MusiMid
Revista Brasileira de Estudos em Música e Mídia
Brazilian Journal of Music and Media Studies

The invention of sound

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Abstract: The 20th century was one of great technological innovation in Western music. For seven centuries, composing consisted of writing on music paper and assign scores to performers until the middle of 20th century when music began to be composed in studios with machines and not notes. This technological revolution echoes a first one, the revolution of wring that took place in the 13th century, when the notation was no longer used to just keep track but to invent music with the help of the sight. The technological revolution of the 20th century concerns all musical genres: jazz, for instance, has been developed on the basis of the music recording; rock is linked to the appearance of the long-playing discs as well as the revival of the performance of baroque music. Over the centuries, timbre has become increasingly important and controlled by composers. As the word 'timbre' became insufficient to describe all details, a broader concept appeared, apparently vague but very clear to music-makers: "sound". This technological mutation upset the social practices

Keywords: sound; contemporary music; timbre; listening.

Resumo: O século XX trouxe importantes novidades para a música ocidental: Depois de sete séculos, em que o ato de compor consistia em escrever sobre papel pautado e confiar a partitura à execução dos intérpretes até que, em meados do século XX, passou-se a compor música com máquinas em estúdio, com sons e não com notas. Tal revolução tecnológica faz eco a uma anterior que a precedeu: a revolução da escrita, ocorrida no século XIII, quando a notação, que era apenas usada como registro, passou a servir para inventar música com o auxílio dos olhos. A revolução tecnológica do século XX diz respeito a todos os gêneros musicais: o jazz, por exemplo, desenvolveu-se graças ao disco, o rock está ligado ao desenvolvimento do disco de longa duração (long-play), assim como o resgate da interpretação da música barroca. Ao longo dos séculos, o timbre tornou-se cada vez mais importante e controlado pelo compositor. A palavra "timbre" é hoje insuficiente para descrever tudo em detalhes; deu lugar a um conceito mais amplo, aparentemente fluido, mas muito claro para os músicos: o "som". A mutação tecnológica abalou as práticas sociais.

Palavras-chave: som; música contemporânea;timbre; escuta.

