Journal of New Music Research
2001, Vol. 30, No. 4, pp. 289–293

0929-8215/01/3004-289$16.00

Introduction:
Preserving Electroacoustic Music

S. Canazza and A. Vidolin

Centro di Sonologia Computazionale – Dept. of Electronics and Informatics, University of Padova, Padova, Italy

1. Introduction

Despite its youth, it is necessary to preserve electroacoustic music, since these works are less durable than other cultural heritages, and their maintenance and restoration give different problems than they usually give. In order to keep the electroacoustic music culture alive, binding interventions are required, conducted from the inside by specific institutions and with the contribution of experts in the field. The brief life of the audio storage supports, the reading systems of the data, and the instruments, impose that these interventions are rapid, thus avoiding that the works which have been heavily deteriorated are definitely lost.

In regards to the instruments, many technological generations overlap in the history of the electrophone instruments, and many electronic components, fundamentals for the functioning of the instruments, are not easily available. The preservation presupposes the presence of several experts in the field and the need of specific researches, because the damage done by a bad conservator or through inadequate restoration is irreversible. So, these activities must be scheduled and made inside an institutional framework, with adequate funds and with an interdisciplinary planning. The work is considerable. In fact, the number of electroacoustic music works has surely increased: already in 1967 Hugh Davies catalogued around 5000 electroacoustic music works in the world.

Nonetheless, the need to sound an alarm lives side by side with the optimism generated by the interest this problem has caused, among other factors. One has to be conscious of the precarious passive conservation of the cultural heritage in the recent past, seen in the reports presented in this issue.

2. Different sides of Electroacoustic Music

With the advent of the electroacoustic and telecommunication technologies, electrophone instruments and new musical forms are born. They have become more and more important artistically from the second half of the last century onwards. Electronic music, concrete music, electroacoustic music, tape music, experimental music, acusmatic music, live electronics, computer music and informatics music are terms used to denote the musical work that makes use of modern electronic technology. They constitute together, with the respective instruments and the performance praxis, the cultural heritage that will be denominated in this paper as "musical electronic heritage." The problems of conserving these materials are very different from those from the musical work of the past, because the storage support does not only consist of paper. Often it is magnetic and therefore transitory and a great variety of data coding systems exist.

It may seem absurd, but today, as we finally are able to record and memorize almost all sounds, gestures, images and sequences, and are therefore able to deliver more information to the future nowadays than in the past, we discover that the conservation of this enormous data quantity constitutes a very serious problem. That cannot be realized by the individual but must be done by an institutional structure equipped with funds and specialized personnel. That makes our society much more vulnerable than its precedents, because a catastrophic event or a period of long recession that stops the preservation activity could delete many years of Music History. This is the other side of the coin: the price that we need to pay in order to conserve the information of our age.

Accepted: 26 November, 2001

Correspondence: E-mail: {canazza,vidolin}@dei.unipd.it

Modern society, based on the continuous technological evolution, on the rapid succession of the fashions and on the constant renovation of daily objects has radically changed the concept of time. Our century distinguishes itself from its precedents for it has introduced the parameter "duration" in the characteristics of the heritage, so as to have a drastic reduction in cost.

Therefore common materials like, for instance, paper and ink that have passed on thoughts and ideas down through the centuries are durable. Furthermore, if we have increased our knowledge to realize good quality materials, the objects used are not made for eternity, because the market doesn't require it.

Because many have used artistic materials on a daily basis, often without thinking of their conservation, many works have already disappeared or are seriously deteriorated. In particular, the electronic era, with the thick use of magnetic and/or optic storage, greatly amplifies these themes, for beyond the support maintenance, it requires the acquaintance with the reading key of the storage data.

The musical works that use electronics could be divided in different categories, as regards their conservation:

Recorded music

In this category there are the musical works, or the musical parts performed by the author (or by others performed under the direction of the author) and recorded as the definitive product. These are works commonly made for tape only or for instruments and tape in which, independent from their nature, the recorded musical materials are ready for the performance, since a score doesn't exist nor an explicit indication from the author to remake them.

The musicology research is very important to preserve the partial sound materials used for the tape processing, like the graphic schemes or the software used for the processing or the synthesis of the sounds.

Live Electronics

These are works in which the acoustic sounds (human voices or traditional instruments) are processed in real time during the performance, without the use of pre-recorded materials. In this case, beyond the traditional score for voice and instruments, the work conservation consists of keeping the detailed documentation of the electronic processes used (patches) and of keeping the score to the performance of the electronic parts.

