it rather reminds of the mechanisms of oral poetry from within human performers itself, its specific mode of re-production. Oral epic

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Hans-Thies Lehmann, *Postdramatisches Theater*, Frankfurt/M.  
(Verl. d. Autoren) 1999, 61

37 "[...] wenn sein Körper den allerverwickeltesten Führungen des Rhythmus, sein Vortrag den seinem Seelenleben am fremdartigsten gegenüberstehenden Zeitmaßen wie von selbst gehorcht": Appia 1899: 41

38 Annie Dorsen's essay "On Algorithmic Theatre" (2012), originally published on the blog of Theater Magazine vol. 42, issue 2 ("Digital Dramaturgies" edition); accessed 24 May 2016:  
[www.anniedorsen.com](http://www.anniedorsen.com)

[/useruploads/files/on\\_algorithmic\\_theatre.pdf](/useruploads/files/on_algorithmic_theatre.pdf)

39 Peggy Phelan, *Unmarked. The Politics of Performance*, 1993, 146 (as quoted in Dorsen 2012)

40 On that neo-graphism, see Shintaro Miyazaki, *Algorithmics. Understanding Micro-Temporality in Computational Cultures*, *online in: Computational Culture, Issue 2 / 2012*,  
<http://computationalculture.net>

41 Yucan 2015: 165

poetry communicates knowledge of the past not in the mode of historical discourse, but as a memory, relegating past events to the present not by notational or signal recording (like written text, musical scores or presence-generating media such as the phonograph) but by variable iteration: invariance in dynamic transformation. In the age of algorithmic, that is: re-generative (instead of simply inherited) memory, a different kind *poiesis* of tradition emerges, known as the art of "live-coding" of computer music on stage these days.<sup>42</sup>

A rigorous theory of the media theatre does not stop with focusing attention to the new role of computational algorithms as cultural poetics; in a media-archaeological opening of its new techno-mathematical archive, it proceeds with a critical examination of the source codes themselves - not simply with the aim of philological re-reading, but re-executing. Before a human reader can make sense of such a text, it must first be logically be "understood" by a compiler or non-human literal "interpreter". The observer in this media theatre is not primarily the human spectator any more. Therefore the program code that is stored in a masked Read Only Memory (ROM) chip may become the target of media-archaeological or media-archival analysis. As long as the chip itself is embedded in a known computer architecture and assembly language, reverse engineering is able to recover the actual instructions stored in the ROM; "data" become clearly discernible. The microprocessor becomes the scene of media theatre where it actually happens. While human actors embody the textual script of a play for performance, integrated circuit chips implement a code which can be operated again even if obsolete or hidden. The Aperture Labs managed to read out the raw bits preserved in electro-magnetic remanence on Read Only Memory chips.<sup>43</sup> These were put through a disassembler and became re-readable as code.

Collections like the Computer Games Museum in Berlin and libraries are necessary to preserve past computer hardware architectures and software solutions. But in order not to reduce this to mere historical documents, the validity of mathematical algorithms have to be kept "alive" as tradition of past knowledge to the present.<sup>44</sup> It is possible indeed to identify Assembly code as charged elements in a Static Random Access Memory; a more evasive time-object is code stored in Dynamic RAMs. This has to be achieved as executable programs instead of passive reading - which makes all the difference to the Gutenberg Galaxy of printed typography, beyond the *stasis* of traditional textual archives, in favor of operative media theatre.

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42 See W. E., *Sonic Time Machines. Explicit Sound, Sirenic Voices and Implicit Sonicity in Terms of Media Knowledge*, Amsterdam University Press (series *Recursions*) 2016

43 See <http://adamsblog.aperturelabs.com/2013/01/fun-with-masked-roms.html>; accessed July 10, 2014

44 See Friedrich Kittler, *Museums on the Digital Frontier*, in: Thomas Keenan (ed.), *The End(s) of the Museum*, Barcelona (Fondació Antoni Tàpies) 1996, 67-80