Texto submetido em / Submitted on:
22 Fev 2020

Aprovado em / Approved on:
15 Abr 2020

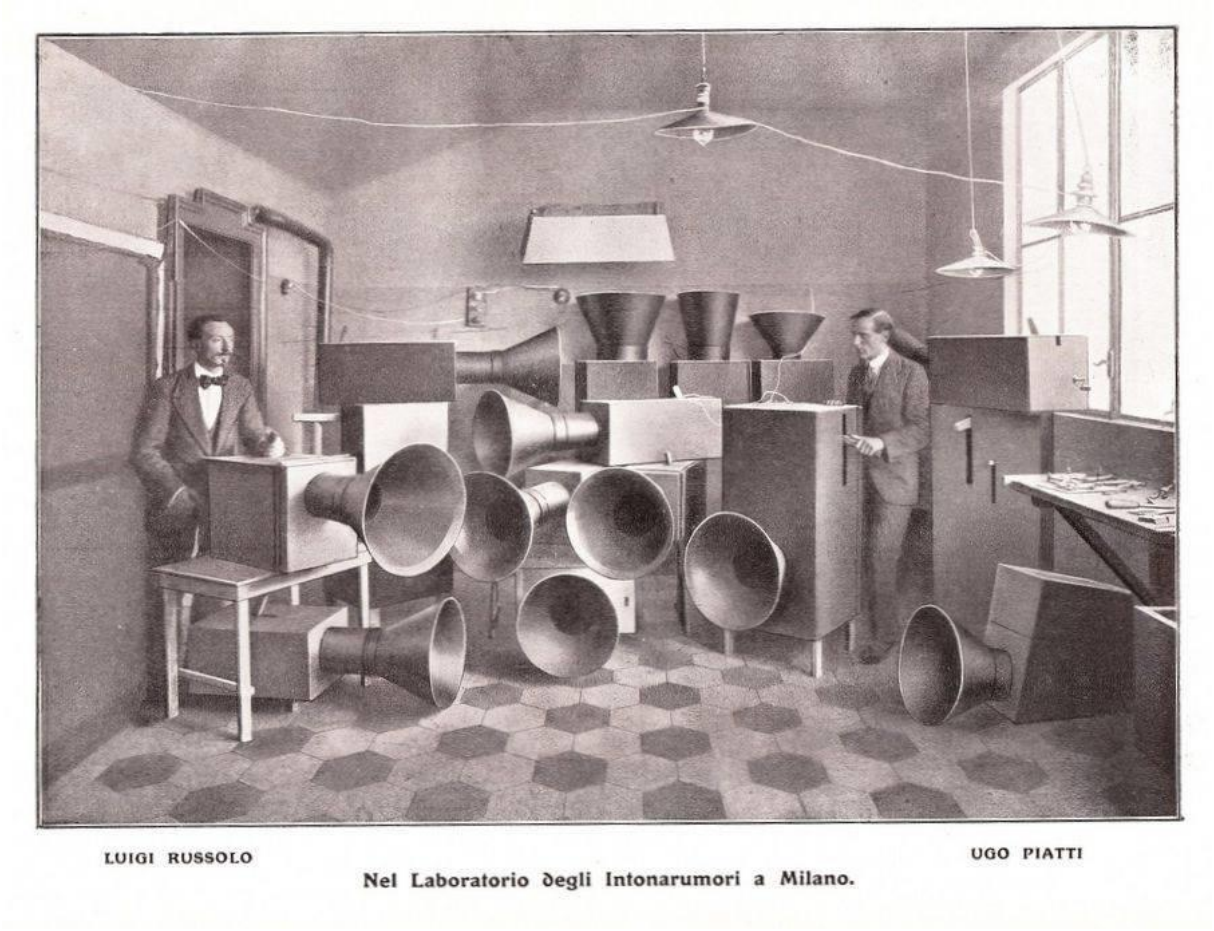

Figure 1: Luigi Russolo in his labyrinth of “noise-makers” Milan, 1914, DR.

In music, the 20th century has been that of the eruption of sound technologies. All types of music—not only those that come out of research laboratories, but also rock, jazz, chansons, the interpretation of composed music, especially baroque music, obviously the popular music that is known as electronic music…—were all affected by this shake-up. The immediate cause is technological, but several centuries of evolution laid the groundwork for this change. The consequences are aesthetic, with the development of an aesthetics of “sound”, and social, as practices are redefined and roles are distributed differently.

The extent of this “technological revolution” can only be appreciated if we compare it to the other “technological revolution” in Western music (for there were only two such revolutions in Western music), namely the adoption of writing as a means of composition around the thirteenth century. So, let’s begin the story with an introductory flashback. Since antiquity, music has been more or less notated, but it was still oral. What had previously been played or sung was written down for the purpose of preservation and transmission. This is how the Gregorian repertoire was transcribed so as to alleviate the memory of chanters and speed up their training. But, of course, this repertoire had been

sung before it was written down. There was a revolution, probably around the beginning of the 13th century: notation was used in reverse, i.e. the music was written down first and then played. From then on, writing became a technology to assist in creation. Of course, it’s no longer the same music that we imagine, using paper and pencil—or whatever takes their place. Thanks to the new medium, polyphony can be mastered. By looking at the music, it is possible to control how the voices work together. And so, for seven centuries, the art of crossing the vertical and the horizontal in a two-dimensional representation was perfected, and many writing processes have survived, from Ars Nova to serialism. Machaut’s motets, Palestrina’s counterpoint, Bach’s fugue, Schoenberg’s combinatorial style are, strictly speaking, unimaginable without the use of sheet music.

Another medium was invented in the 20th century (as early as 1887, to be precise). Like notation, recording was first used to preserve and transmit pre-existing music. But here again, the medium was soon used in reverse. Through editing and mixing, one learned to juxtapose sound units—to compose them. The recording studio became a creative tool. Just as the scope and technology of writing had favored polyphony, so the possibility of fixing sound itself developed a taste for sound, an art of working with it, an ear; henceforth in jazz as in the Baroque style, with popular music or electro-acoustic music of course, the search for a “sound” (in a new sense of the term) that is striking and innovative has turned into a major aesthetic issue. Professions, practices and institutions are reorganizing themselves according to this imperative.

A Foretold Revolution

In the course of barely a hundred years, this revolution of means was the culmination of several centuries of evolution in usage, which will be examined here from three points of view.