The patches must be documented in an abstract form or, in other terms in an independent manner by the system used, since the machines have an extremely brief life.

The values assumed by the patches parameters must not be documented in a unit of measurement of a particular system but in a standard unit. In this way they can easily be transferred from one system to another. If the composer has written the electronic score in an "apocryphal" unit, it is necessary to preserve the manual and the technical documentation of the machine, so that it is possible to convert the parameters in standard unit. When information is lacking or when it is a unique prototype the machine itself must be preserved.

Other existing considerations impose on the machine conservation, rather than on the functional abstract principles. In some machines, especially the analogical, any intrinsic imperfections of the technology are the source of acoustic transformations that play in a different manner in comparison to the canonical realization. An other case concerns the unique prototypes realized by the composer or under the guidance of the composer himself. In these the technical choices are conditioned often by aesthetical factors, so the machine is part of the composition itself.

Synthesis sounds

In some electronic musical works the sounds are composed and noticed so to allow the remake of the piece both in a recording studio and during live performances. These compositions, like Live Electronics, are generally noted supplying the synthesis algorithms, which are the rules of sound production (equivalent to the patches), and the time variations of the parameters required by the algorithms itself (something similar to the traditional score). Therefore the conservation of the typology of this work has similar problems like those of the Live Electronics. As well as in many works of synthesis with musical recorded parts, the conservation of both the algorithms and the relative parameters are not required to the performance purpose. Instead this becomes important for a musicological research, which is to reconstruct the musical genesis of the piece and the thought path carried out by the composer.

Computer aided composition

Many works exist, not necessarily of electronic sounds, but of traditional instruments as well, whose composition has emerged thanks to a particular software. In this case the software conservation is not useful to the music performance, but to the musicological research only. In any way, the recovery of the data could be precious, since the rules used are formalizations of the thoughts of the composer. So, to conserve the archive of the software realized by a composer, it becomes extremely important in order to analyse his work.

3. Conservation and restoration

Electroacoustic music preservation is intended to keep alive musical thought of men by preserving masterpieces and instruments, allowing performances and functionality both for musicology research and philological interpretation. In many cases, if the musical works are tied in an indissoluble manner to the production system, it is preferable to separate where possible, the problem of musical work preservation from that of the instruments and from the performance praxis.

First of all, it is necessary to make clear the meaning of the preservation. To preserve means to conserve and to restore.

– *To preserve*: to keep unaltered the cultural heritage in its original form.
– *To restore*: to make available the cultural heritage, following subjective aesthetical principles. In this way, the restoration is limited to the music performance, and so it is part of the interpretation process made by the performer. Therefore the restoration is subject to the aesthetical choices of the performer and to the aesthetical conditionings of the historical period in which he works. The themes tied to the audio restoration will be described in detail by the scientific papers and by any testimonies presented in these issues.

Summarizing, in most cases the electroacoustic musical piece exists of various elements like a score, recorded music, suggestions for interpretation, and other materials which are often important in order to understand the making of the piece itself. This leads to the need of preserving both graphics and textual materials (score, schemes, suggestions) and audio materials (musical parts or the whole piece), software (for sound synthesis, live electronics, etc.), and electrophone instruments. The first materials are usually on paper and are thus concerned with the more general problem of the preservation of paper materials. Audio materials are recorded on various supports in which a rapid degradation of the information occurs.

3.1. The instruments

The electroacoustic musical instruments are different from the traditional for many reasons: the use of the electric energy as principal source of sound production, the rapid obsolescence, the dependence on the scientific and technological research to have lost the characteristics of musical instruments for those of *system*.

In order to illustrate how problematic the conservations and restoration of these instruments are, it is first necessary to describe their nature. The musical electrophone instruments are divided into three categories: electroacoustic, electromechanical and electronic (analogical or digital). Furtermore, such instruments could be distinguished to be monophonic, partially polyphonic or polyphonic.

In all electroacoustic musical instruments a device exists called a transductor,which transforms the acoustic vibration of a vibrating body, for instance, a string, a reed, a plate or a stick, in a electric voltage variation corresponding to the acoustic wave. Therefore the sounds of the instruments are produced through an amplification system, while the original acoustic wave is scarcely perceivable. The transductor could be of four types: electromagnetic, electrostatic, photoelectric and piezoelectric. Examples are the microphone, the electromagnetic pick-up of the electric guitar, the piezoelectric pick-up of the turntable.

