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Authenticity Issue in Performing Arts using Live Electronics

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***Abstract* — The CASPAR project is an European project devoted to the preservation of digitally encoded information. In the course of the project, the contemporary arts testbed aims at building a preservation framework for contemporary arts using electronic devices, and particularly for performing arts (music, dance, video installations...). The project addresses very specific issues as digital rights, or authenticity. In this paper, we address the issue of authenticity and give an overview of our approach.**

The approach of authenticity in CASPAR is based on provenance, that is to say, addressing the question of who, when, and why. Implementing this approach in the field of contemporary artistic production including electronic devices is not a trivial task. In CASPAR we intend to study the production process, and extract from the elements and traces left by the production process key elements for future assessment of authenticity.

We will present some "case studies" in order to explain our approach. Notably, in the production of the *String Quartet* by Florence Baschet, the electronic processes are evaluated towards their robustness against changes of instrumentist, changes of tempo, changes in the hardware settings (particularly, removal of a specific sensor). We will show the interest of this evaluation for authenticity preservation issues, and give an insight on the tools we intend to develop, aiming at proving, beyond authentication of provenance, authentication of the results that can be assessed towards author's intentions.

I. Introduction

Many researchers, users and composers, especially in electronic studios, are now aware of the fragility of pieces using electronics [6]. As Nicola Bernardini and Alvise Vidolin noticed it, the situation is quite paradoxical [1]: "real-time/performed electro-acoustic music (also known as live electro-acoustic music) is currently facing a serious sustainability problem: while its production is indeed considered very recent from the music history point of view, several technological generations and revolutions have gone by in the meantime".

This sentence may be applied to all artistic works using electronics, not only to electro-acoustic music. Being able to reperform correctly the most important pieces previously created in the studios of institutions [2] becomes important for them, since they all try to find a balance between the constitution of a repertoire and the promotion of creation [7], [5].

Whereas preservation of music has been studied and practiced for many years on a wide range from manuscripts to instruments, improving the sustainability of live electronics pieces has recently become a growing issue. Several recent publications (in 2004 and 2005, [4]) show that many institutions feel concerned. A European project named Caspar[1] (Cultural, Artistic, and Scientific Knowledge for Preservation, Access and Retrieval) has been launched in 2006, gathering 17 partners, and among them IRCAM, on the general topic of preservation of digital data. This project intends to address three different communities, by developing three different testbeds: one for Scientific knowledge, one for Cultural Heritage, and one for Performing Arts.

A major concern in the development of the testbed for Performing Arts is the issue of authenticity. As some parts of the underlying system have chances to become obsolete, there are two main ways of preservation. The first is to maintain the systems, hardware as well as software, in their initial state. The second is to envision different forms of reimplementation, that range from the emulation of hardware and software to virtualization, that is, the expression of the underlying process in independent terms from their current implementation, through porting and migration of data as well as processes.

In the event that reimplementation becomes the only chance of preservation, the major concern is that of the authenticity of the result [3], that is to say, to guarantee that the results will be conforming in some way to the intentions of the creator.

II. Authenticity Issue in Preservation

A. Definition on the basis of international projects

Considering the state of the art on the question of digital preservation from a conceptual point of view, authenticity should be considered "as a preliminary and central requirement" as clearly investigated in many international projects, namely InterPARES 1 and 2 [4] (www.interpares.org) whose main focus has been the long-term preservation of *authentic digital records* not only in the e-government environment, but also for scientific and cultural domains. The project in its second phase (2002-2006) has identified that the main role and the main function is that played by the *trusted custodian of society's records* who should act as "as a neutral third party, i.e., demonstrate that s/he has no stake in the

[1] One may refer to the official Website of the project: http://www.casparpreserves.eu

content of the records and no reason to alter records under his/her custody, and that s/he will not allow anybody to alter the records either accidentally or on purpose" and "establish a trusted preservation system that is capable of ensuring that accurate and authentic copies of the creator's records are acquired and preserved".