The first is the emergence of timbre. Most of Telemann’s or Corrette’s sonatas are written for flute, oboe or violin and basso continuo, Bach himself almost never gives any indication of register for organ pieces, and we know that he willingly played the Well-Tempered Clavier, written for the harpsichord, on the organ or the clavichord: one can hardly imagine timbres more different. This is not to say that Baroque composers were not interested in instrumental sounds—quite the opposite. But the positioning of the final sound was not integrated into the compositional work. That was the job of instrumentalists. When the instrumentation was specified on the score, it was usually because the piece was intended to be played only once (like cantatas or festive music), most often conducted by the composer, who knew very well who would play each part. Such relative instrumental indeterminacy is no longer the case with Berlioz, who wrote the first Treatise on Instrumentation and Orchestration (1844), and it becomes

progressively less so as we enter the twentieth century and timbre becomes an ever more relevant parameter in composition. Therefore, it was not at all surprising for a musician of the late 1940s to have the idea, in Paris, of assembling the most diverse sounds and noises on 78 rpm discs (Schaeffer spoke of “the most general instrument there is”(1952, 15)), or, in Cologne, of synthesizing artificial timbres by calculating the frequencies of their spectral components and their respective intensities. But the story does not end at that point, and we will see later on how the word “timbre”, dear to Stockhausen in 1952, or the word “morphology” of the sound object invented by Schaeffer had to give way to the more vague, albeit more general, concept of “sound”, which was adapted to current production techniques.

The second point of view from which we will examine the beginnings of the technological revolution of the 20th century is how the roles of composer and performer are divided. Indeed, the modern concept of the interpreter does not suit the seventeenth-century harpsichordist very well. Instead of a score, what is in front of their eyes is a kind of canvas, which a 19th or 20th century composer would consider unfinished, and their role is rather that of a producer (réalisateur). Even if all the notes seem to be written, they still need to be ornamented, the cadences improvised, the rhythms softened, according to one’s taste, with unequal notes. As for the flutist playing an adagio, they would read on their score one note per measure, and it would be up to them to wrap it around a round of 32 sixteenth notes. In other words, it is not so much a question of interpretation—which would consist in playing on nuances, slight restraints or expressive fluctuations—as of a true co-production.

The rest of the story involves the composer taking this margin of invention increasingly into their own hands. Cadences and ornaments are set into writing, followed by nuances, articulations and tempi, to such an extent that the composer’s ideal, explicitly formulated by Schoenberg (Donin 2004, 56), is to take away all interpretative freedom from the performer. Without knowing it, Schoenberg was unknowingly calling for electronic music that would finally avoid this regrettable approximation of the human machine.

At the same time, as we shall see, the performers took their revenge with the recording, becoming the real creators of discographic works.

A third point of view from which we can consider these three centuries of evolution is the gradual emergence of the figure of the listener. Schaeffer’s apparent lapalissade that “music is made to be heard” is in fact representative of a state of social practice around 1950. This was far from obvious to a seventeenth-century musician. As soon as music printing was invented in the early 16th century, a repertoire (the polyphonic song) appeared that was intended to be performed with family or friends, without witnesses. In the 17th century, the so-called “academies of music” were not organized for those few guests who might be admitted, but for the pleasure of the musicians. What we see

represented in painting under the term “concert” is a small group of instrumentalists or singers, and if there is a listener, it is a dog in a corner or a cat on a piece of furniture. At church, the main focus is not supposed to be on what happens in the gallery but on what is happening in front of you. The listener, the one who comes there to listen, only appears very gradually in social practices in the eighteenth century, with the institutionalized concert. Still, attentive listening is far from being acquired. Mozart demanded silence for listening to his works, but the poor composer would have to wait for another century. In the 19th century, the audience was still very tumultuous. The silent, respectful concert, in which one refrains from applauding between movements, in which the slightest noise maker incurs general disapproval, is a conquest of the 20th century. And this time the music was made to be heard, to be listened to attentively. So, when the first listening instruments appear—the record player, the radio—they come at the perfect moment. There is nothing to do, nothing to see, except to listen. From baroque music expressly published to be played by groups of amateurs, we have gradually moved on to an ideal of reception—dreamed of by Mozart but realized in the 20th century—which consists of listening. It is not surprising, therefore, that listeners of concrete or electronic music of 1950 agreed to sit obediently in front of rows of loudspeakers. While there is a major technological breakthrough, it is the result of a continuous evolution of social practices.

