

The CASPAR Artistic testbed

A precise case from artistic production: the preservation of FM Synthesis

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Overview

- Context
 - Music production with digital components since the 70s
 - CASPAR and OAIS: a formal approach
- An example
 - *Diadèmes* by M.A Dalbavie (1986)
 - The FM Synthesis issue
- Assessing authenticity
 - The composer's point of view
 - Other example of use of FM Synthesis : *Madonna of Winter and Spring* by Jonathan Harvey (1986)
- Authenticity in the CASPAR framework
 - Authenticity as a process
 - Examples of authenticity processes

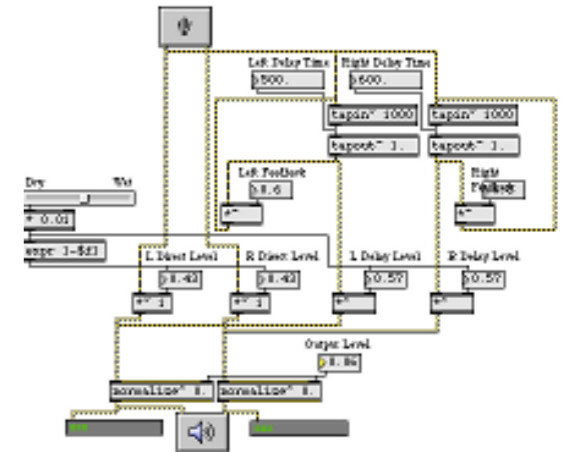
Historical context

- IRCAM: musical production since the 70s
- Development of audio/music digital processors:
 - 4A, 4X.... (Hardware)
 - Max/MSP (Software, interactive music)
 - Audiosculpt, Modalys, OpenMusic... (software)
- Musical creation using audio digital processing
 - 450 works created since 1977
- Problem of preservation well-identified since the middle of the 80s, but no formal approach
 - Production of documentation (from 80s to 2000 - on paper)
 - Since 2002: digital storage of documentation and digital objects (Mustica)



Context: aims and goals

- To be able to REPERFORM the works
 - Not simply record audio files!
 - To make possible interactions between human performers and digital processes:
 - Preserve the processes themselves, not the results
 - Which processes?
 - Digital instruments (audio effects, for instance reverberation, harmonizers...)
 - Encoded as “softwares”



Context: CASPAR and OAIS

- OAIS: a formal approach of preservation
 - provides the concepts needed by non-archival organizations to be effective participants in the preservation process;
 - provides a framework for the understanding and increased awareness of archival concepts needed for Long Term digital information preservation and access;
 - provides a basis that may be expanded
- CASPAR: implements an OAIS compliant framework

