The Longevity of Musical Works for Instruments and Electronic Music in the Digital Era

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Abstract

Until the mid-XXth century, classical music relied on a range of stable practices that guaranteed its survival: the written score; the notion of interpretation; lutherie instrument making; oral (in particular) and written teaching traditions; institutions (conservatories, ensembles, orchestras etc.).

The advent of digital technology in musical creation from the 1970s onwards perturbed this landscape, forcing us to rethink these practices, particularly all those concerning the endurance of the new kinds of works that have emerged over the past thirty years – especially works for traditional and electronic instruments. Furthermore, the digital arts - though scarcely established - were soon in danger through the proliferation and fragility of digital standards and formats (cf. the "Digital Dark Age" phenomenon).

If contemporary music has the ambition to prolong the classical music tradition, it must find the techniques, modalities and practices to ensure its survival despite the instability of digital technology.

In the field of music, the issue of archiving became concerned relatively quickly with the preservation of recordings with regard to format, standard or medium etc. On this occasion, it is more a question of describing a specific context of musical creation, namely the Institute for Acoustic/Music Research and Coordination (IRCAM), and how this specificity has sparked questions on archiving far removed from the aforementioned concerns.

Why IRCAM?

The introduction in the 1930s of electricity to musical creation, mainly through tape recording and records, activated a new field of exploration and creation. In 1936, Edgar Varèse led the way with his trials on record manipulation. A certain number of musical works followed: *Imaginary Landscapes* (1942) by John Cage for variable speed record player, an electroacoustic work *Timbres-Durées* (1952) by Olivier Messiaen, *Deux études* (1951) by Pierre Boulez for magnetic tape, *Le Voile d'Orphée* (1953) by Pierre Henry and *Gesang der Jünglinge* (1956) by Karlheinz Stockhausen –a kind of synthesis between electronic music and musique concrète.

The period from 1930-1950 was marked by research and experimentation essentially focused on the tape recorder. The very notion of "musique concrète", which we also owe to Pierre Schaeffer, is inseparable from the tape recorder that was used to collect and mix the sounds of everyday life.

From the 1950s, the most striking phenomenon was the creation of studios. From 1956 to 1958, studios were created in Los Angeles, Munich (Siemens), Warsaw, Moscow and Paris, where Schaeffer created the Groupe de Recherches Musicales (GRM) collective in 1958. These studios were equipped with the basic instrument - the tape recorder - to which other equipment was added: filters (for removing parts of a sound), generators (to create artificial sounds) and reverberators (to extend sounds or give them greater body).

But none of these "instruments", designed mostly for the needs of radio, were directly derived from a musical reflection or necessity, and it is precisely this point that would constitute the difference between the initiative of the institute founded by Pierre Boulez and most other studios created at the time. Similar to architects who had transformed their profession by the use of new materials - Mies van der Rohe or Frank Gehry, for example - Boulez had a project in 1969 allowing engineers and musicians to work together to create technologies that would enable composers to explore the musical vocabulary offered by the new electronic sound materials. In 1970, Georges Pompidou asked Pierre Boulez to propose a musical project - which would be accepted in 1971 - for the future CNAC-GP. It would become IRCAM (Institut de Recherche et Coordination Acoustique/Musique or the Institute for Acoustic/Music Research and Coordination) in 1972.

IRCAM is now one of the largest public research centres in the world dedicated to musical creation and scientific research. A unique site and hub of artistic potential together with scientific and technological innovation, the institute brings together more than one hundred and sixty colleagues.

Tradition and Modernity

The perspective furnished by over thirty years of IRCAM's activities enables the observation that this collaboration between musicians and scientists has created technologies that can be seen as the modern extension of the traditional four practices through the reinterpretation or reformulation of compositional problems:

Composition – Computer-assisted composition extends the possibilities and modalities of musical notation: the creation of instrumental, virtual scores (with the final realisation in concert dependent on the performance), the generation of electronic scores, and controlled improvisation.

Performance – Real time lends a new dimension to musical interpretation and performance through analytical, recognition and synchronisation technologies along with the instrumental performance.

Lutherie, stringed instrument making – Sound synthesis and processing technologies expand the notion of lutherie but with an emphasis traditionally placed more on sound production (synthesis engines) than on control (recording and interpretation of the signal or gesture).

Projection – Sound spatialisation redefines the relationship between the work and the space where it is played by opening up opportunities for virtuosity in the projection, the proliferation of spaces and the new relations between the musical work, the performer and the listener.

