

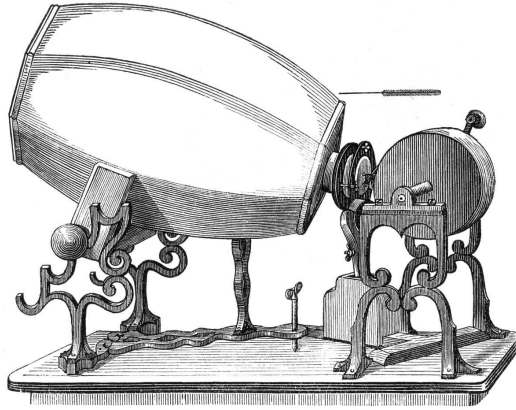
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DEEP LISTENING TO SOFTWARE

Media for music

Media for sound are far from being simple archival and reproduction tools. As *molar* technologies, they were of course created first and foremost with these objectives in mind, to record, *educe*¹ and *retroduce*² sound. They are therefore usually not thought of as technologies for the creation of sound and they are often conceptualized – by composers, musicians, and listeners – as being limited to fixate, transport and reproduce sounds that were otherwise created – using means such as the human voice, musical instruments and other natural or artificial sound sources, etc., all of them resources that Lévy (1997) would describe as *somatic*.³

Phonography⁴ was therefore mainly intended for the recording of sound, it was designed for stability and permanence, traits that we are able to already discover in the earliest man-made phonograms, such as Édouard-Léon Scott de Martinville's analog *phonautograms* from the 1850s and 1860s. These artifacts were produced with the *phonautograph*, an “instrument designed to inscribe the movements of a taut membrane under the influence of sounds passing through the air, using the same principle of recording later employed in Edison's phonograph” (Feaster 2010, 43), but unlike the phonograph, the phonautograph was never intended as a means to retroduce sounds, simply as a means to visually apprehend the acoustic phenomena that was being documented. The phonautograph used a “physiological *tympanum*” (Scott qtd. in Feaster 2009, 8) and a stylus to trace sound waves as undulations of a line drawn in black paper, and Scott intended it as a technology for preserving sound and sound performance⁵ but also to scientifically study them – with applications in the fields of acoustics or linguistics.⁶



1859 model of Scott's phonautograph. Reproduced from Franz Josef Pisko's *Die neueren Apparate der Akustik* (Vienna, 1865), downloaded from firstsounds.org

Scott intended to achieve for sound “a result analogous to that attained (...) for light by photographic processes” (qtd. in Feaster 2009, 5) and, actually, should we attend to the etymological roots of the word phonogram,⁷ this was exactly what he achieved. Only several years later, by the 1870s, was it first considered that phonautograms could contain enough information to allow the successful reproduction of the sounds there registered, at least in theory, as the means through which they were created made direct physical retrodution impossible. Some of the techniques proposed at the time for extracting those sounds were apparently used by Emile Berliner in the development of the Gramophone but no systematic attempt has been made, as far as we know, to retroduce Scott's archives until 2008, when they were recovered using optical scanning and digital signal processing by Patrick Feaster, David Giovannoni and Richard Martin (Hennessey and Giovannoni 2008, 2).

Reproducibility,⁸ education or retrodution only became a goal for sound media after the invention of the phonograph by Edison in 1877, a device that was not only a *listening machine* but also a *talking machine* (Kahn 1999). This second goal, dependent as it was from the first, quickly overshadowed it, at least in what concerns to the general public's experience of these devices.

But unlike later devices, Edison's and other early phonographs allowed the recording and the retrodution of sounds, and if a large market for pre-recorded phonograms rapidly emerged, there was also a striving movement of amateur

phonographists and, if one looks outside the fields of music, ethnography or science, there were many professional users of phonography for business dictation, one of the first segments to which Edison marketed the devices (Milner 2009, 34).

