STUDIA UBB MUSICA, LVIII, 1, 2013 (p.115-121)
(RECOMMENDED CITATION)

THE MUSICAL SCORE: FROM PAPER TO THE ELECTRONIC MEDIUM

CIPRIAN GABRIEL POP[1]

SUMMARY. The article presents several aspects regarding the evolution of the musical score. It touches upon a series of aspects of the development of musical notation support in consistency with technological evolution. The first part focuses on the traditional score, while the second one treats the close connection between the score and the electronic medium both from the point of view of its building and from the perspective of creation.

Keywords: musical score, notation, technology, printing, visualization, electronic music

1. Introduction

The evolution of the written word opened the way for transmitting information on material support in a timeless manner. That was a very important step in the development of human interaction from several points of view: that of transmitting information, of preserving it, that of education based on already written information etc. Information attached to a support, regardless of its nature, is and will be one of the most powerful tools in human evolution. From the writing on the walls of the caves to stone, clay or wood carving or writing on paper, information is now stored in an impalpable, but infinitely more secure medium – the electronic environment, which can host large quantities of information of any type. In principle, one of the main advantages of this environment is, first of all, the possibility to replicate information, making it accessible to everybody. Another benefit is the flexibility of information, therefore, with the right technology; it can shift from one form to another. For example, the same text can be, at the same time, projected on a large screen in Madison Square Garden in New York, broadcasted in real time by the Tokyo television network, read by someone in the same network for the visually impaired audiences, printed by a printing house in Paris and carved in steel in a metal workshop in Norway and all by means of the electronic medium. The evolution of fixating and

[1]*Gheorghe Dima* Music Academy in Cluj-Napoca, 25 Ion I.C. Brătianu Street, Cluj-Napoca, 400079, Cluj-Napoca, Assistant professor Mus.D., ciprian.pop@amgd.ro.

transmitting information offered real help to music, being, at many points in time, not necessarily chronological, also a motor for its creation. Technical difficulties from the old times led to the loss of a significant part of old musical art. Therefore, we will never know exactly how the ritual songs of the Sumerians or of the Aztecs sounded. We can only draw a few conclusions based on folkloric scientific research, but the information itself is lost and their musical image is distorted and vague. We will always know exactly how certain Gregorian chorales or the music of Mozart or Wagner sounded, as they were fixed in an informative medium based on conventions, which can faithfully reproduce the pitches and the durations, as well as the indications of expression and timbre (instruments and voices). Nevertheless, we will never be able to hear Mozart himself play his piano sonatas on the instruments of those times, as not even the concept of audio recording was present at that point. Due to technical evolution, later on, besides fixating music on paper through signs, the recording of audio information became possible through various techniques which, regardless of their nature, make for the same thing: the repeated listening, at any point in time, of played or sung music. Consequently, because of these techniques, besides the written work, we have the huge benefit of accessing or creating audio recordings which can correct the main disadvantage of music as an art – its temporality. The concerto played on stage by an acclaimed pianist together with a famous orchestra conducted by a master of the wand in a concert hall with a limited number of seats can also delight the following generations due to the audio recording, (later audio-video without any obvious advantage), preserving the ephemeral moments of the interpretative act in an timeless manner, with the possibility of replicating it in an infinite number of copies. Alongside the traditional writing of music on paper, technological evolution offers the possibility of the electronic medium becoming the “pen and paper” of the composer. The electronic medium ends up as the only place where music is created and “stored”. We will analyse these directions as follows.

2. The Score on Paper

Since writing was invented, information was fixed on various supports: stone, wood, clay, animal skins, parchment, and paper. Regardless of the civilization using writing as a means of storing information or the language used, there were conventions which clearly established the way of writing and reading the written code. The writing parameters are the set of characters and the direction of reading them. The characters used by every civilization served especially to the specific phonemes of the language, with the exception of those based on ideograms. The Greek civilization had a set of characters which were read from left to right and downwards. The Roman civilization

had a different set of characters, but they were read the same way as the Greek ones. The Chinese civilization had a much larger set of characters and the reading direction differs from one period to another: downwards and from left to right. Another example is the Hebrew writing, which has a different set of characters and they are read from right to left and downwards.