We shall see, however, that through a spectacular rebound in narrative, it is precisely these instruments of pure listening—with nothing to do, nothing to see—that have gradually, for nearly thirty years now, become production tools in the hands of new listeners. These listening instruments are powerful enough to enable one to delinearize listening (to start anywhere, to go back, to loop), to extract fragments, i.e. to sample, to recompose them differently, i.e. to compose.

Recording and the Invention of “Sound”

One of the most radical technologies is the one that has just been mentioned, the one that has allowed itself to do without the performer, without sheet music, and to sit its listeners in front of loudspeakers. This is called electroacoustic music on a support (also known as “acousmatic”), as opposed to instrumental electroacoustic music that uses sound machines—the computer or a whole range of electroacoustic devices—only as a complement or partner to an instrumentalist who is actually present on stage (also known as “live electronics”). This alternative was first imposed on the music of research in the scholarly tradition, but it also belongs to the field of modern popular music. Some rock groups are satisfied with electroacoustic effects that can be used in real time to safeguard the concert performance, while much of the “electronic” production is only possible with the patience of deferred time, by choosing, processing and assembling the sound units

within the memory of a computer. Already in 1966, the Beatles had to admit that their most original arrangements could only be obtained in the studio and they had abandoned touring. But long before that, right from the beginning, the appearance of rock was due to the effect of technology. In an article entitled “But why in 1955? How can rock’s origins be explained?” Peterson (1991, 6) gives an unambiguous answer to his question: certainly not just because of the talent of one Elvis Presley, but because of a combination of technological factors: the multiplication of radio stations in the United States, the marketing, since 1952, of the 45-rpm LPs that were sent to the stations by mail, and the improvement of recording studios equipped with tape recorders, which allowed Elvis and others to record their songs in bits and pieces and by successive approximations.

We depart here from the central and prototypical case of electroacoustic music to travel through seemingly fewer radical universes. Just as medieval notation had a function of preservation and transmission before it became a medium of creation, so recording in the twentieth century was first the means of fixing sound and transmitting it, and it was not until 1948 that Schaeffer turned the radio studio (and thus the recording and broadcasting studio) into a place of composition. But the boundary between preserving and creating is actually quite fragile. This is what we learn from the technological history of twentieth-century music, for example the history of jazz and the revival of Baroque music.

Michel Chion commented on a recording by Miles Davis:

> What did he engrave? Notes, of course, rhythmic values, but also the minutest passing inflections, the slightest coloration that he gives to the timbre, the faintest emissive effect: Miles Davis therefore knew that he was in fact tracing sound on a support, as a cartoonist can trace a line on a piece of paper (Chion 1991, 6).

Fixing the improvisation, the recording turns it into a creation:

> The jazz musician signs his performances, and they become works in the formal sense given to this term in the modern West. [...] It is to phonographic engraving, ... that we attribute the virtue of this individuation (Stiegler 1986, 129)[1].

More precisely, the history of “sound” in jazz is directly linked to the history of recording techniques:

> In the early days of the phonograph [...] in 1925, electric recording offered an alternative. Musicians themselves could be the object of the microphone, just as all the great film actors were the objects of the camera; and the interiority of the musician could be revealed [...]. Electric recording provided a tremendous creative outlet for the second tradition in popular music and jazz; Billie Holiday, Bing Crosby and Fred Astaire taught singers to be the subjects of the microphone (Eisenberg 1988, 172).

[1] Bernard Stiegler is the author of the expression “the invention of sound”, which I am borrowing from him as a sign of collaboration.

Here we see what “sound” means to a jazz musician: a signature, a set of personal and inventive cues. Philippe Carles recounts how a young double bassist, Claude Tchamitchian, “was waiting for the moment when one could say, ‘from the first bow stroke or the first pizzicato: Hey, that’s Claude Tchamitchian’” (in Delalande 2001,70).

It may seem paradoxical and shocking to make the return to 18th century instruments depend on the technological history of the 20th century. Yet the correlation is clear. Harnoncourt founded the first ensemble of early instruments, the Concentus Musicus, in 1953. The LP was marketed in 1952. Between Wanda Landowska (who already played Bach on the harpsichord, but on a thundering Pleyel harpsichord) and Leonhardt or Harnoncourt, the bandwidth of the recording had been divided by 3.5. It had become possible to differentiate the finer points of sonority on the disc, to render the image of the balance of the instruments in the room whose acoustics were being captured. Henceforth, research on instrumental sonorities was capitalizable thanks to the disc, just as scientific research is capitalizable thanks to written publication. A corpus of interpretations was built up in discotheques, the equivalent of libraries, from which the heirs of the Harnoncourt generation would obviously draw inspiration. Research on “sound” would not have taken place if it had not been cumulative.

