The critical editing of computer music

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Abstract

Preservation, restoration and critical editing of music start becoming aspects which concern even the youngest musical genre made with digital techniques. It can already happen that a CD is illegible, a program language is obsolete, computer data used to produce a piece twenty or thirty years ago are no more available. Some disciplines such as the philology of music should therefore start considering a music which, on the contrary, has seldom taken into account the problem of preservation against the obsolescence of the digital technology.

Although in different forms compared to traditional western music, computer music stays anchored to the writing techniques and tools: texts, (digital) scores, supports, and notation. In these terms, it benefits from a tool, the computer, which is one of the main actual tools for stocking and composing music. Software and hardware components are, at the same time, supports for registration (preservation), manipulation, computation, reproduction, actual musical writing.

Philology normally aims to reconstitute the authentic editing of the text itself, in a form which could be as near as possible to the author's intention and its idea of perfection. I will portray the necessity of philology of computer music and what critical editing means if applied to this music.

The first difficulty is genuinely terminological. We must think about the typical vocabulary of those musicological tools, for borrowing or modifying it in the study of computer music. I will describe concepts such as source, texts, sketch, variants, with strict reference to computer music. The methodology of this type of studies needs accuracy and a precise formal order: identifying witnesses, accurate description, precise apparatus, and presentation of criteria and problems of edition, since editing consists of series of educated, critically informed choices; in short, the act of interpretation.

1. Introduction

During my research activity, I've discovered that sources, or "texts" as philologists call them, have a fundamental role for the study of computer music. This type of research already shows an important background of studies, that is the textual criticism, or the philology of music. Musicological investigation of electroacoustic music should start from that, and rethink philological methodologies in the light of what an electroacoustic music source could be.

Over the past century, the philology of music has showed interest in studying texts as they are developed in time. While the task of traditional philology was to reconstitute the original form of the text, which could be as near as possible to the author's intention and its idea of perfection, the main issue of current philology is to investigate the text's development and change, in order to know its profile over each moment of its cultural history, its mobility, instability and relationships with the culture.[i]

The study of computer music benefits from the presence of the authors of the texts. Composers allow, with their presence and documentation, to find more sources since they are real witnesses of their own work. This justify my idea to set my research among the research field named "philology of author" (in Italian *Filologia d'autore* from the definition by Dante Isella). This discipline could also be called 'variant criticism', being this the analysis of the process of rectification and adjustment one author makes on his own work.[ii] The 'variant criticism' is slightly different from the *genetics research*. Genetics research (in French *Critique génétique*) explores the genesis of the text and its development, its compositional process, and above all it systematically classifies and analyses typologies of authorial sources. The philology of

author more widely explores the revision activity by one composer, in the light of his/her interrelation with personal aesthetics and cultural and biographical context.[iii]

It is important to apply this kind of study to computer music, since there is a whole musical repertory which is since long considered historical. We could just name the IDEAMA project, started already 20 years ago in 1986,[iv] whose aim was to preserve the most important and endangered early electroacoustic works and make them publicly available on CD. The philological discipline could be a good means for preserving and studying the knowledge characterising one work's creation with methods borrowed from disciplines which are well-established and developed.

2. Historical, technological and aesthetic boundaries: what is computer music?

My philological research focuses on a delimitate field among the electroacoustic music field, that is the computer music. I need therefore to define what computer music is. According to the EARS definition, this term covers a broad range of music, which can hardly be defined.[v] The long and technical definition examines above all the compositional and synthetic process and its performance. Nevertheless I think that this definition is incomplete. After a long deliberation during my post doctoral research, I have come to the conclusion that Computer Music could rather be considered a historical genre which ends to be clearly definable in the '90. I think the term means: the repertory of computer music works, from pioneer to more recent works, using computer for the elaboration, transformation and organization of sounds in the field of musical research of acoustic phenomenon, developed or partly realized in public or private institutional centres or laboratories, and showing strong connections with the writing technique (meaning both the compositional attention to macro level and/or the accurate care for the micro level).

