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The IPEM-archive Conservation and Digitalization Project

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Abstract

The IPEM-archive conservation and digitalization project aims at digitalizing the IPEM tape archive which consists of music produced, mainly, between 1963 and 1987. This period covers the area of the international institutional avant-garde in Flanders, Belgium. The archive contains a collection of electro-acoustic music on tapes, as well as related documents such as photographs, written texts, videos, etc. . . . Associated with the digitalization of the sound archive is a dissemination project which aims at opening the archive for all interested users. The dissemination deals with the development of a simple, efficient and user-friendly database as backbone for a music-on-demand system and future mass-storage technology. The database in its current version can be consulted at http://www.ipem.rug.ac.be/Archive.

1 Introduction

The Institute for Psychoacoustics and Electronic Music, of the University of Ghent, Belgium, has a collection of music on tapes which originate from the 1960ies, 1970ies, and 1980ies. This collection, together with related documents such as photographs, videos, written sources, and concert brochures is historically important because it covers the area of the international and institutional musical avant-garde, with a focus on the electroacoustic medium in the area of Flanders and Belgium. The tape archive is a testimony of a generation of composers fascinated by the opportunities offered by the new mass-media and communication technologies. The IPEM-archive conservation project aims at (i) digitalizing the archived sound tapes, (ii) disseminating the results using advanced distribution technologies. In what follows we give a brief introduction to the origin of the collection, its content, the digitalization strategy, and the database and dissemination project.

2 Origins of the archive

To understand the origin of the IPEM-archive, it is necessary to give a brief overview of the history of the institutional activities between 1963 and 1987. IPEM was founded in 1963, as a joint venture between the Belgian Radio and Television broadcasting company (BRT) and Ghent University (at that time called: "Rijksuniversiteit Gent"). The institute was first located in an electronics laboratory of the university, headed at the time by H. Vuylsteke. The academic interest was motivated by problems of generating new sounds, new tuning systems, and scales by electronic means. Hence the development of electric organs and control unit generators at the time. The interest of the broadcasting company was to promote the new music and, above all, to use this know-how for radiophonic applications. The collaboration resulted in the erection of a production studio for electroacoustic music whose international reputation as an artistic center was soon established. Of course, this initiative was not unique in the sense that similar collaboration between the academic world and the powerful broadcasting companies had been undertaken before in Paris, Cologne and Milan. And many other initiatives at different other places all over the world would follow soon.

Soon after its erection, IPEM was transferred from the electronics laboratory to the musicology department headed by J.L. Broeckx. From then on, the institute continued to develop as a production studio for electroacoustic music and in addition, it became a documentation and study center for contemporary music. The results, since 1966, were published in yearbooks which, in collaboration with the Institute for Sonology of the University of Utrecht, now at the Conservatory of The Hague, The Netherlands, resulted in the Journal of New Music Research, formerly called "Interface." This journal was published for the first time by Swets & Zeitlinger in 1972. The music production at IPEM was guided by the composers L. De Meester, L. Goethals and K. Goeyvaerts, while the technical aspects were handled by W. Landrieu. The

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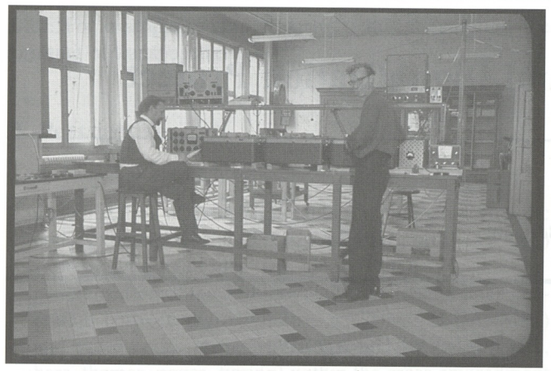


Fig. 1. The IPEM studio in the early 1960s with L. Goethals and D. van de Woestijne.

musicological section was headed by H. Sabbe. The joint venture between university and the broadcasting company implied that the composers were employed by the company as music producers, while the research and technical staff was employed by the university.

In the pioneering years, the studio was transformed from a classical manual electronic studio to a studio based on semi-automated voltage controlled audio equipment. Figure 1 shows the studio in the very early stage of its development. A number of new instruments such as various sequencers, a melo-writer and samplers were designed and built. Some of these instruments have recently been transferred in loan to the Music Instruments Museum (MIM) in Brussels. Yet many instruments built during this pioneering period don't exist any longer. Components of old instruments were often used to build new instruments and schemas no longer exist. This makes the restoration of old electronic equipment for music a difficult enterprise. (The IPEM conservation project does not consider aspects of restoration of old equipment.)