Marketing ready-made recordings – *read-only tokens*, as Lessig puts it (2008) – instead of a machine to create and listen to recordings – or *read-write tokens* – was naturally a sensible commercial decision by Edison’s, Berliner’s, Bell’s and ensuing companies. But regardless of whether a given musical phonogram was home- or studio-recorded, it always took music out of the time dimension, brought into a space dimension (Eno 1979) and thus it allowed repetitions of once ephemeral and unique listening experiences, it allowed music performance to crystallize and ultimately, for the emergence of *canonical* versions of these recordings. At first these were not *universal* as we may understand them today – as before duplication processes were perfected, each phonogram was an effectively unique recording⁹ (Milner 2009) – but for all purposes, and for each individual listener, once a phonogram of a given musical piece was at hand, once it was educed several times, it became effectively canonical.¹⁰

This of course made the experience of music become very similar in some aspects to the experience of visual arts, architecture or even of the nascent cinema. It made the study of music performance possible in new ways and allowed audial memory to play a very different role¹¹ in the enjoyment of music, allowing one to become familiar with all the details of a performance one would be certain to miss upon first hearing it, when attention is most likely far more focused on macro-structural entities as rhythm, melody, etc., than on details. As Brian Eno puts it, this also leads you to actually become “very fond of details that weren’t intended by the composer or the musicians”, (1979) and you could understand whether and to what extent what you experienced upon first listening to a recording was shaped or influenced by your perception or emotional status.

If until phonography the performance of music was the instantiation of a score, from then onwards, each eduction of a phonogram became an instantiation of a recording. The performance, in its turn, became the distant originator of the recorded signals, not something that was captured on the recording but rather an act designed in order “to capture the recording” itself (Sterne 2006, 342), something that was deliberately created with an entirely new set of goals.

Another consequence of phonography and of its usage for music recording and fruition was the increasing pervasiveness of some classes of sounds – and

increasingly also of some types of music – and an overall familiarity with sounds that would otherwise be fairly alien to most listeners.

If we were to take an inventory of those musical predilections most characteristic of our generation, we would discover that almost every item on such a list could be attributed directly to the influence of the recording. First of all, today's listeners have come to associate musical performance with sounds possessed of characteristics which two generations ago were neither available to the profession nor wanted by the public – characteristics such as analytic clarity, immediacy, and indeed almost tactile proximity. (Gould 1984, 333)

“Simply put, there were more sounds, and people could hear them more quickly.” (Kahn 1999, 12) But rather unlike what would perhaps be expected, and with the exception of a residual number of individuals – such as some audiophiles, some artists, ethnologists, etc. – the aural ecologies were left pretty much unexplored for quite a long time, not much attention being given to soundscape recordings or to the documentation of the sound of the quotidian. Looking at other new media such as photography, and perhaps especially cinema,¹² the discovery of the sudden capacity to portray and archive representations of natural phenomena – landscapes, people and their actions, etc. – was an early stage of their exploration, only somewhat later being developed experiences beyond this naturalist direct recording. *Realism* in early cinema, perhaps better represented by the Lumière brothers, has since very early on left roots in the medium and in its culture, even while the *conjurers*, from which Georges Méliès was one of the first representatives, would become more and more numerous in the art. Of course that if Méliès, the *cinemagician*, developed special effects and a host of tricks and techniques to allow the development of his remarkable fabulations, he nevertheless still captured some reality, some real actors, sets, actions, etc. But his reality was not that of nature or of the street but rather that of the theater stage and of reverie, while Lumière's reality was one of train stations, factories, cities, landscapes and people. *Documentary* and *fiction* thus became two broad fields of work that often intersect but that nevertheless keep very strong identities.

Sound recording, as an art and as an artistic medium, seems to have been since its very early days taken by conjurers, with realists only discovering its potential much later. The conjurers didn't have the theater stage as a starting point,

nor a recording or broadcast studio – which would be spawned by phonography and later by broadcasting – but they did have music and its stages,¹³ and although recording did influence the composing process, the overall “quality of listening” was therefore not very improved. Even if in principle phonography did not establish a distinction between sounds, appropriating them indiscriminately and placing them in similar positions before the listener (Moles 1966, 119), the fact is that the “narrow domain of musical instruments” for a long time prevailed over everything else.¹⁴

The medium as constructive agent

Recording media imposed constraints to music that were taken into consideration during composition as well as by performers and engineers during recording sessions. Duration was naturally an issue, but so were dynamics, fidelity, etc., and over time solutions were found to address many of these initial issues, but constraints nevertheless remain, and they continued to deeply affect the creation and the experience of recorded music, or of mediated music, should we prefer to describe it as such.