The relevance and the centrality of the authenticity concepts (and its related consequences in the application environments) are clearly illustrated by the list of the responsibilities identified for the digital repositories in the international and national projects and developments (see also the international recommendations for digital repository as approved in February 2007 by RLG-*NARA (Trustworthy Repositories Audit & Certification: Criteria and Checklist*):

- assess the *authenticity* of the records of the creator by monitoring their creation and maintenance,
- produce an *authentic copy* of them after having acquired them in the format last used by the creator as its own records,
- migrate *a second authentic copy* to the trusted preservation system of the archives (always keeping the copy of the format transferred by the creator).

Considering the question as a *quaestio de facto* defining and assessing authenticity are complex tasks and imply both a number of theoretical features and of operational and technical activities, a clear definition of roles involved and recommendations and policies for building trusted repositories and running the custodial function. First of all, it is necessary to define the key conceptual components

B. The key conceptual components

Giving the assumption that authenticity would mean that a digital object keeps in time its identity and integrity (what it purports to be and that is free from tampering or corruption), some key-difficulties arise within a digital environment. Authenticity cannot be given once and for ever within a digital environment. This point implies that a clear distinction should be made between the authenticity of the preserved record/resource (not necessarily the same objects as those originally deposited) and the procedure of validating the same object, that is only a part of the first and more general process (to assure that a component of the information, i.e. the data object bit sequence will be kept).

One of the main accepted assumption at international level implies that a digital custodian will have always to maintain authentic copies, or even better authentic components required for ensuring the capability (all the information required, all tracks of handling…) for a trustworthiness performing of the object/record/resource.

It is clear that the authenticity cannot be a quality of the object/record/resource in itself but a complex process and its complex documentation.

C. The authenticity within the chain of preservation

The authenticity of electronic resources is threatened whenever they are transmitted across space (i.e., when sent to an address or between systems or applications) or time (i.e., either when they are in storage, or when the hardware or software used to store, process, or communicate them is updated or replaced)

Therefore, the preserver's inference of the authenticity of electronic resources must be supported by evidence (provided in association with the resources through its documentation that is by tracing its history of various migration and treatments occurred over time) that they have been maintained using technologies and administrative procedures that either guarantee their continuing identity and integrity or at least minimize risks of change from the time the resources were first set aside to the point at which they are subsequently accessed.

In conclusion, **authenticity** is never limited to the resource itself, but it is **extended to the information/document/record system**, thus to the concept of **reliability**, that is to the control over the information/document/record creation process and custody (the verification of the authenticity of a resource is related to the reliability of the system/resource and this reliability should be proved that is fully documented with reference both to the creation process and to the chain of preservation).

If the resource system is reliable and accurate, authenticity may be determined with greater certainty and less effort.

To check a resource for its authenticity, it is necessary to verify its integrity and identity; to verify its trustworthiness it is necessary to prove or at least to document the presumption of its reliability and accuracy. In general the resource/record has to be "carefully managed throughout its entire existence to ensure that it is accessible and readable over time with its form, content, and relationships in tact to the extent necessary for its continuing trustworthiness as records" (from the InterPARES report "The chain of preservation model").

It is also widely recognized that management and preservation of digital resources must include a comprehensive understanding of all phases or stages of their existence, "from the time they are generated, through their maintenance by their creator, and during their appraisal, disposition, and long-term preservation as authentic memorials of the actions and matters of which they are a part. The MCP model has, then, within its scope all these phases or stages in the life of electronic records and all the activities and important, specific actions that must be undertaken to ensure that electronic records are properly generated in the first instance, maintain their integrity over time, and can be reproduced at any time throughout their existence. As well, it characterizes the data and information that must be gathered, stored, and utilized during the various processes of management all along the life cycle. The MCP model also depicts the constraints or controls on the various activities and actions it characterizes" (*ibidem*).