In the 1960s, 1970s, and beginning of the 1980s, IPEM flourished as a production center for avant-garde music, but owing to its limited technical staff and limited sources, it lost connection with new developments in the domain of digital sound synthesis. IPEM could no longer play any leading role in this area and, as many other similar institutes in Europe, it became a consumer of the Japanese music industry production.

By the end of the 1980s the broadcasting company lost its interest in a studio for electroacoustic music and the contract with the university was terminated in 1987. Since that time, IPEM became part of the Musicology Section of the Department of Art, Music and Theatre Sciences of the Faculty of Letters and Philosophy at the University Ghent. It developed into a pioneering laboratory for cognitive musicology, with a focus on different aspects of musical content processing (http://www.ipem.rug.ac.be).

In order to get a flavor of what the collection is about, it is of interest to note that the erection of the institutions for musical avant-garde in the 1960s runs parallel with the development of the popular music industry (Veitl, 1997; Pichevin, 1997). As known, at that time, the institutional electro-acoustic music production had nothing to do with music industry. In fact, it was characterized by an attitude of (i) *historicism*, or the belief that avant-garde music was the logical continuation of music history after the Second World War, (ii) an *autonomous* legitimated status, or the belief that music production was justified by the institution and not by the market or audience, and (iii) a radical *non-commercial* attitude justified by its institutional approach and situation within a scientific context (Born, 1995; Leman, 2000a, 2000b). Nevertheless, the institute functioned as an obligatory and very often also as an educational location for a generation of Flemish, Belgian, and foreign composers.

3 Archive content

From a quantitative point of view, the IPEM studio, with a total of about 470 works produced between 1963 and 1987, was one of the 4 most productive studios in Europe, next to EMS Stockholm (767 works), INA GRM, Paris (751 works) and Sonologie Utrecht and Den Haag (495 works) (Hein & Seelig, 1996).

Altogether the archive consists of approximately 1000 hours of music besides a library of concrete sounds assembled by composer L. De Meester. Most of the tapes contain electro-acoustic music but a part is also concert recordings of avant-garde music. We can divide the archive in two parts: 1000 tapes which form together the actual IPEM-archive and 800 tapes from De Meester (most of it his own compositions and a collection of samples). About 50% of the recordings are electro-acoustic music, the others are recordings of concerts of *new music*, often organized by IPEM in collaboration with the Belgian Radio and Television broadcasting company.

Some 92 composers worked at IPEM, among which 39 Belgian and 53 foreign. The Belgian composers were:

Aertgeerts, Pierre Bartholomée, Paul Beelaerts, André van Belle, Guy van Belle, Peter Beyls, Etienne Beyst, Rudi Blondia, Philippe Boesmans, Boudewijn Buckinx, Patrick de Clerck, Frederic De Vreese, Louis Debras, George de Decker, Didier Gazelle, Frans Geysen, Lucien Goethals, Karel Goeyvaerts, Yves Knockaert, Joris de Laet, Eugeen Lievens, Mia Loose, Louis de Meester, Paul-Baudouin Michel, Frank Nuyts, Daniel Pletinckx, Henri Pousseur, Godfried-Willem Raes, Norbert Rosseau, Raoul de Smet, Raymond van Soens, Fernand Vandenbogaerde, Maurice Verstuyft, Roger Vossenaar, Emmanuel van Weerst, Ward Weis, David van de Woestijne.

The Foreign composers were:

Benno Ammann (Switserland), Jorge Arriagada (Chili), Erik Belgum (USA), José Berghmans (Belgium/France), Brian Bevelander (USA), Dominic Boreham (England), George Bouché (France), Joanna Bruzdowicz (Poland/France), Roland Cahen (France), Lelio Camilieri (Italy), Tony van Campen (The Netherlands), Henri Chopin (France), Micheline Coulombe Saint-Marcoux (Canada), René Defossez (France), Yann Diéderichs (France), Liliane Donskoy (France), Patrick Dorobisz (Poland/France), Jacobo Durán Loriga (Spain), John Elmsly (New Zealand), Leandro Espinosa (Mexico), Lionel Filippi (Argentinia), Patrick Fleury (France), Henry Fourès (France), Robin Heifetz (USA), Luc Houtkamp (The Netherlands), Martin Davorin Jagodic (Croatia), Philippe Jubard (France), Erhard Karkoschka (Germany), László Király (Hungary), Eduardo Kusnir (Argentinia), Nicole Lachartre (France), Helmut Lachenmann (Germany), Ton de Leeuw (The Netherlands), Jacques Lejeune (France), Bruno Liberda (Austria), Diego Luzuriaga (Ecuador), Grégoire Lyon (France), Ricardo Mandolini (Italy), Luis Marques, Wolfgang Meyer-Tormin, Stephen Montague (USA), Octavian Nemescu (Rumania), Rodney Oakes (USA), Michael Obst (Germany), John F. Paul (USA), Jorge Peixinho (Portugal), Eduardo Polonio (Spain), Douglas Quin (USA), Eric Ross (USA), Eugeniusz Rudnik (Poland), Peter Schuback (Sweden), Martin Schwarzenlander (Fischer) (Austria), Lidia Zielinska (Poland).