So, the medium shaped the music. It forced musicians to learn new techniques to *play* their instruments for the phonograph. It led them, and composers alike, to discover and to understand how to use the recording studio as a significant part of the recording process, almost as an instrument – not in the later sense of the studio as *the* instrument of electronic music practitioners, but rather as an indispensable part to the production of a music recording. The medium therefore started to become a *tool* and an *instrument* for sound-making.

This goes however much further than constraining influences, because phonomanipulation, as defined by Feaster¹⁵ (2011) was born with phonography, a technology that was not only intended as a means to record, store and reproduce sounds (and sound sequences) as transparently as possible, but also as a way to manipulate and transform these sounds. Feaster documents a series of practices that are nowadays commonplace, both as recording-studio and as performance techniques, which were developed in the very early years of phonography. Some of these are as old as phonography itself, such as speed-shifting, to which Edison’s notes from 1877 make a clear reference (2011, 165). And besides speed-shifting, we can find evidences for the physical modification of phonograms through the displacement of their center hole, for reverse eduction or the backmasking of sounds,

for segmentary eduction and recording, for editing, for mixing by superimposition, for synchronous and asynchronous multitracking, for the simultaneous eduction of multiple parts of a phonogram and even for sampling, as understood nowadays, “the use of short phonograms (or excerpts of longer phonograms) as compositional elements (loops, musical instruments, and so forth), often in conjunction with speed-shifting.” (2011, 191) All of these are documented to have been developed and used in a period of just a few years after Edison’s invention of the Phonograph, and they are presented as not being only technically or practically motivated, e.g. for the dictation market in which Edison was originally so interested in, but as also being invented and explored by a large number of hobbyists that most likely were chiefly driven by aesthetic motivations (2011, 168).

Many of these techniques were to be rediscovered much later by artists as László Moholy-Nagy, John Cage, Walter Ruttmann, Edgard Varèse and Pierre Schaeffer, later still by Christian Marclay, Janek Schaefer, Otomo Yoshihide and several others, but they very rapidly evolved from the phonographic equipment as it was invented and commercialized. Of course that it only makes sense to speak of phonomanipulation once it is established, by inventors and users alike, that the medium is able of transparent eduction and retroduction, but once this is surpassed, the technologies can then be put to much broader uses and can start to be used as tools for the creation of the contents they carry and educe.

Furthermore, once that the medium adds itself to the music and effectively becomes part of it – in the sense that much of the time, when one currently talks of *music*, without adjectives, one is very probably talking about *recorded* music – then the medium itself can start to be used creatively, in ways that may make it become more than a tool or an instrument for the creation of contents, but rather a constructive agent that shapes and transforms such contents.

Being a constructive agent, in this sense, should not be understood as providing a device or system that contributes to a performance that may be ephemeral or recorded – such as the usage that Yasunao Tone or Markus Popp make of prepared CDs, or that William Bassinski makes of magnetic tape in his *Disintegration Loops* series – rather it tries to describe the (somewhat rare) occurrences when a distribution medium, through its physical properties or its mechanics, actually acts upon the recorded matter or its eduction on an individual and singular basis, thus making the actual eductions of each phonogram become potentially very different from other phonograms that were originally created from

the same matrixes. This should not be understood as phonograms that need to be manipulated by human listeners and that due to that manipulation are able to articulate varied instantiations, as e.g. Noto's *Endless Loop Edition* set of two 10" vinyl discs with 48 locked grooves.

Christian Marclay's *Record Without a Cover*, released in 1985, and originally containing a recording of a performance of Marclay manipulating other vinyl records in multiple turntables, was distributed not only without any cover but also bearing the inscription "Do not store in a protective package". This is a phonogram that was conceived to be corrupted, degraded, dirtied and in other (intended or unintended) ways very much transformed, so as to with it transform its contents and – what ultimately is its goal – the music that it is able to educe. Marclay's recorded performance starts with vinyl crackles and pops and slowly evolves from them during a period of a couple of minutes during which one is not sure what the original source of the sounds really is, whether the original performance inscribed in the recording or the medium that carried it and from which it is educed. *Record Without a Cover* is also very interesting due to how it aestheticizes the glitches and imperfections of the media *from which* and *to which* it is composed. It relies on the establishment of the medium as being able to transparently educe its contents in order to immediately, and continuously, hypermediate it (Bolter 2001) and with this imbuing it with (some) agency in the process of aesthetic creation.