The specific nature of works created at IRCAM

Beyond the general framework above, IRCAM has a specific character. After thirty-seven years of existence, the institute has about seven hundred works to its credit, including about a hundred that are subject to regular programming in artistic seasons both in France and abroad. This repertoire is the expression of the institute's musical culture, and already in this capacity, entails a duty of longevity. Spurred on by a number of composers, led by Berio, IRCAM gambled, not on the independence of acoustic composition compared to electroacoustic composition, but rather on the fusion or interaction of the two. In other words, IRCAM embraced the challenge of real time, not for the technological feat it represents, but as a hypothesis of a relationship between electronic writing and the instrumental musical gesture. Hence, a valuable link with the instrumental tradition was maintained. This choice encouraged the creation of a set of technologies to analyse, process, generate and spatialise sound in real time, as well as creating original technologies to synchronize in an automatic mode the interpreter's performance with the electroacoustic sound production. A new musical form emerged from this choice: "mixed works" for instrument(s) and electronic "live" performances.

Thus, with real time, the institute did not choose the record - with its inflexibility and promise of (false) perfection - but rather the constantly renewable interpretation of the work. The performance of the work would henceforth be achieved using a computer program operational for each performance of the work.

Two other factors would also have an impact on the existence of these works, however. The first is of a technological and the second a musical order. In the first case, the constantly changing nature, and even the malleability of computer technology, would impact the work. Technological developments affecting musical lutherie (instrument making) is not new - for example, the mastery of steel enabling the creation of a structure capable of bearing highly tautened strings facilitated the creation of the modern piano - but this process of technological development accelerated with computers. Musically speaking, the work can potentially have, even in its essence, an indeterminate quality. Therefore, to technological malleability is added the malleability of the work's progress – which goes far beyond the traditional notion of interpretation. Consequently, the musical works exists within this context.

The double life of musical works...

What are the different stages in the creation of a "typical" IRCAM work – even if this requires some simplification?

First, the creation of a mixed work requires, of course, a composer, the participation of researchers, but also a computer music designer (RIM). The computer music designer, a profession introduced at IRCAM in the early 1980s into the researcher / composer dialogue, has played a mediatory role between these two worlds – serving as a translator of concepts back and forth and helping free the researcher from focusing on a single musical project in favour of a more interdisciplinary vision. The profession of computer music designer within the Institute in the early 1980s responded to a number of needs: freeing researchers from an excessively exclusive relation with the composer, providing support to composers in production, effecting the translation between the worlds of music and research, and finally, in collaboration with the sound engineer and composer, assuring the performance of the work.

The work is created, therefore, usually following a period of research (during which the work will be focused on one or more fields of investigation) or at the conclusion of a training course (upon completion of the composition and computer music curriculum at IRCAM, for example). The work that precedes creation is occupied with tests, experiments and drafts. At the moment of creation, in most cases one is dealing with a preliminary version of the work. The composer will want make some changes after a first listen, and the computer music designer - who has accompanied the composer throughout his work - will want to review the writing of the computer part to make it more reliable and enhance sound quality. Now suppose that the composer is asked to perform the work in musical seasons and festivals. This is where the double life of works begins, and also where questions concerning archiving arise.

Archiving works: distribution, porting, publishing

Distributing and porting works

The work is presented in the form of a twofold object for the purposes of dissemination – a program (accompanied by a manual) written in a specific computing language and a musical score that refers to the computer part. The performances of the works will be the fruit of the collaboration between the performer and the computer music designer, who, over time, will accrue a kind of auditory memory of the work. After some time, two phenomena occur. First, the fact of playing the work repeatedly will possibly stimulate the desire to change parts of the musical score and / or computer program. In the latter case, the changes will aim to make improvements to the sound quality - whilst, of course, respecting the spirit of the work - or will respond to changes induced by amendments to the score itself. Secondly, the inexorable progress in computing will sooner or later induce the need to carry out an update or "porting" (the transfer of one computer system to another) of the software for the work. If porting involves the transition from one computer language to another, the problem of accurately translating the musical intent of the work arises. However, many things expressed in a computer program are implicit, and this is why it's difficult to retrace the meaning when taking charge of a computer program written by another (or even oneself!). In other words, it is easier to go from the musical idea to the computer realisation than the reverse. In actual fact, therefore, the computer program serves to play the work, but does not deliver a lot of information in musical terms, hence the importance of an alternative approach that will be discussed further when addressing the issue of publishing.