It is relevant to stress that all the phases and the steps are interconnected to make the preservation feasible and successful.

III. AUTHENTICTY FROM THE MUSICAL POINT OF VIEW

A. A tentative definition

Trying to build a definition of authenticity from the musical point of view is not a trivial task. There are many possible definitions of authenticity of performance, ranging from the simple attribution of provenance to the modern concepts of historically informed performance,

that has been subject to controversial statements and criticism. We will not try to give here an additional, probably useless definition of authenticity, but merely will try to establish a list of conditions that should be fulfilled in order to complete the operations of judgment on authenticity in the future. In the course of the CASPAR project, we will then try to fulfill these conditions by identifying the facts and documents needed, and ensuring permanent access to these documents for the future generations.

At this stage of the development, we identify the main issues in judgment of authenticity are as follows:

- identification of provenance,
- recording the intentions of the creator,
- means and methods envisioned to assess results towards intentions.

B. Identification of provenance

In contemporary music using electronics, identification of provenance is quite different than in traditional music production. In traditional music production, the provenance for the music score, that records the expression of the music and that is generally considered sufficient for a performance of the work, is the composer himself, even if there are subsequent actors such as the copyist or the publisher that could have introduced modifications. These modifications could be more or less identified and corrected in subsequent publishing by reporting to the original manuscript (when available…).

In contemporary music production, the electronic part is the result of a complex process involving for example in addition to the composer himself, the "musical assistant" (the role of this actor being well defined in Ircam, but possibly less accurate in other institutions), even the developers of specific software packages that are implemented or tuned specifically for one piece. It could be also the case that the sound engineer responsible for example for the setting up of the stage, and particularly of speakers, could make interventions that imply modifications in the implementation of electronic processes. The specificities of the electronic processes could be recorded, or not recorded, in the music score, this operation being generally done by the musical assistant, as for example with the important work completed at Ircam by Andrew Gerzso for *Anthèmes II* by Pierre Boulez. This work consisted in finding representations as independent as possible from technical implementation for signal processing modules. His work concerns the score and the technical documentation released by Universal Editions as well.

He applied his approach to three kinds of electronic modules :

- Sound processing modules: Gerzso's approach is based on basic and standard modules, considered as universally known and scientifically described in a unique way. For instance: frequency shifters, comb filters, ring modulators.
- Spatialization modules: with the help of Olivier Warusfel (Head Researcher of IRCAM Room Acoustics Team), Andrew Gerzso has identified rather universal descriptors, which values can be induced from current patches. For instance: source direction, level of direct source, level of first reflection.
- Score-following modules: nothing is precised in Gerzso's documentation, except the features of what the module should be able to do.

In this complex process, the different roles of the different actors are difficult to identify, and there is no precise definition of the limits of their respective roles. Nevertheless, a precise identification of provenance should be made available for future generations, that is to say, at least, actors, with their precise roles, and whch part of the final electronic documents they have contributed to.

C. Recording the intentions of the composer

It should be noticed that during centuries, the music score has been able to record the intentions of the composer, not in terms of features of the desired result, but in terms of specifications of musical gestures that have to be performed in order to achieve the desired result. The description of the process – that is known as the expression of the music in FRBR terms - is *prescriptive* and not *descriptive*. To our knowledge, the first attempt to describe the desired result in terms of feature, and using numerical values, and a technical device specifically designed for assessing that feature, was completed by the metronome from Maelzel, that was designed in order to solve the problem of tempo.

The electronic processes are designed today not in term of specifications of musical gestures, but merely in terms of technical implementation, that can generally not be considered as really representative of the intentions of the composer. For example, some electronic parts of *Jupiter* by Philippe Manoury have been implemented in a very different manner, by using completely different technologies, in two subsequent versions of the work. For this reason, an analysis of the intentions that will be based only on the actual implementation of the electronic process will probably have some chances to fail, with probably a few exceptions, as for example in the process of spatialization, that have been achieved by composer not using electronic process (*Mobiles* by Marc André Dalbavie…). As can be seen from the example of *Anthèmes II,* description of spatialization can be given in terms of universal descriptors (source direction, level of direct source, level of first reflection), which values can be induced from current implementation. But for some processes, such as score following, there is no such description.