The historical repertory is the computer music realized from the experiments of the 50s. The date *a quo* is the intuition to use computer for sound production or musical composition (1956, Lejaren Hiller and Leonard Isaacson Illiac Suite for String Quartet – 1957, Max Mathews: MUSIC I). It is much more problematic to define the opposite historical date. I propose to take into account a turn over when the paradigm of musical research pass through a crisis. This aesthetic gap starts during the late 90s when computer non-research music starts to be considered by the same standards by musical reviews, festival and composers. At the same time, composers and research institutions open to artistic and research trends which were different form the original ones. I think one specific episode is noteworthy. This is the 1999 Cyberart Ars Electronica Linz Festival, where the Computer Music price (and the correspondent Computer Music categories) change its name in Digital Music and the first price is given to Aphex Twin (Richard James) and his video-artist and collaborator Chris Cunningham. Digital Music is therefore the new trend open to any music that has been generated using digital processes, as the EARS site says.

Musical research is intended in both the typical French and 'political' accepted meaning, and as the interaction between musical research, which tends to create digital instruments, and conceptual materials for the creation of new forms, notion and perception of music. Computer music is widely developed in and recognised by institutions such as academic, public or private, musical and research institutions, and to be produced through commissions, specific researches and concerts.

3. Terminology and sources

The first term which the philological investigation deal with, is the concept of Source. According to the traditional philology, a source is any *witness*, authorized or not authorized, carrying the tradition of one musical piece, and it is a *physical object* transmitting a text. It is a «reference model», that is the place where projects are written in a tendentially stable form, in order to preserve and transmit it (Caraci Vela 2005). Nevertheless the text within electroacoustic music is not necessarily a visible or symbolic trace. In the computer music field a *witness* can indifferently be: 1) the audio source, that is the tape where the computation is analogically converted, or the CD, the mini disc, the memory of the computer; 2) the data storage device containing the digital data and algorithms for any process of synthesis, transformation, spatialization, automatic composition; 3) printed digital scores; 4) traditional scores in the case of mixed music; 5) different sketches by the author; 6) articles dedicated to the piece; 7) mental texts. Together with the presence of objective witnesses, the analysis benefits from and is forced to take into account the presence of the author, who can help, elucidate or complicate the analysis with his memories. These are what I call "Mental texts". The mental text is the most delicate witness in the philology of computer music, but it is a legitimate and sometimes fundamental source, if we consider human mind and memory as a support for the writing of the musical thought. It finds its justification in the electroacoustic context where

aurality/orality and writing are blurred. Mental texts represent the musical intention of the author, and are heterogeneous. These types of sources need of course to be interpreted, verified and compared with physical sources, but sometimes are fundamental to make the analysis proceed. Moreover, since obsolescence and preservation are crucial problems in the study of electroacoustic music, mental texts of composers or technicians are important to preserve competences and processes of writing. All the sources I have listed can be *authorized* sources (according to the traditional philology, authorized sources are 'manuscript' or printed copies controlled by their author: in French *temoin autorisé*, in Italian *testimone autorizzato*). Non authorized sources are also important because they could include authorial corrections converged for some reasons in different variants made by "copyists", which can happen in computer music production too.

Audio sources are a new kind of sources within the field of philology of music. They involve, as any written musical score does, two different levels of analysis: the container and its contents. That could introduce the necessity of another discipline together with the Philology of author. This is the Material Philology, a recent field of the contemporary philology. It investigates the way material conditioning of the support influence writing techniques (Schreibman 2002). Digital sources are problematic because involve new approaches to the organization of the writing space and its writing instruments (as it is underlined by Fiormonte 2003). Their particular nature influence writing techniques also in computer music. At one more specific level, philology of computer music needs listening strategies combined with analysis of audio contents by way of any software for the editing of music and for analysis of audio contents (spectrograms, sonograms, etc.). That allows the comparison in order to verify the story of one musical works, its variants, transformations and so on. Audio sources also involve a very specific and technical discipline which is the modernization of the ancient codicology (it. Codicologia, fr. Codicologie). This is the discipline devoted to analyse physical characteristics, materials and history of manuscripts. A new corresponding discipline has already produces several scientific contributions. Digital preservation and archival of cultural assets is now a widely-studied and active research problem (audio restoration for example already studies analogue music in order to preserve it). This is a very specialized discipline for the analysis of physical aspects of support material. A collaboration between the new corresponding figure of electroacoustic music restorers and the philologist of music is advantageous and desirable. Moreover it must be emphasized the blurred digital-analogue nature of each piece of computer music realized during the historical period: data were digitally calculated but fixed on an analogue support. That justifies the congenital 'imprecision' within the digital-analogue conversion (or copy from tape to tape) and, consequently, some inaccuracies in analogue audio sources (or their recent digitalization) and their comparison. Again, analysis and comparison of these sources help to verify the story of one musical works, its variants and transformations.