To ensure the dissemination of the most popular works, the IRCAM production department uses the Sidney server (*http://brahms.ircam.fr/sidney/*). For those who wish to play one of the works created at IRCAM, this server brings together technical information, computer programs, samples, videos, instructions and a specific version of the score that refers directly to computer programs. Through a contract with the work's publisher, IRCAM guarantees the maintenance and porting, if necessary, of the work for a period of four years. The Production Department dedicates a man / year exclusively to the issue of porting works to ensure their availability. The maintenance and porting of works is assured by the RIM (computer music design) team at the institute.

Publishing works

Publishing musical works poses other problems. In what form should works be published knowing that technologies are changing rapidly and publishers are poorly equipped culturally, technically and economically for carrying out the regular updates required? For us, the most sustainable way to publish and document a work is through an approach whereby the work is described at the technical level in the form of operating principles and not with reference to a specific technology in existence at a given time. This approach («technology independent») has a number of advantages. It guarantees the longevity

of the work by releasing it from an overly restrictive association with any particular technology of the moment. It presents more clearly the operating principles of the work, thus rendering the musical intention more apparent. It facilitates the porting of works, especially when one must pass from one computer language to another, or one technological system to another. Finally, it makes it easier to study the use of technologies in electroacoustic music. This is the approach adopted by the author of these lines for the publication, for example, by Universal Edition (Austria) of the works *Répons*, *Dialogue de l'ombre double* and *Anthèmes 2* by Pierre Boulez.

So far, the archiving of mixed works requires at least two components:

•The first, independent of a specific technology: the musical score accompanied by technical instructions usually published on paper. Both of these documents are the referents for the work in terms of writing.

•The second, dependent on an operational technology at a given time: a musical score derived from the reference version and adapted to an updated computer program, which is possibly accompanied by audio samples, sound files and, if applicable, gesture capture devices, specified microphones etc.

There remains the question of the musical work's sound quality.

Interpretation and authenticity

Sound quality relates to the following issues. How should the work sound? Which elements will serve as references to faithfully reproduce the sound and musical intent of the mixed work?

An obvious initial element is the recording of the work, ideally with the composer actively involved at the mixing stage. This provides us with a primary idea of the composer's intent for the sound and music.

A second element involves using the opportunities afforded by new multimedia technologies and computer music, which open up another richer field for the preservation of mixed compositions through the simulation of the work's execution. Here the performer, computer music designer, the composer or sound engineer can simulate various acoustic and musical renderings of the work by choosing different recordings (by various performers) of solely the instrumental part of the work. The simulation makes it possible to give an idea of the variability of sound renderings possible through different performances subject to the same computer processing. This approach allows us to put the composer's intention into perspective and to detach ourselves from too literal and narrow a vision of the work provided by the recording alone. We will thus avoid the pitfalls of seeking "authenticity" at all costs!

Let us not forget, in passing, that the piano of Beethoven's era was transformed by the Industrial Revolution with new techniques for the treatment of steel. This development made possible the construction of a steel frame able to bear the tension of steel strings, thus lending power to the piano's tone that Beethoven had never imagined! No doubt computer technology reserves similar surprises that will have an unsuspected impact on music!

So we can see that the preservation and archiving of mixed works must draw upon a variety of approaches, making it possible to both respect the composer's intent whilst still retaining some degree of openness – a course which is the best guarantee of the musical work's lifespan.

Biography

Born in Mexico, **Andrew Gerzso** completed flute and composition studies at the New England Conservatory in Boston, the California Institute of the Arts in Los Angeles, and subsequently at the Royal Conservatory in The Hague.

Joining IRCAM in 1977 as a researcher, he has held several positions in the fields of scientific research, musical research and creation. In 1993, he founded Forum IRCAM (an IRCAM software users group) and the performance division in 2000 (a multidisciplinary project designed for the dissemination of IRCAM technologies in live performing arts fields). Since 2012, he has been the Director of Educational and Cultural Action. He coordinates the European Ulysses project (2012-2016) for the creation and dissemination of works by young composers.

From 1980 to 1995, he collaborated with Pierre Boulez on annual seminars at the Collège de France as well as on the electroacoustic production of *Répons* (1981-2011), *Dialogue de l'ombre double* (1985), *Explosante-fixe* (1991-1995) and *Anthèmes 2* (1997). The recordings at Deutsche Grammophon of *Explosante-fixe* won a Grammy award in the United States in 1996.

Andrew Gerzso has published articles on computer music in journals such as *La Recherche, Pour la Science, Scientific American, Leonardo and Contemporary Music Review*.