D. The means and methods envisioned to assess results towards intentions

In order to achieve the assessment of results towards intentions, one possible approach should be based on an analysis of the features of the desired result, merely than an analysis of the technical specifications, or of the prescriptions achieved by the composer through their technological implementation (in Ircam by the musical assistant).

Fortunately, technology gives us a number of means for recording features of the desired result, ranging from the recording of excerpts, to description of results using signal processing based processes. As an example, it could be used a description of the desired result in terms of

granularity, spectral description, envelope and so on, that could be implemented in terms of MPEG 7 descriptions.

Implementing this approach for recording intentions of the composer implies several consequences on the production process itself, that we intend to study and implement (at least partially) in the course of the CASPAR project.

IV. A Case Study : A *String Quartet* by Florence Baschet

A. The technical setup

The *String Quartett* that is the subject of this study is an "augmented" string quartett. Each instrumentist is equiped with specific sensors, able to trace the movement of the right arm, and the pressure of the bow. The electronic implementation is based on Hidden Markov models, able to analyze the inputs from sensors, based on specific training using simple musical gestures (spiccato…) or more sophisticated musical events, composed of several musical gesture.

B. Intentions of the composer

Briefly speaking, the intention of the composer in this *Quartett* is to become able to trigger specific musical events, generated electronically, when a specific gesture or musical event is recognized by the electronic process. It shall be noticed that, in the intentions of the composer, this recognition should be independent from the instrumentist, from the pitch (and notably from the change of instrument, from violin to alto or cello), or even from the tempo.

C. Technical implementation and the evaluation of robustness

One of the main goals of the production process is to evaluate the robustness of the electronic implementation towards the variations envisioned by the composer, that is, independence from the instrumentist, independence from the instrument, independence from the tempo. It should be noticed that these cases, considered as use cases, are of interest for a preservation framework like CASPAR, where these cases have to be envisioned.

V. Extending the Robustness to Authenticity

Extending the approach of robustness to evaluation of authenticity causes some problems. Notably, evaluation of robustness is made accordingly to the evaluation made during the production process by the composer himself. It should be evident that, in order to extend evaluation of robustness to authenticity evaluation, we shall envision that evaluation without any intervention of the composer, and, to this end, we need to identify, during the production process, the facts and elements that can be recorded in order to describe the features of the desired result, with their limits and acceptable range (in much the same way that composers have indicated metronomic tempo for their works, with some acceptable limits…). We could study notably, how the results could be described using numerical descriptors, and how an acceptable range for these descriptions could be specified by the composer. We could try to apply this method, for example, to the evaluation of audio synthesis.

It should be noticed that using this approach, instead of simply using the audio recording, has the advantage to enable an evaluation of the *significant* feature that is to be described.

VI. Key findings and future work

We have shown with this study the main problems that are to be solved in order to guarantee a certain form of authenticity in preservation of live music with electronics.

First, an identification of the different actors, their roles, and an identification of the precise parts of the work they have contributed to is necessary.

Second, it should be studied how the intentions of the composer could be expressed in general terms, and for which kind of electronic process, such as for spatialization, and it shall be studied if the approach followed by Andrew Gerzso for *Anthèmes II* is applicable to other works. We should identify electronic processes where this approach could be applied, and how this could be integrated in the music score, and what kind of notation should be developed. Finally, these notations should be proposed to the music community.

Third, it should be identified which kind of features could be described in terms of descriptor, and how these descriptors can be used to define a certain range of *acceptable results* from his own point of view. Notation of these features, with the appropriate range, should also be integrated in the score, in a form very much like the metronomic tempo indications.

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