4. Methodology

The most important aspect of the computer music philological investigation is the method. One supposed *critical edition* should follow different steps. First of all, the philologist should give information about the musical works, its history, and then explain main criteria and problems. The second step should be the complete *recensio* of extant sources. The sources criticism (Fr. *Recension*, It. *Recensione* or *recensio*) is the complete survey of the witnesses and their description. The philologist should list all different sources and name them with abbreviations derived from their content or origin. One should also indicate where the source is taken from, giving bibliographical or recording references or name the archive where the source is kept. I think an orderly order of presentation is important; so one could start from written sources (articles dedicated to the piece, musical scores), then list audio sources, digital scores, and at last mental texts and oral witnesses. The accurate description of the sources is the third moment of the investigation. The philologist should describe, for example, what is the main theme of an article dedicated to the piece, which is the origin of a digital score and how it looks like, or cite the text of the booklet of one CD or give information of the conditions of a tape where the piece is recorded. The systematic collation (fr. Collation, it. Collazione) – fourth step – is the place where the philologist compare all the sources he has collected during the *recensio* and the source criticism (Caraci Vela 2005: 207); this is an important moment of the investigation because it can already stress significant aspects of the musical piece, some problems of variants or different contemporary or historical versions. The restitution of the text is the fifth moment, the central and conjectural work of the philologist. The aim is to make a critical investigation of the musical piece and its tradition, trying to restore its history, innovations and changes during its transmission and reception. Results depends on the accuracy of the precedent steps. The sources' apparatus (it. Apparato delle fonti) is finally the place where the philologist shows the variants. These are

also called *Critical notes* (fr. Appareil critique, it. Apparato critico). This is the place where the critical edition (the musicologist or the musical editor) registers differences readings (fr. Leçon, it. Lezione) derived from the comparison of the sources. The critical notes could be divided in *diachronic* or *internal* or *dynamic* notes, which contains the authorial variants, and *synchronous* or *static* or *external* notes, which are the variants of the tradition.[vi]
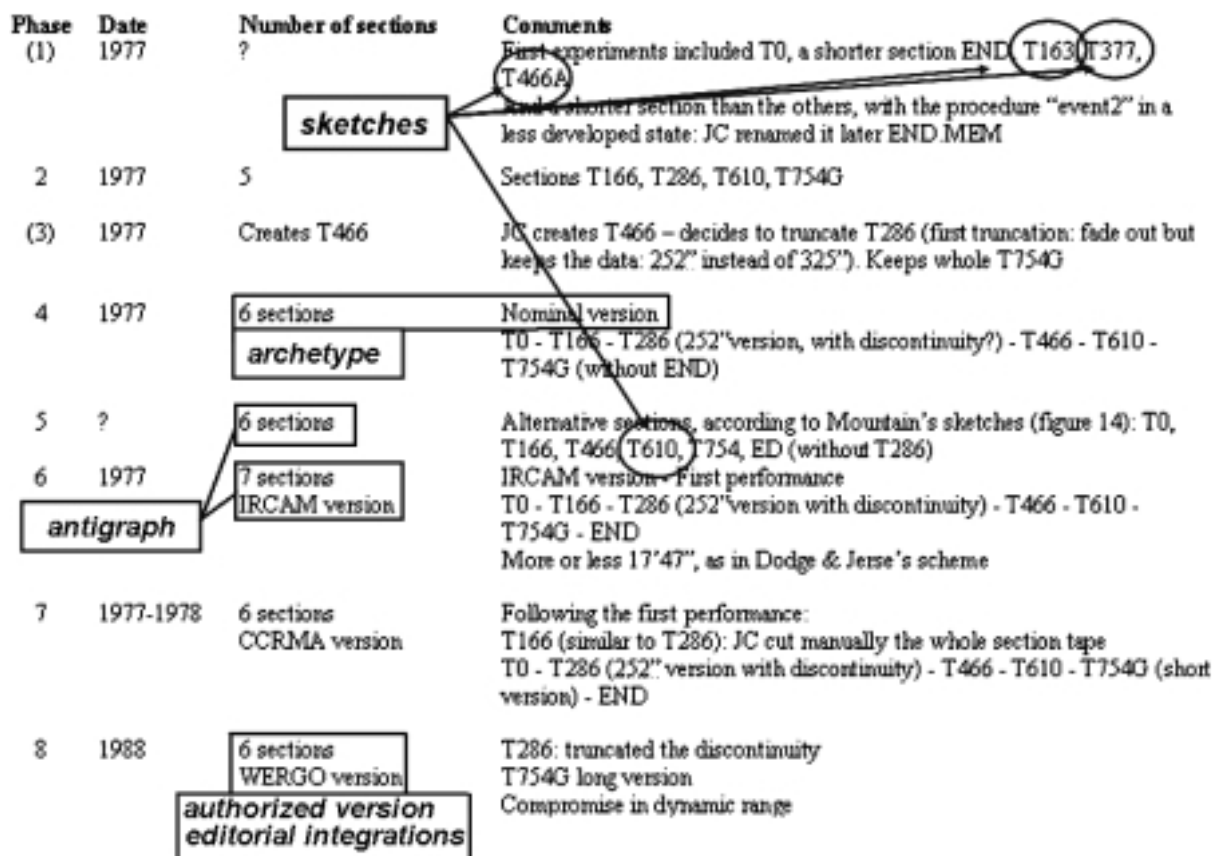
5. Case study