Software as a medium

Since the 1970s we have been witnessing the digitalization of a series of media and tools, sound and music being one of the fields where this phenomenon started the earliest. With the notable exceptions of vinyls and analogue cassette tapes, two apparently *dead media*¹⁶ that have recently regained some prominence, most of the other current phonographic systems, and many musical instruments, are now digital and many have even been totally dematerialized in the process. Although this may not have been apparent at first – back in the early 1980s when CDs were first introduced, or even when DVDs were developed in the mid 1990s – these digital media are developed through the usage of computers or computational systems as platforms for the simulation of previous media. These computational systems are built on largely general-purpose physical layers and are chiefly defined by their program or logical layers, or *software*, where we can find

both data structures as the techniques or processes for generating, changing or displaying this data.

Lev Manovich's recent book *Software Takes Command* (2013) is a good guide to how digitalization affects the nature of the media being simulated and how the process inevitably spawns *new media*. It starts with the very idea of simulation, and how when computers are used to simulate processes in the real world, whatever these processes may be, the chief concern is to correctly model their necessary features (2013, loc. 1292), or to develop a totally transparent simulation (Bolter and Gromala 2003). However, the goal is usually not simply to simulate, because the opportunity – and often also the simplicity and the low cost – to add new properties to any given medium is too appealing to resist. Manovich quotes Alan Kay and his willingness not to imitate paper with computational systems but rather to create something of a *magical paper* (2013, loc. 1297). Therefore some digital contents become searchable, annotatable, shareable, quantifiable, etc. Phonographs become able to shuffle or repeat tracks, of displaying timers counting up or down the length of a track or the entire disc, etc. Far from being simple and neutral expansions to the medium, each of these new properties has far-reaching consequences that deeply affect the medium and its creative potentials.

It is in software that the medium and its contents are simulated, but also where the tools that are used to create the content are simulated, often blurring the distinction between medium, contents and tools. And when the same content – i.e. the same data structures – are accessed within different systems – e.g. when the same phonograms are educed through different applications, when the same e-book is read through different readers – the system may substantially transform the experience of the content, to the point of almost configuring it as a *new* medium. Furthermore, algorithms designed to simulate what once were physical tools, machines or phenomena, only do so when they are setup with particular settings. When these settings are changed by the user or by the software, they therefore have the potential to generate new phenomena that were hitherto non-existent (loc. 2446), and they effectively simulate something that didn't previously exist (loc. 2315).

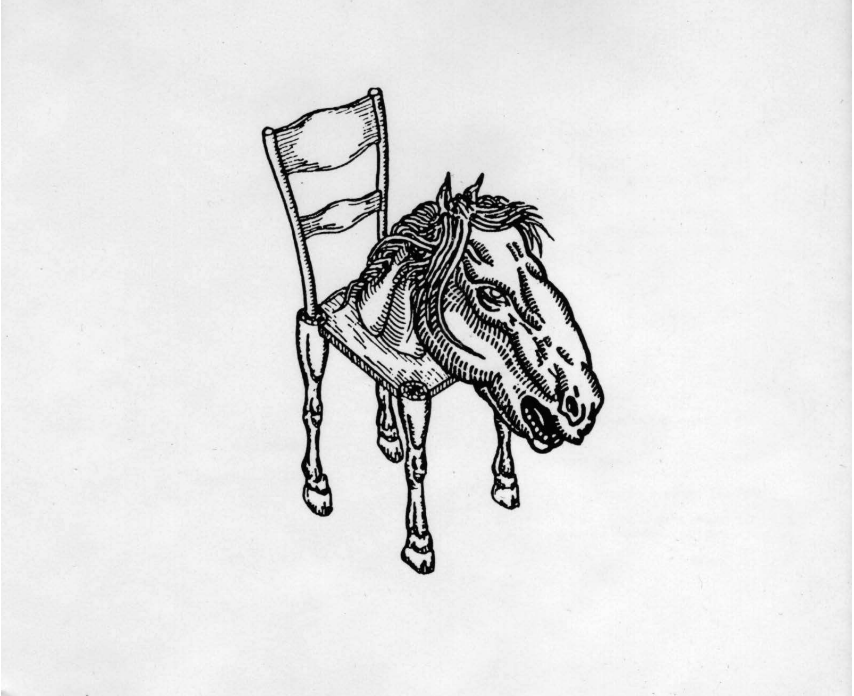
In addition, and unlike molar media, software doesn't simply instantiate the data structures that we may otherwise identify as its content. It rather *performs* those data structures, so, because what one experiences with digital media is constructed in real time, one does not engage “with pre-defined static documents but