Instead, in the electromechanical instruments the variation of electric voltage is caused by the storage of the waves on a rotating disk or on a tape in movement (an optic film or a magnetic tape) according to one of three principles: electromechanical, electrostatic or photoelectric. The principal electromechanical generator is the audio-wheel which was used for the first time by Thaddeus Cahill in the beginning of the century when designing his Telharmonium. Generally, the audio-wheel is composed by several disks given on a pivot started up by a synchronous motor. The disks could be metal (electromagnetic principle), plastic (for instance bakelite: electrostatic principle) or glass (photoelectric principle). The most famous applications for musical electromechanical instruments are the Hammond organ (audio-wheel) and the Mellotron (magnetic tape). Unlike the electroacoustic instruments the audio wave could only be heard through the amplification in electromechanical instruments.

Finally, electronic instruments which have a high circulation today, will be described. In these instruments the sounds are synthesized by one or more electronic generators without any acoustic or mechanic vibration. Several electronic component generations suitable for sound synthesis follow one another in the 20th century: from the valves to the semiconductors, from the circuits integrated to the LSI and VLSI circuits. Besides, the analogue technology is quickly replaced by the digital one.

In order to synthesize the sound, "primitive" components are used (oscillator, noise generator, filter, modulator, envelope generator, mixer, etc.): these are connected in order to realize the process of synthesis. Examples of electronic instruments are the electronic organ, the synthesizer, and the musical workstation based on the digital technology.

The electronic musical instruments lose the traditional characteristics, and they become a programmable and interactive system that can be "played" (in real time or off-line) by only one performer (sometimes the composer himself), giving dense phonic results: some systems are able to synthesize an audio event more dense and complex than the orchestral one. So, each system is an unique prototype of "instrument" that, through his components and his operating characteristics reflects a particular musical thought.

An estimation of the electronic instruments to recover and to preserve is very difficult, for, like Hugh Davies said, "today, probably, more electronic than acoustic instruments are made and within short time, it is probable that more electronic instruments will be produced than all the acoustic instruments made in human history."

The ideal would be to preserve these instruments, not only for museological purposes, but also to preserve their functionality. In fact, it is usual for a violin virtuoso, to aspire to play a Stradivarius or a Guarneri del Gesù. Nevertheless, in order to adapt this instrument to the modern tunings and to avoid the aging, it needs to be modified and often distorts its structure in an irreversible way.

Therefore, it is important to distinguish between the functionality that makes the conservation of the instrument vital

and that finalized to the musical performance. In our opinion, it is necessary to keep alive the music in the present time independent from its original instruments, of which the dutiful conservation protects a cultural heritage useful to the historical and musicological research.

The same thing is true for the electrophone instruments, although their restoration and the recovery of their functionalities are rarely of a mechanical nature, but rather of an electronic one and probably linked to the untraceability of the deteriorated elements. In this case, to make a circuit function of which the components have different characteristics than the original, it involves a new electronic design of the same circuit and its substitution.

Therefore, the preservation of the electrophone instruments give different problems in relation to the functionality of the instrument. If the instrument is not able to "play," the restoration is limited to tune. To get the mechanical aspects and the preservation ready is part of the usual praxis. On the contrary, it is necessary to distinguish between the instruments produced in large scale and the experimental prototype realized in laboratories of musical research. The former, for its commercial nature, is a closed and compact instrument with a great sturdiness, equipped with a manual and often protected by patent that documents the operational aspects. The great number of specimen produced makes their preservation less problematic, because a specimen in good condition can be chosen as well as an other specimen which can be used as material of recovery in case of breakdowns.

On the contrary, the experimental prototypes realized in research laboratories are harder to preserve, because they lack technical documentation as well as that they are affected by the phenomenon called "cannibalism." Diffused in the field of technological systems: the practice of reusing some instruments components for the construction of a new instrument. This phenomenon also makes it difficult to date the prototype as well as to know its characteristics at the moment of the realization of the musical works. In this case the restoration is very difficult, since it is discovered in the history of the instrument, it is necessary to choose to maintain the modifications occurred or restore it to the original conditions. In fact, the alterations are often irreversible.

Such a task must be performed by electronic experts specialized in the technological period related to the particular instrument. In the future, this task will be complicated because the technological evolution is very rapid and it will not be easy to find a technician specialized in obsolete technology as well as electronic components for the substitution of breakdowns. The problematic changes depend on the technological construction period.