During my research on the philology and its terminology applied to computer music, my investigation has also investigated the assembling process of *Stria* by John Chowning.[vii] *Stria* has been, at the same time, a case study for my work on the philology, and the incentive, with its numerous problems, to the enquiries and its reflection to proceed. Through the course of my initial research, it had been evident that Stria was realized in different steps and has had different durations and descriptions since its first conception. This immediately emerged during the collection of the documentation.

The following figure represents the documentation (in some cases not published) dedicated to the piece. The witnesses are divided in written and audio texts. All witnesses are *authorized* sources that are produced by Chowning himself or accepted and partly controlled by him. For each source I have assigned: an abbreviation, as it is showed in the figure, a brief description, the reference, and the duration, since I was interested in the pure timing data in order to reconstruct the history of the assembling process. The presence of two durations in the same article by Roberto Doati (RD: Doati 1988) is a symptom that at least two versions of Stria have co-existed since long.[viii]

Written sources

TbM — Description: Toby Mountain's graphical score of the piece
Reference: (Mountain 1981 ca.)
Duration: 15'46"

TM-LK — Description: Tod Machover & Lev Koblyakov: short text quoting an (unpublished) interview to JC
Reference: (Machover 1984)
Duration: any duration marked on the article

DJ — Description: Dodge & Jerse's scheme; Graph of the compositional structure
Reference: (Dodge-Jerse 1985, 126)
Duration: 18'

RD — Description: Roberto Doati's analysis; Musicological analysis of the compositional process
Reference: (Doati 1988)
Duration: two duration emerge:
15'46" (4-ch)
16'57" (WERGO)

IR — Description: IRCAM website (Written documentation of the piece)
Reference: (IRCAM 2005)
http://brahms.ircam.fr/
Duration: 15'.

Audio sources

4-ch — Description: Roberto Doati's 4-channel version
4-channel digital version – digitalization made from an analogue 4-channel tape (Doati's personal archive)
Reference: (Doati 1988 ca. - audio)
Duration: 15'46"

WER — Description: WERGO CD
Reference: (WERGO 1988)
Duration: 16'56"

IR-ta — Description: IRCAM's 4-channel tape
Reference: (IRCAM tape) No dating on the box
Duration: ???

IRdig — Description: IRCAM's digitalization from the 4-channel tape (CDrom provided by John Chowning, dated January, 6th 2005) – sampling rate: 48kHz
Reference: (Chowning's personal archive)
Duration: 17'26"

Computational sources

JCdig — Description: Printing of the digital data for the calculation of the structure of the piece.
Dating: from September, 26th 1977 to October, 3rd 1977.
Reference: (Chowning 1977 – dig)
Duration: each section (from T0 MEM to END MEM) shows a different duration

The only real *Autograph* among these sources is what I have called *JCdig*. An autograph is a "manuscript" by the author. These are printed sources (pdf scanned from paper printout of the digital data) from the original digital data used for the synthesis and the calculation of the structure of the piece, and belong to Chowning's personal archive. There are 8 different files dating from September, 27th 1977 to October, 3rd 1977..