with the dynamic outputs of a real-time computation happening on our device and/or the server.” (loc. 646) The final media experience, the *message* that the user of digital media *receives* is not just a result of their interpretation and other user functions (Aarseth 1997; Carvalhais 2011) but is also “actively managed (defining what information s/he is receiving and how)” (Manovich 2013, loc. 686) by software that mediates the production, distribution and reception of most content (loc. 751).

Manovich therefore concludes that this centrality of software puts in question what are the properties of a medium and that these, or what we experience as the properties of a given medium’s content, come from the software that was used to create it, edit it, present and access it. Ergo,

There is no such thing as “digital media”. There is only software – as applied to media (or “content”). Or, to put this differently: for users who only interact with media content through application software, the “properties” of digital media are defined by the particular software as opposed to solely being contained in the actual content (i.e., inside digital files). (Manovich 2013, loc. 2727)

Looking at what we may now, with the benefit of hindsight, call *early* digital media; we are able to discover interesting examples of works that bring software *to command* some aspects of this performative education. I will focus on three works that develop similar procedural approaches and that were composed to run in domestic (or consumer) audio systems. Rudolf Eb.er’s 1992 release of the CD *Ho* (under his Runzelstirn & Gurgelstøck moniker) was comprised of 69 tracks ranging from a few seconds to just over four minutes each and that were intended to be randomly played by the listener (or, what is certainly implied, by the CD player). If we exclude human actions over the process of education and focus solely on the shuffling actions to be developed by the CD player’s software non-repeating pseudo-random number generator algorithm, we find that although not able to command the *deep units*¹⁷ of the composition, i.e. the recorded sounds that constitute each of the individual tracks in the disc, software is able to determine the actual articulation of each performance of this disc.



Cover of *Ho* (Runzelstirn & Gurgelstock 1992).

Two other works develop what is basically the same principle and were released in 1998 by the label OR: Farmers Manual's¹⁸ *Explorers We*, released as a CD, and Gescom's¹⁹ *Minidisc*, released in the same year as a MiniDisc and reissued in 2006 as a CD. The first of these comprised 60 one-minute tracks, the later 88 tracks, both destined to be educed in shuffle.

These three artifacts actively propose varied (although finite) articulations of their parts through a deliberate usage of the shuffle function of CD and MD players.²⁰ The *transparency* of the eduction is therefore affected by this somewhat simple function that can of course be used upon any phonogram with multiple tracks but that is, in this case, chosen as a central strategy in the compositions. These artifacts are therefore something entirely different from conventional phonograms, which in their turn are simulations of non-computational phonograms, expanding and transforming them through software. The new qualities that thus originate are, as Manovich still points, not situated *inside* the media objects but rather existing *outside* them, "as commands and techniques of media viewers,

authoring software, animation, compositing, and editing software” (2013, loc. 2679) that allow the software to determine what to do with the media asset data, fundamentally determining the ontology of the message.

As CDs, MiniDiscs or DVDs, new media are imminently processor-based and software-based. They are procedural. Regardless of whatever surface similarities can be found between their emanations and those of traditional, conventional or molar media, this procedural nature not only may transform them beyond recognition as it opens vast new fields of possibilities for procedural poetics and aesthetics. We are currently living at a post-CD world, one where digital phonograms have largely dematerialized, but one where current phonographic mainstream technologies are still not far beyond the simple procedurality enabled by the shuffle playback of the 1980s.²¹ As musical works may start being distributed not as data files (mp3, FLAC, etc.) but rather as applications that provide the listener with data and also with a program layer for its education, far more adventurous experiences may follow, experiences that may come to deeply affect our concepts of authorship, participation and performance.