When the need for the musical information to be fixated in writing appeared, the compulsory parameters were also established for the support. They were the pitch and duration of the sound, followed later by the timbral component. Later, more and more parameters were added, until the score we have today. The evolutional process of musical writing was slow. Naturally, the first scores were destined to the human voice, the notation conventions being applied to the literary text in the beginning; subsequently, special space was given to music by using neumes, tabulatures and different types of staves. The first musical scores were manually written and were for religious music. The development process of musical writing also improved from the point of view of efficient notation, which was absolutely necessary for economic reasons also. In the beginning, the process of obtaining the paper or parchment for writing the music and the text was difficult and expensive. The writing also, required much time and attention and the musical encoding had to be as simple as possible, with dense information content, in order for a large quantity of music to fit in one page. Later, during the 14th through the 16th centuries, when musical writing crystallized by using notes on the five line stave, which remained unchanged (proving the efficiency of this system), the multiplication of scores involved innovative technologies due to Guttenberg's printing press and engraved plaques. Although the typographic systems of copying have evolved in time, the way of writing notes for industrial printing remained the same until the 80s and 90s, zinc plaques being used, with the mirrored score engraved on them. The engraving process was manual, difficult and required sharp attention and precision from the engraver, who, in order to practice this trade, had many years of "master-disciple" apprenticeship behind. The result, however, was very good, both from the point of view of visual efficiency and from the aesthetic one.

Beginning with the 90s, with the evolution of the computing technique, software was created to replace the engraving technique for industrial multiplication. These programs are musical text editors which can generate highly complex scores with a great advantage – rapidity and fast specialization of the users. The writing of scores became thus team work, involving several technicians and any corrections could be made by or at the indications of the proof-reader.

The contemporary score, written/printed on paper, can contain various types of information/sonorous parameters which can be encoded through writing. Pitch and duration are the most important. Among others, the

following can be encoded: the metric – by indicating the measure, the tempo and character – through specific indications, the fixed tempo – through metronomic indications, the volume of sound - nuances, the gradual change in loudness, articulation, the mode of attack, the prolongation of a note, "respirations" – through specific signs, the presence of several voices on the same stave – through the convention of the position of notes, the phrasing sequences of sounds – through legato connections, the repetition of certain musical passages – through repetition signs, timbrality – through specific indications etc. all these encodings, on paper, have the advantage that, aside from an instrument or voice and musical reading knowledge, they only require a source of light. Nevertheless, the additional information brought by the performer, who does not play or sing mechanically, cannot be written on paper. It can be:

- of time – prolongations or shortenings of durations of fractions of seconds, as well as subtle acceleration/slowing down of the musical discourse;
- of volume of sound – subtle accentuations and changes in nuance, according to the performer's own knowledge and perception of the musical style of the work, which are not written in the score.

All of these make the written score the main medium of storage for musical information, with obvious advantages.

The disadvantages of this system are connected with the way information is stored and its limited quantity on paper. Another disadvantage is also the way of multiplying and distributing the scores to the users, as the work time is sometimes extended and the number of copies available at a certain point is limited.

3. The Electronic Music Score

When the musical product passed into the electronic medium the notation system proved inefficient from the point of view of the density of information to be efficiently represented and read. In each case the invention of new notation types was necessary, customized for each work. Electronic music brings an infinite number of possibilities of expression and technological progress, represented here by the permanent emergence of new devices producing and processing sounds demands for the generation of scores which are different from what is understood by musical notation.

In the beginning (the 50s and the 60s), when the computer was not involved in operating the sources of audio signal and the sound producing devices were analogue, the composer had to represent the scores as precise drawings on millimetric paper, time being presented by the timing. The respective drawings could also include notes and were representations

of the changes in sound parameters, of sounds and their successions. Timbrality was also precisely represented through descriptions of how the sounds are obtained. For example, the composer wanted a 12 seconds A^2 obtained by equal combination of 6 oscillators, each generating a sinusoidal wave and each being out of tune every 3 commas in relation with the next one. The sonorous result has to be passed through a tape filter where the cutting frequency should gradually pass upwards in the sonorous spectrum and downwards every three seconds. These requirements can be represented in various ways and it is clearly impossible to make a standardization, therefore each score will have its own individuality, depending on the composer and their way of making an efficient visual presentation. This type of score can only be multiplied by photocopying and scanning.

Subsequently, when computers penetrate in almost all areas, the way the electronic sound is conceived develops due to the invention of new synthesizers, both analogue and digital, available to the public. Computer science starts to gain ground, especially by redefining the concepts of manipulation and standardization of the set of signals to be used in the creation of electronic music. This is how the well-known and much used MIDI (Musical Instrument Digital Interface) standard appeared, and which initially was not necessarily envisioned as an interface between the computer and the synthesizer, but more like a standard communication language between synthesizers (digital or hybrid – digital-analogue) and sound modules, digital and generating sound effects. Later, following the appearance and spreading of the sound boards, computers begin to use the MIDI language/standard to communicate with all these devices. The MIDI standard is used not only to control external devices, but also to virtualize it in the form of software emulating work environments, synthesizers or even virtual recording studios which are very used nowadays. But this MIDI standard cannot be read and used as a score as it is an abstract table, with everything that happens from the first to the last bar of the musical work. It is a list which is read very rapidly by devices and that is why a new type of score was necessary for this electronic medium. This type of visual score was represented by the concept of *sequencer.* Basically, the sequencer resembles the cardboard or cloth music rolls of the barrel organs or player pianos, where sounds were triggered by rectangular holes of variable lengths. The rolls were unwounded with constant speed above hooks moved by the holes and acting upon the keys through heavers. The horizontal disposition of the holes represented the pitch and their length represented duration. The tempo was given by the speed of unwinding. The computer software sequencer assumed this concept, reversing the reading direction; therefore, the pitch is represented on a vertical axis, duration on the horizontal one and reading is from left to right, as in the Latin reading system.