Systematic collation and the textual criticism have made possible the reconstruction of the history of Stria's assembling. This has been helped by oral communications (phone calls, e-mails, letters). The actual investigation leads to outline some stages in the history of the piece (following figure). John Chowning has personally added some other steps (between brackets) which could be validated by further research.

Phase	Date	Number of sections	Comments
(1)	1977	?	First experiments included T0, a shorter section END, T163, T377, T466A
		sketches	And a shorter section than the others, with the procedure "event2" in a less developed state: JC renamed it later END.MEM
2	1977	5	Sections T166, T286, T610, T754G
(3)	1977	Creates T466	JC creates T466 – decides to truncate T286 (first truncation: fade out but keeps the data: 252" instead of 325"). Keeps whole T754G
4	1977	6 sections *archetype*	Nominal version T0 - T166 - T286 (252"version, with discontinuity?) - T466 - T610 - T754G (without END)
5	?	6 sections	Alternative sections, according to Mountain's sketches (figure 14): T0, T166, T466, T610, T754, ED (without T286)
6	1977	7 sections IRCAM version	IRCAM version - First performance T0 - T166 - T286 (252"version with discontinuity) - T466 - T610 - T754G - END More or less 17'47", as in Dodge & Jerse's scheme
		antigraph	
7	1977-1978	6 sections CCRMA version	Following the first performance: T166 (similar to T286): JC cut manually the whole section tape T0 - T286 (252" version with discontinuity) - T466 - T610 - T754G (short version) - END
8	1988	6 sections WERGO version *authorized version editorial integrations*	T286: truncated the discontinuity T754G long version Compromise in dynamic range

What philology of music call *sketches*, which at this stage of research are conjectures, are sections which were deleted for the IRCAM version, that is the version for the first performance, which unfortunately has been lost, and appears on the *JCdig* source. The *archetype* (the hypothetical original witness) could be what John Chowning calls the nominal version which has never been publicly performed nor maybe has aver existed (D/A converted?). Wergo version appears to be an *authorized* edition of the piece, realized under the control of Chowning. But the fact that there is a difference in timing in the penultimate section make suspect that it is a version with the so-called *editorial integrations*, which has become authorized in the course of the years. The *Antigraph*, (fr. *Antigraphe*, It. *Antigrafo*) is the source from which someone copy one text. In the case of Stria, the Wergo version could have been 'copied' from the 4-tracks original tapes or from the fifth or sixth step. This requires further analysis.

Variant criticism has identified at least two alternative variants. *Variants* exist when two or more versions co-exist and when their author does not make a choice between the two of them. The philological study of Stria could hypothetical end with the edition of the *authorial level* (Caraci Vela 2005: 221), that is the moment in which the author establish his own true version. This would be the *revision by the author himself*, where he fixes a new and definitive version of his work.

6. Conclusions

This article stresses the importance of founding research and analysis of computer music works on the methods of philology of music. Knowing them, knowing past researches on traditional music, and understanding problems and mistakes of other philologists, will avoid better analyses of musical works. The goals of the philological research could be the preservation of the knowledge, the research in the field of writing techniques, the creation of multimedia scores capable of providing the necessary indications to the complete re-construction of one piece (Bernardini-Vidolin 2005). The same philological work could be extend to other works which already show philological problems of variants. Many computer works show this type of problems because of the adjustment of the technology involved in the production.

One problem I have found is that of the sustainability of computer music. Different researches and articles already stress one basic problem, which is the concept of avoiding concentration on the technology needed today, by creating adequate and timeless notation and transcription methods. Paper is still considered the best support for these purposes. But one real problem is related to the notation. Accepted

and common praxis of preserving, transcribing and notating computer music is far to be reached. Why? I think this is because of the oxymoron of the inner concept of 'written music'. As the Italian ethnomusicologist Francesco Giannattasio writes, this oxymoron relies on the double identity which puts together a visual predicate and an aural phenomenon (Giannattasio 1998, cited in Scaldaferri 2005).[ix] Its writing is therefore partial, made in the light of arbitrary conventions and requires study and direct knowledge for its decoding. Computer music also shows this characteristics and faces the same problem music encounters during the medieval age. Since one cannot write everything, it is necessary to simplify contents and musical parameters and, we can say, to represent the computer music work via a sort of 'pixelization', as pixels do in digital images. The central problem, and maybe the solution rather is which dimension and what one composer or his/her collaborator knows are valid to be preserved. It is for this reason that philologists should register, collect, interview, compare and interpret all sources carrying this type of information. One must accept the imprecision and impossibility to preserve all, decide what to write, and write all what is possible to write. Of course, philologist has to be aware of what each edition and act of analysis carry, since editing consists of series of educated, critically informed choices; which in short, the act of interpretation.