Deep listening to software

As creators and listeners of music and sound art, as we are led to discover the new strategies for creation that are enabled by this autonomous procedurality of the media – or if we prefer, of the computational systems where the media are simulated or created –, we start to be faced by the fact that although in every work there remain conceptual, structural and even surface elements that are invariable and that confer it with part of its identity, many details of each particular (software) performance may change at each contact with the work. Maybe we won't be able to recognize a canonical form in a phonogram, and this may lead us to identify something other than the surface structures as the distinguishing essence of a musical work. And as we start placing a not necessarily lower but certainly different value on fidelity and transparency of the media for music, we may come to discover that variability, performance, process and the uniqueness of each experience of an artifact are to be valued. And as what previously were educations or instantiations become unique performances, every element involved in them becomes more significant – loudspeakers and sound-systems, the space and the entirety of the context in which the performance is developed, etc. The musical experience therefore becomes wholly concrete, transforming several

of the central tenets of much of the music of the past century and a half. So when we now listen to these *new* phonograms we may not necessarily expect stability but rather autonomy, surprise and novelty, in short, several of the things that we may have come to expect from *live performances*. And we may experience these as acousmatic performances and enjoy them as such. In the same measure as acousmatic performances liberate us from musical gestures and from a compromise from and with the visual, enabling the confrontation of the listener with unprecedented layers of complexity and a higher level of sonic awareness, so may these phonograms.

When the musical gesture and other levels of visual information are not weaved into the musical performance (and therefore into the listening experience), one is more able to focus on probing the sound at various levels, on *deep listening* and not on the struggle between performers, instruments and audience, between visual and audial stimuli, where the latter are always subordinate to the former. When we abandon a certain idea of authenticity, directness, transparency or non-mediation of phonography – something that was not there to begin with²² (Dyson 1996, 87) and which absence is made clearer by their new dynamics – we indeed discover a whole new medium for music creation and fruition.

Furthermore, in non-concert contexts such as installations, sound-sculpture or even domestic usage, this new phonography permits the creation of long-duration compositions that are no longer dependent on the constraints of human performers, not of context-sensitive compositions that may react or respond to the moment and location of their deployment, and to all sorts of interactive approaches.

This new phonography not only registers sound as it also embodies procedures and compositional intentions, ultimately performing them.

1. "(...) when we speak of 'reproducing' a phonogram, we don't generally mean that the phonogram itself is being duplicated, but rather that sound is being generated from it, and that it is being actualized or 'played,' to use a metaphor drawn from musical performance. I will use the verb *educer* to refer to this activity (...); *educion* in this sense is synonymous with *output transduction*. Educating a phonogram entails generating a sound wave based on microchronic patterns of amplitude fluctuation specified in it, much as educating a film would mean to project or display it – that is, to cause its latent program of moving images to unfold over time and become perceptible." (Feaster 2011, 164)
2. "It is also common to speak of the phonograph as 'reproducing' sounds it has recorded. This proceeds from the belief that the phonograph is duplicating or making copies of these sounds, but it has been argued to the contrary (persuasively, I think) that phonography always represents such sounds subjectively, for instance by reducing three-dimensional complexes of vibrations to their two-dimensional impact on one or more given points in space. Hence, I prefer a more neutral word for the distinctive relationship that exists between the sounds the phonograph records and the indexically and iconically linked sounds it educes from the resulting phonograms. The word *playback* comes close and is probably best for casual use, but it originated in the film sound field about 1929 with the more specific meaning of *educion* carried out for evaluation immediately after recording, a nuance it may still carry to some extent. I will instead say that a phonograph *retroduces* ('brings back') a sound if it educes a phonogram made by recording that sound and the educed sound has an audible similarity, however tenuous, to the originary sound." (Feaster 2011, 164-5)
3. "Somatic technologies imply the effective presence, commitment, energy, and sensibility of the body for the production of signs. Typical examples would be the living performance of speech, dance, song, or music in general." (Lévy 1997, 45)
4. "(...) any inscription in which one dimension represents a time base and another represents fluctuations in the amplitude of a sound wave will be a *phonogram*. The practice of recording and actualizing phonograms will be *phonography*, and any device that effects phonography will be a *phonograph*." (Feaster 2011, 164)
5. Scott was clearly contemplating the study and recording of aural sounds and performances. "Will one be able to preserve for the future generation some features of the diction of one of those eminent actors, those grand artists who die without leaving behind them the faintest trace of their genius?" (Scott qtd. in Feaster 2010, 43)
6. See also Thomas Y. Levin's *Tones From Out of Nowhere*, "the 'invention' of synthetic sound – that is, the ability to actually 'write' sound as such – effectively depended on four distinct developments: 1. the initial experiments that correlated sound with graphic traces, making it possible to 'see' the acoustic; 2. the invention of an acoustic writing that was not merely a graphic translation of sound but one that could also serve to reproduce it (this was the crucial contribution of the phonograph); 3. the accessibility of such acoustic inscription in a form that could be studied and manipulated as such; and finally 4. the systematic analysis of these now manipulatable traces such that they could be used to produce any sound at will. The archaeology of the above-mentioned robotic speech, in turn, also involves four distinct stages: 1. the coming-into-writing (*mise-en-écriture*)