The complete list of composers whose pieces have been recorded at the IPEM/BRT-concerts, although not produced in the IPEM studio, is still under construction.

4 Digitalization and conservation

In the IPEM-archive conservation project, priority is given to the tape archive. Fortunately, most of the archive is in a good shape, due to the use of professional quality magnetic tapes (AGFA, Per 555 Professional or BASF LGR 30 P) and good quality recording (Telefunken). Restoration of tapes in most cases has not been necessary, and audio restoration (in particular noise reduction) is considered in some cases only after sec digitalization in two exemplars on CD. The Samplitude commercial software (44100 Hz, 16 bits) and a good quality sound card (ARC 88) are used. A collection of photographs, written documents and letters, program brochures and publicity material will be handled in a second phase of the project.

5 Database development and dissemination

Apart from the pure conservation aspect, the project disseminates the conservation results using advanced distribution technologies with a semi-automated CD-on-demand facility. This was realized after the first year of the project. The digitalized music pieces are textual documented using a relational database which can be consulted via internet at http://www.ipem.rug.ac.be/Archive. Users of this database can compile and order their CD on-line. The experiment has been set up in agreement with SABAM, the Belgium Author Rights Association.

An important aspect of the project concerns the easy and efficient follow-up and maintenance after the termination of the project. For that reason, we took the option to build an efficient and user-friendly relational database at low cost. Music, and multimedia in general, however, can give rise to conceptual problems when it comes to mass storage and certainly when relational databases are used. This is because the dynamic nature of a musical product can be very difficult to fit in a static structure of a relational database which consists, basically, of rows and columns. A thorough analysis at the end of this project will clarify whether a relational database system might be really sufficient or whether an object-oriented approach should be used in the future. What follows here is a brief description of the adopted conceptual structures of the relational database which is currently used.

The most important entities in our archive are pieces containing sound data such as musical audio, voices, noise, . . . Each piece has a name and often there are multiple versions made by the same composer(s). In certain cases, a piece consists of other pieces which belong together as if they were one piece. We divided the entity *piece* into two abstract entities: *work* and *version*. A work contains the information that is common to all versions of a certain piece. The entity *version* contains more specific data of the piece or recording. Each version is related to one and only one work and in reverse each work is related to at least one version (aggregation) (Fig. 2). Both entities have their own specific attributes and relations. The entity *work* has e.g., the attribute *title* and *commissioner*, the entity *version* has its own properties such as *duration*, *date of composition*, *score*, . . .

Each *version* is assigned to the attribute *type* and *genre*. The attribute *type* holds information concerning the recording and the attribute *genre* specifies information concerning the content of the musical recording. The attributes may be relevant for content description in the context of MPEG-7/21 coding.

To increase the comfort of questioning the database, we had to take into account that not everybody knows the correct title of the composition or uses the desired language in which the title of the composition is originally expressed. For that reason, we decided to store two titles of each piece, in particular: the original title and an English translation. The original title is the name the piece received from its composer(s) and it can be in any language. The English translation is chosen for practical reasons because English is the most spread language on the internet.

If we want to represent a piece that consists of other pieces, we need some kind of a hierarchical structure. To allow hierarchical structures, we relate a work to a couple consisting of work and version. The related couple can be viewed as the parent of a particular work (Fig. 2, in UML notation). The parent is in fact an abstract piece which expresses a relationship between different pieces. The database structure thus allows relationships between instances of the same entity. In what follows, all of the following schemas that express such relationships are in UML (Unified Modeling Language). The Unified Modeling Language is the industry standard language for specifying, visualizing, constructing, and documenting the artifacts of software systems.

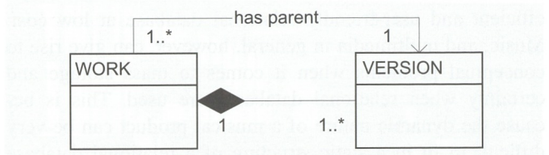


Fig. 2. Work-Version relationship.

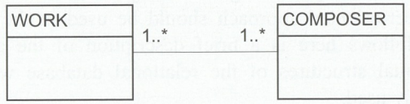


Fig. 3. Work-Composer relationship.

Further documentation about a particular piece is stored in entities which contain information about: composer's biography, instruments, performers, orchestras, conductors, studios and audiotapes. These items are all related (directly or indirectly) to a version or a work. These data attributes may contain links to photographs, scanned text files, video, film fragments, etc. . . .