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i Some schools try to reconstitute musical texts in a form which could be as near as possible to the author's intention and its idea of perfection, other trends (such as Joseph Kerman *sketch studies*), study genetics of musical works. The goal of philology could be the restoration, the preservation of the historical knowledge of their realization, the analysis, the critical editing, or the preservation for allowing the performance. The philologist centres its work on the systematic analysis of the sources and explores all the extant documentation. That means that his research could stop at certain point, if he feels that the documentation is not complete or available and his conclusions could be not definitive and open to other future researches. As it is for the text, the work of one philologist develops in time and it is never definitive.

ii The 'variant criticism' replaces the notion of musical work, by the dynamic concept of 'process' and aims at reconstructing the musical work's genesis and life in time and space (Caraci Vela 2005: 64). Rather than reconstruction of its original form, rescuing it from errors and alterations due to the transcription or the process of printing, the variant criticism tries to faithfully and integrally recover its genesis, development and elaborative history" (Brugnolo 1992: 101).

iii These operations are called *textual criticism* (or in French *critique textuelle* or *ecdotique*) and I intend this term in an ample sense of critical investigation of the text and its tradition in order to study its nature, history and transmission in time (Caraci Vela 2005: 210). Philologists of authors have developed their methodologies on relatively "recent" traditional and past music, since for these periods it is easier to manage original materials, sketches, revisions and alternative variants. The interest for variants has already produced important works (for example Joseph Kerman Sketch studies). My need for embracing philology of authors comes not only for the fact that the youngest musical genre made with digital techniques benefits of all these types of documentation, but also because it is already facing a serious sustainability problem: while its history is indeed considered very recent, several technological generations have gone in the meantime. Moreover, during my research I've often found a common fact, that is the composer's or their collaborator's activity was characterized by a certain imprecision in documenting their works due to the urge of creation.

iv This project involved Johannes Goebel, Max Mathews, Patte Wood, CCRMA and (from 1990) ZKM.

v "Yhe computer may work as (assistant) composer. In this case one speaks of algorithmic composition. Alternatively the computer can be used as an instrument; that is, the computer is the place where the sounds are to be generated. Here one speaks of sound synthesis. The computer is sometimes brought on stage to create and manipulate sounds made during performance. Finally, the computer may analyse incoming performance information and "reply" in what is known as interactive composition. The former two possibilities sometimes necessitate a good deal of compilation time; the latter two belong to the category of real-time. More recently, music making has witnessed the extensive use of the networked computer" (from EARS site, www.ears.dmu.ac.uk).

vi One observation about the *Urtext* concept is useful. The *Urtext* edition purports to present the "original" text of the composer, unmediated by the editor. It is intended as the ultimate and definitive version of the author. This is one possibility of the possible results of the philological investigation. But, as James Grier states in the preface to his *The critical editing of music* (Grier 1996, xiii), "even the staunchest proponents of the concept, Giinter Henle and Georg Feder, recognize the necessity for the editor's critical involvement". The philological activity is always an act of criticism. I think the philological investigation of computer music should better stress all different steps of involvement of the composer (composition process), and of his collaborators, avoiding the pretension to offer 'the' real version. An Urtext in the field of computer music during the historical period is rather a non-sense, because composers did not often work independently, and their text were not unmediated.

vii (Article accepted for publication in the Computer Music Journal).

viii Accurate descriptions of each source help to figure out some problems and possible interpretations of the sources. For

exemple, the booklet of the WERGO CD shows a 16'57" duration. The difference of 1 minute between this and the 4–channel version is remarkable.

[ix] A very (but impossible) complete notation would be as if putting in one unique score the musical score of one piece together with measures, tools and type of wood needed for building a string quartet. But these obviously are competence which belong to different professional figures.