Studying, analyzing, dissecting Harnoncourt’s Four Seasons (as it is said in a notice), the Giardino Armonico will release his Four Seasons which are a masterpiece of sound invention. The barking viola (il cane che grida from Vivaldi’s argument) of the Spring adagio has the provocative, moving modernity of Pierre Henry’s door squeaks. The violins playing al ponticello at the beginning of Winter evoke ice, as Vivaldi wished, but as he would probably never have dared to do, with high-pitched, almost synthetic harmonics. It is a Vivaldi of the digital age that we hear here.

The invention of “sound” that we are talking about here is an effect of technology. Not only had the record made it possible to fix, to transmit the search for sound, but electroacoustic machines offered the means to open the sound thus stopped at leisure, by successive retouching. Timbre had gradually caught the attention of composers. But the word “timbre”, attached to the instrument, was no longer appropriate as soon as all sound sources were admitted. Schaeffer proposed “morphology”, and gave a set of descriptive criteria: mass, attack, grain, gait, etc. The word “tone” was used to describe the instrument. But here again, the vocabulary quickly became unsuitable as soon as one spoke of a “disguised” result, possibly incorporating not only editing, but also rubbing noise, air blowing, spatial settings: presence, panoramic effect, echo, or simply reverberation of the room; as soon as images were made or captured and reproduced with a specific rendering. A closed descriptive vocabulary was already obsolete, since the musicians’ inventiveness, their search for singularity and novelty was focused on “sound”.

The word “sound” has thus taken on a special meaning in the mouths of musicians, amateurs and critics, for perhaps thirty years: “One has the impression that in jazz and a

little beyond,” says Philippe Carles, “we only talk about ‘sound’, all the time” (in Delalande 2001, 67). Far beyond! dear Philippe Carles. In rock, according to Olivier Julien, “... the notation of sound [...] is the basis of the discourse produced by the competent observers and producers of this music” (1998, 61). Gérard Authelain extends the same principle to song, even the least technological: “All musicians will say that what is important to them is the sound, those who use the help of electrification and amplification as much as those who remain in the acoustic game.” (1998, 31). As for baroque music—that of the 20th century — we know how it ventures, in the words of Philippe Beaussant, “in search of the lost sound” (1988, 13-17).

The “sound” in question is not that of acoustics, which is analyzed in terms of frequency, intensity, etc.; nor is it the combinatory unity of written music, the “art of combining sounds...” that is found in expressions such as a “chord is made of three sounds”. “Sound” is used here in the singular. It is what makes it singular. It therefore enters into the study of style, but it applies to all kinds of musical objects: We talk about the “sound” of a harpsichord, to compare it to others, but also the “sound” of Miles Davis, which is not Chet Baker’s, or the “sound” of a band, like the “sound” of the Beatles, of one of their songs, or of an album, or of a period, if it is a question of showing differences, or the “sound” of a label, a studio, or even a listening channel, when all the possibilities of technical measures have been exhausted and one resolves to qualify, by ear, comparatively, an overall result. Because “sound” cannot be measured, it can be qualified, appreciated and compared. It is a matter of aesthetic judgement, although it is obviously the result of technical know-how and operating methods: those of the harpsichord maker, the jazz trumpeter who has defined by practice the manner of making an instrument sound, those of the arranger or the studio technician, etc.

The Reconfiguration of Social Practices

It is certainly in terms of social practices that it is most difficult to describe the consequences of the technological rupture, because there is a lag between the social and the technical. The epicenter of the technological earthquake was around 1950, while the social effects spread slowly, and probably for a long time to come. The 1950s marked the appearance of new forms of creation: electroacoustic music, rock, and record creation. At the same time, domestic listening became the norm: whereas the phonograph was rather reserved for a minority of discophiles, the electrophone penetrated into all families, who, to justify their investment, also bought... records. It should be noted in passing that if the market incentive for consumption has launched a “product”, it is music.