- of sound as mere graphic translation or transcription; 2. the functional development of that inscription as means to both trace and then rephenomenalize the inscribed sound; 3. the optical materialization of such sounding graphic traces that would render them available to artisanal interventions; and finally 4. the analytic method that would make possible a functional systematic vocabulary for generating actual sounds from simple graphematic marks (of the sort made famous by Humphries).” (Levin 2006, 28-9)
7. *Phono-* (phōnē, sound) + *-gram* (γράμμα, written character, letter, that which is drawn).
 8. As normally intended and not in the sense of being able to duplicate the recordings themselves – which was possible with the phonautograph – but rather the sounds recorded.
 9. Even in studio sessions, each phonogram was individually recorded – sometimes multiple machines were set to maximize the time of musicians and technicians, but a given edition of phonograms would normally result in a vast number of different, hence unique, recordings of the same piece.
 10. Who hasn’t felt the strangeness of listening to a very familiar piece of music played in a slightly different tempo, slightly different timbre, etc.? One can argue that in an early stage each phonogram for each listener or small group of listeners became canonic and that at a later stage, once reproduction or duplication of the phonograms became possible, the recordings became canonic.
 11. Audial memory can be very precise and detailed, especially when reinforced by multiple listenings of the exact same sounds and articulations, something that became possible with the new phonograms.
 12. We are very aware how inadequate this comparison may be, with cinema and photography inscribing themselves in visual arts, and phonography in the field of sound arts or music, where, to put it simply, by the end of the nineteenth century there really weren’t any concepts of soundscape, audial ecologies, etc., unlike what happened in visual arts.
 13. Music must here be understood in the light of its late-nineteenth century definition, a Romanticism, pre-Russolo, pre-Cage, definition, not what may be the current twenty-first century definition of the reader.
 14. And in spite of *musique concrète* and its progeny until the present, it still prevails.
 15. “Like photomanipulation, phonomanipulation makes use of ‘recorded’ raw material but foregrounds its transformation, sometimes beyond recognition.” (Feaster 2011, 164)
 16. For more on this, see Bruce Sterling’s *The DEAD MEDIA Project: A Modest Proposal and a Public Appeal* (1995).
 17. More about this in *Procedural Taxonomy: An Analytical Model for Artificial Aesthetics* (Carvalhais 2011).
 18. Mathias Gmachl, Stefan Possert, Oswald Berthold & Gert Brantner.
 19. A collective including Russell Haswell, Sean Booth & Rob Brown.
 20. Of course that this mode of education needs to be manually selected or activated by the listener, as the protocols of CD and MD players do not allow the automatic activation of the function in ways similar to those that are possible to program in DVD discs using the Virtual Machine DVD command set. If the listener does not activate the shuffle function then she’ll be confronted with what we may call a *default* articulation of the tracks, which are played in sequential order.
 21. As curious as it may seem, most file players as iTunes or VLC do not allow for a significantly increased agency from the

part of the media software, seemingly attempting to simulate what originally already were simulations...

22. "Recorded sound cannot claim the so-called authenticity of direct, live transmission, since the recording is tied to neither the here nor the now of the sonic event but rather to a system of representation guided by technology. The inscription of sound thus presents a troubling moment in the discourse of audiophony." (Dyson 1996, 87).

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