We can fairly say that the sequencer is one of the most common and standardized types of musical score in the electronic medium. This pattern of electronic score can include all the elements necessary for the computer to "play" the respective work. This score fixates not only notes and their duration, but also the force of attack (the Velocity parameter) and the variations of notes (the Aftertouch parameter). The sequencer can note/record a multitude of curbs controlling the gradual increase/decrease of all specific parameters of each element of virtual or real devices controlled by computer. Moreover, the tempo, as well as its large or small variations can be encoded in the sequencer. The sequencers of certain programs can accept not only MIDI events, but also audio recordings, which can be easily modified/ edited/ combined by the composer to change their volume, pitch, length, tempo etc.

The sequencer is built around the tracks assigned to each instrument, virtual or real. These tracks can contain, in certain sequencers, sub-tracks (lanes), with sound events destined to the instrument of the track they are subordinated to. The sets of events or audio sequences of musical materials are on these tracks and sub-tracks, in the form of larger or smaller blocks. The sequencer also contains, in most cases, instruments for writing notes, curbs for the control of parameters and editing (duplication, moving, division, erasing, cutting or pasting). The existence of an adjustable grid for durations facilitates the work with a sequencer as all sound effects can be adjusted to it in the first phase of composition in order to obtain a very precise interpretation. Most sequencers offer the possibility to apply an algorithm to temporally move the sound events, in milliseconds, earlier or later, in order to "humanize" the electronic performance. All these are, of course, applicable only when the score is created directly in the sequencer, as there is also the alternative of directly recording the sounds with keyboards or MIDI controllers, where the problem of mechanical interpretation disappears.

Thus, having the control of all the parameters, the composer can create, in principle, with the help of the sequencer, the entire score and it will be rendered the same each time. Of course, the human factor of uniqueness of interpretation, of relation with the audience, disappears, but the score, with all the written intentions of the composer, remains flexible for any modifications. This type of score has multiple advantages.

The first advantage is that the modifications to the score can be made at any time and they can be quickly listened to. The electronic score can control an electronic musical instrument, real or virtual, through the computer, much more than a human being, as blocks containing any number of sounds can be "handled" in any tempo and with any number of parameters, limited only by the computing power of the computer, which lately has increased exponentially. Another advantage lies in how musical sections can be arranged, as flexibility is a very important factor in the architecture of the

work. The faithful way in which the electronic score is recorded directly in the computer, without any other intermediary, is also a step forward. The possibility of multiplication and transmission, in various forms, of the electronic score also favours the spreading of electronic musical creation.

4. In lieu of Conclusions

The way in which musical information has been fixed on various supports has represented an important challenge from the point of view of improving musical reading and rendering.

From the music passed on orally to that written and to the digitalized one, the road can be also correlated with the stylistic periods and the technological development from many points of view.

Although at first glance, the musical score on paper can be considered outdated, we can say that its main advantage still lays in the way it is read, without electronic mediators, while the performer only has to know musical notation. On the contrary, the electronic score, requiring at least a computer and amplification equipment, can also be created and controlled by numerous enthusiasts, talented but oblivious of musical notation, while effortless communication resulted from the omnipresent *online* energizes the experience exchange of the musical community.

Notice: "This article (specialty study) is part of the TE research project *The artistic and social impact of the contemporary music of the 21st century from the perspective of the relationship composer-performer-audience* (Project director: Lect.univ.dr. Cristian Bence-Muk), project financed by C.N.C.S.I.S. – U.E.F.I.S.C.S.U. with the contract no. 5/5.08.2010."

(Translated by Roxana Huza)

REFERENCES

Dean, Roger, *The Oxford Handbook of Computer Music*, Oxford University Press, Julio d'Escrivan, 2009.

Propellerhead Reason – Ultimate Guide, Computer Music, Future Publishing Ltd., U.S.A.

Roemer, Clinton, *The Art of Music Copying: The Preparation of Music for Performance.*, Roerick Music Co., Sherman Oaks, California, 1973