It was at the same time that the then nascent “musical research” invented a type of institution that brought together musicians, scientists and technicians under the same

roof not only to create music, but also to develop tools and at once—so new was this music—a reflexive return for perception and analysis. The composer, until now eminently solitary in front of their desk and music stationery, is now part of a team. Radio stations in Europe first offered accommodation and a budget (RTF, WDR, RAI), and this circumstance is neither fortuitous nor meaningless. It raises the problem of the delimitation of the concept of music. Of course, the cause is technical: the same studio equipment could be used for radio and composition. But the proximity with audiovisual and media arts, owing to this community of technical means, is also an aesthetic one. Schaeffer’s “musique concrete” could have been called “abstract radio”, or “cinema for the ear”, as some people say. It was through a deliberate act that Schaeffer imposed the word music and went to present his works in concert halls. However, the demarcation line is constantly crossed, by radio creators who are particularly composers (such as Yann Paranthoën), or by composers who are authors of Hörspiele (such as Luc Ferrari) who practice the same art of staging sound objects in relationships of form. One would say as much of a Godard who does not hesitate to make words incomprehensible, abstract, by masking them under a weft of noise, to create a relationship of materials and planes. A filmmaker, Walter Ruttman, author of a sound film without images (Wochenende 1928) is often cited as a precursor of acousmatics.

The use of the same tools has created analogous bridges with popular music, including entertainment: mixing electroacoustic music, entertainment, a radio drama or the soundtrack of a film requires not only the same console but the same talent, the same creative attention to “sound”, to the perfection of the details that will make the result singular, make it endearing, moving, make it an art.

It is now with the visual artists that links are established. Sound installations, long considered a bit of a gadget by purist musicians, are gradually conquering their tools and vocabulary, and all the frontiers of musical art, traditionally guaranteed by a technical know-how linked to writing, are fading or moving.

As for the million amateur composers[2], half-listeners and half-creators, who passionately appropriate other people’s music via the Internet to sample and recompose it, establish small music labels, rediscover the domestic concert and undermine the power of the music industry giants. Who can predict what musical practices they will invent?

[2] According to a study carried out for the Ministry of Culture by Serge Pouts-Lajus: “composing on one’s computer” (https://www.culture.gouv.fr/Sites-thematiques/Etudes-et-statistiques/Publications/Collections-d-archives/Travaux-du-DEP-1992-2006/Composer-sur-son-ordinateur.-Les-pratiques-musicales-en-amateur-liees-a-l-informatique-TdD-30).

The Future of Writing

The impression could have been given that the “technological revolution” of twentieth-century music was presented in an outrageously tendentious way: there used to be writing, now there are electroacoustic machines. Of course, recording and signal processing are not in danger of disappearing, but writing?

It would be quite reckless, after the totally unforeseen repercussions of the Internet, peer-to-peer, etc., to venture into an exercise in musical futurology. So, let’s just take a step back. Apart from writing and sound techniques, there is a third major paradigm in music, which is the oral tradition. It is first of all a “technology of memory[3]” based on repetition, the imitation of simple formulas, often based on incorporation in the form of gestures, therefore on a kinesthetic memory, but it also implies social organization and generates privileged musical forms. Now, what has become of the music of oral tradition in the vicinity of writing and then recording? The Inuit produce their katajjaq or throat-singing records, a genre that they had almost forgotten in 1970 and which ethnomusicologists’ curiosity has revived, and even though candidates for the traditional music certificate of aptitude (CA) education program at our conservatories are not allowed to use sheet music, in order to avoid contamination, they cannot be made to forget a vocabulary, models, and culture that has otherwise permeated them—as probably their predecessors have done for seven centuries. This is what is happening to written music. American rehearsals have transposed the loop process to the orchestra. Spectral composers have devised an additive synthesis of instrumental timbres and use what Wilson calls “technomorphic” (1989) processes. Even if the instrument and the score still have a bright future ahead of them, as has been the case with the oral tradition from which scholarly music has adopted writing, a sensitivity to sound and a culture are irreversibly formed. Didn’t Messiaen, in the great wisdom implied by his vision of the 20th century, conclude: “Almost all composers have been influenced by electronic music, even if they don’t make it”? (1988)[4]

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[3] According to Bernard Stiegler’s formula «La lutherie électronique et la main du pianiste», in Mots/Images/Sons, Colloque international de Rouen, Cahiers du Cirem, 1989, p. 235.
[4] Television interview with Alain Duault, December 10, 1988, FR3.

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This text was first published in Source: Cahiers de médiologie, nº. 18, November 2004, pp. 21–30. Translated by Adrian Mróz, Jagiellonian University in Kraków, Poland.