Unlike the traditional music production, the electroacoustic one is not linked to a particular instrument, but to an instrument equipment called "system." The conservation of a single element (of a system) doesn't supply the complete testimony of the way an artist operates in a particular historic period. The most effective solution is the reconstruction of the laboratories where all the steps of the musical work production process were performed. In Colony, for instance, the study of electronic music was reconstructed, in the same configuration used in the '50s. Likewise, it was operated for the Institute of Sonology of the Utrecht University in the '60s. In the Park of the Villette (Paris), a section dedicated to the electrophone instruments was prepared, that descends from the experiences of the informatics music in real time in the '80s. In the Biennale of Venice, in 1986, a temporary exhibition "New Atlantide" was prepared, in which the most important instruments and electronic music systems of our century were exposed for some months.

3.2. The software

The software preservation (sound synthesis or Computer Aided Composition) re-enters in the problems of the preservation of the cultural heritage of the electroacoustic music. The recovery of the informatics data of the computer of the first generation could create many difficulties if they didn't periodically copy. In fact, it is possible to find software for Computer Aided Composition (CAC) recorded on cards or on tape but the respective readers are available with difficulty. Likewise for the old 8" floppy disks or for the portable hard disks, admitted that the magnetization is still good, it isn't easy to find the device able to read them. In many cases, the manufacture company of the computer doesn't exist, or the products have been completely eliminated by the assistance-service.

However, our problems are not over. It is necessary to rebuild the environment hardware/software (Operating System, drivers, components, etc.). The software code will be written surely in a language (or using a language version) now in disuse. Since the purpose of the preservation of these materials is for musicology research only, the language and the library technical documentation could be enough. In order to make the software really operational, harder work is required.

Besides, it is necessary to single out the software release that is really used in the composition of the work among the diverged versions which is possible to find, opening the files in the archive of an author.

With the rising of the personal computer, different software for the aid of the performance (and the composition) were diffused and, although they are pop music oriented, rather than research music, they are also used in electroacoustic music realizations. Therefore, some compositions (or parts of them) could be encoded in a format of a limited commercial software. In case of a long life, it is subject to continuous release not always back-compatible, when there is a notable temporal distance between them. Therefore it is not useful to preserve the data without the release of the software used.

4. To hand down the performance praxis

An aspect often neglected concerns the preservation of knowledge about the performance praxis, both on traditional and electronic instruments. If a new instrument imposes a new performance technique, also a new musical language could stimulate a mutation in the way to play instruments already encoded. This is the case of the Live Electronics, where beyond the birth of new professional figures like the performer of the electronic instruments or the sound director, it imposes on the traditional instrumentalist the study of new performance techniques.

For example, we are now discussing the simplest case of interaction between acoustic instruments and electronic tools, which is called "active amplification." In this case, to know how to move the instrument in front of the microphone is the first motion the performer must learn, in order to use the expressive possibilities of the simple amplification. To know how to articulate the dynamics and the movements in front of the microphone becomes important like, for a pianist, to know how to dose the touch of the keys. In this way, the microphone could be compared to the microscope and it can be used to make audible the sounds that usually are under the audibility threshold. In this case the performer must be familiar with the electroacoustic system, and he must know how to approach the microphone with the instrumental parts that give out the sounds to underline.

Besides, the performer plays with "four hands" with the sound director, who can operate both the amplification and the sound projection in the space. The possibilities of interaction multiply and become complicated if electronic devices for signal processing get into the amplification chain.

A musical composition isn't designed exclusively off-line, on the contrary, it is a continuous experimentation work by the composer with the aid of the performers and the technician. Since this activity could be documented in a partial way only, it is left to the artists memory and to the oral communication.

Therefore, the performance praxis is linked to the Live Electronics system and to the musical language of the composer. They are both hard to formalize and to hand down through written documents. The existence of improvisation spaces creates the need to have the testimonies that traditionally have been left to the oral communication, still more pressing, but which today, thanks to the recording technique of both the sounds and the gestures, is possible to document in a correct way.

In our opinion, it is necessary to create a multimedia file (including sounds, images, films and gesture recorded sequences) dedicated to the performance praxis with the musical electronic instruments, in order to make possible handing down all the techniques that cannot be noticed with the traditional documentation and, above all, those points in the score that differ from a traditional reading of the score itself. That could be very important to the musicology studies about the performers as well.

5. Plan of the issue

This issue is divided into three sections.

- Section 1 – A historical introduction presents the problems related to the preservation and restoration of electroacoustic cultural heritage (H. Davies; J. Chadabe; A. Orcalli).
- Section 2 – A scientific section with original contributions in the field of the audio restoration (S. J. Godsill et al.; A. Czyzewski; G. A. Mian et al.)
- Section 3 – Reports from the principal European Centres closely connected to the preservation of the electroacoustic music.