The entity *composer* is the only entity which is directly related to the entity *work* and hence, indirectly to the entity *version* because the relation work-version is a one-to-many relation (Fig. 3). This is done because we consider a musical piece as a creation of one or more composers. This approach implies that it is impossible to have different versions of a work made by different composers. If the composer is not known, the instance "unknown" for composer should be created. This situation, however, never occurs in the IPEM database since all composers are known.

For each version, we must know what instrumentation is used. In contrast to the previous mentioned composer-problem, we allow that different versions of the same work are created with different instruments or that the instruments are played by different performers. (The instrument can be anything that produces sound.) We also deal with the limitation that not every instrument is or can be played by a performer or that this information is available or will be available in the future. Moreover it is possible that the same performer plays more than one instrument in the same piece. All this means that we have a many-to-many relationship between the entities *version* and *instrument* and also a many-to-many relationship between the entities *instrument* and *performer*. A performer is only added to the database if he plays in at least one performance. This also means that an instance of the entity *performer* must be linked to at least one instrument and at least one musical piece (Fig. 4).

Certain pieces are performed by an orchestra or an ensemble. We don't make a distinction between ensembles and orchestras. A version of a work can be performed by maximum one orchestra, but an orchestra can perform different versions of a (different) work(s). So here we have a many-to-one relationship between the entities *version* and

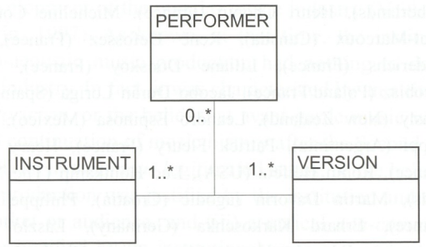


Fig. 4. Instrument-Performer-Version relationship.

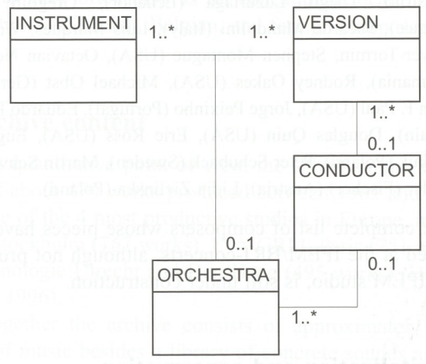


Fig. 5. Instrument-Version-Conductor-Orchestra relationship.

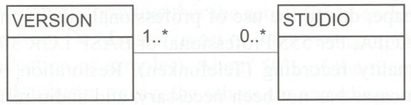


Fig. 6. Version-Studio relationship.

orchestra. As the entity *performer*, the entity *orchestra* is also related to at least one instance of the entity *instrument*. The role of the entities *performer* and *orchestra* is the same in the database because an orchestra can be viewed as a special performer who plays multiple instruments, and not necessarily the same instruments. Nevertheless, we keep both entities separated because an orchestra consists in fact of several performers so both entities can have different properties (Fig. 5). In this concept, we also have the possibility that there is (maximum) one conductor (who is independent from an orchestra), so there's a many-to-one relationship between version and conductor (Fig. 5).

Finally we also keep track of the history of each piece. We want to know in which studios the piece was created, recorded, edited, . . . etc. However not every piece in our archive can be related to a studio. So we have a many-to-many relationship between the entities *studio* and *version* (Fig. 6).

This analysis shows that our archiving problem can be solved using a relational database system. The need for polymorphism of the entities *work* and *version* (i.e., the parent property) can be easily fitted into a relational database structure by adding two extra attributes to the entity *work*. One attribute refers to the parent entity *work* and the other attribute to the parent entity *version*. A disadvantage is that there are a lot of many-to-many relationships, so we will be forced to use link tables to hold the relationships.

An internet-connection to the database is provided by an ODBC-interface. ODBC stands for open database connectivity and is a platform independent application programming interface for database access. The communication with the database is in SQL (Structured Query Language). SQL is the official standard language for dealing with relational systems. Users can select, enter values or names in different fields on the internet-site. Our interface then generates the appropriate SQL-statement and sends it to the database which returns the matching results of the query (if any).

The above concept is specific for the IPEM-archive. It allows an efficient search and retrieval of information using relatively simple methods. The database interface allows users to order their own CD on-line. The production of a CD is currently handled in a semi-automated way.

6 Conclusion

The practical goals of the project are: (i) the digitalization of all tapes, archiving, and (if necessary and possible) restoration of tapes and equipment, and (ii) dissemination of the results by building a database and allowing internet access on a CD-on demand basis. Related research goals, though not handled in this paper, concern the development of content description tools and automatic audio feature extraction tools within the context of MPEG-7/21 coding.

Acknowledgement

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