An example: *Diadèmes* by M.A. Dalbavie



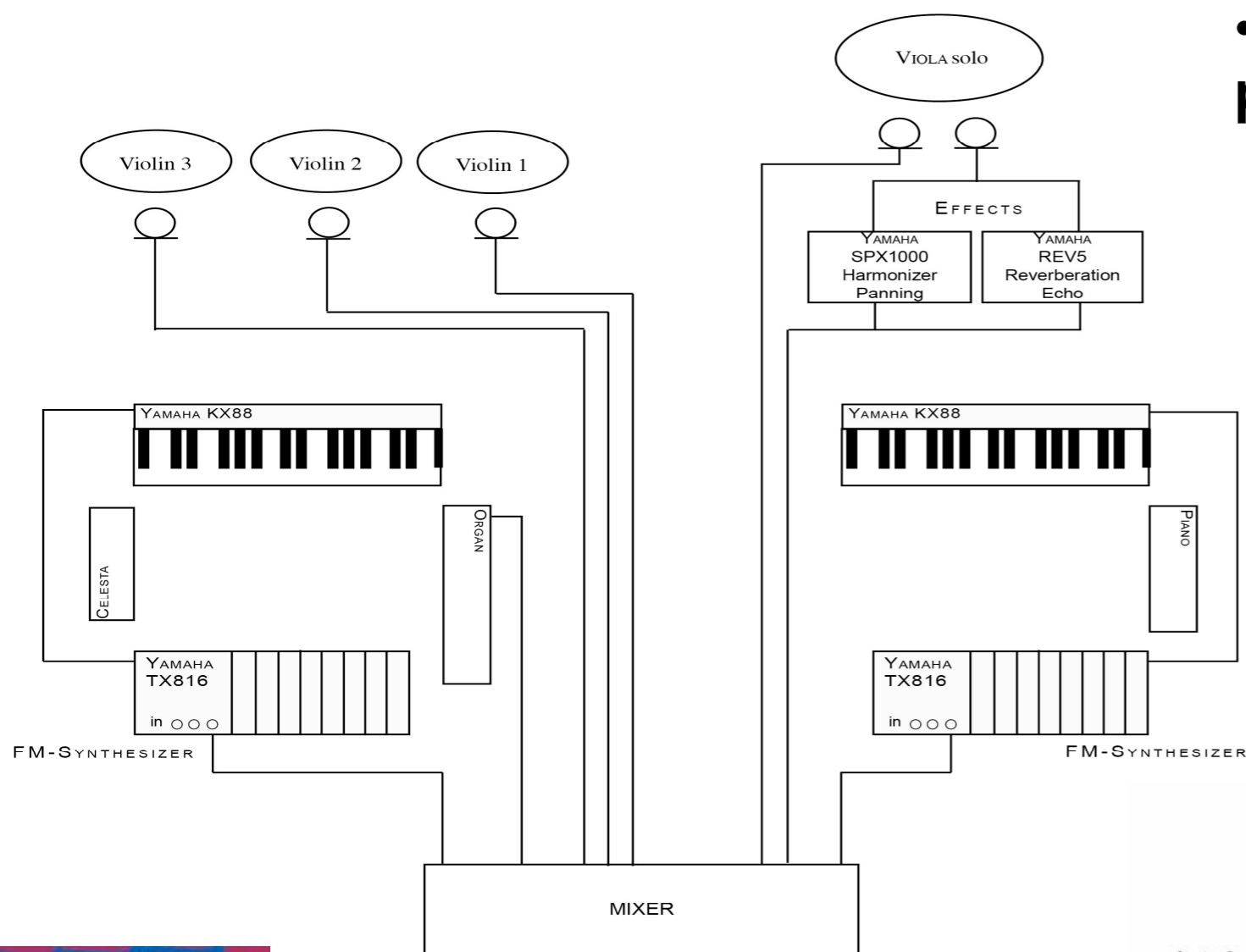
- Creation in 1986
- Written for solo viola, acoustic orchestra and live electronic
- Live-electronic part :
 - 1 YAMAHA TX816: FM-Synthesis for 2 Yamaha KX88 keyboards
 - 2 YAMAHA SPX1000: Effects/Transformation of the viola: Harmonizer & Panning
 - 2 YAMAHA REV5: Effects/Transformation of the viola: Reverberation & Echo
- Several new performances since 1986 (the last one in 1995)
- No new performance since 1995 (but several attempts), due to issues related to the FM synthesis component

An example: *Diadèmes* by M.A. Dalbavie

- A new performance in december 2008 (american creation in New-York)
- Necessity of migration (and ensure the good performance of the live electronics part)
- Most important criteria of « good performance »: **authenticity**

An example: *Diadèmes* by M.A. Dalbavie

ORIGINAL SETUP OF ELECTRONICS

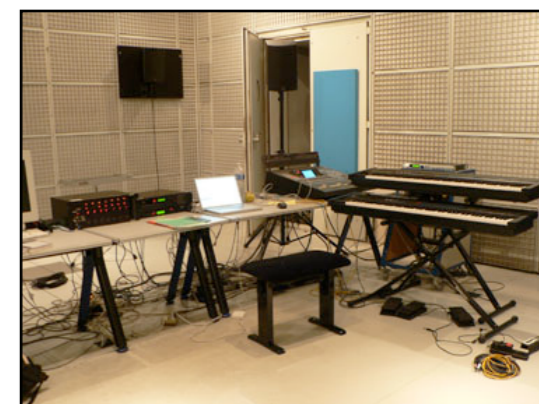


•Live-electronic part:

–1 YAMAHA TX816:
FM-Synthesis for 2
Yamaha KX88
keyboards

–2 YAMAHA
SPX1000: Effects/
Transformation of the
viola: Harmonizer &
Panning

–2 YAMAHA REV5:
Effects/
Transformation of the
viola: Reverberation
& Echo



An example: *Diadèmes* by M.A. Dalbavie

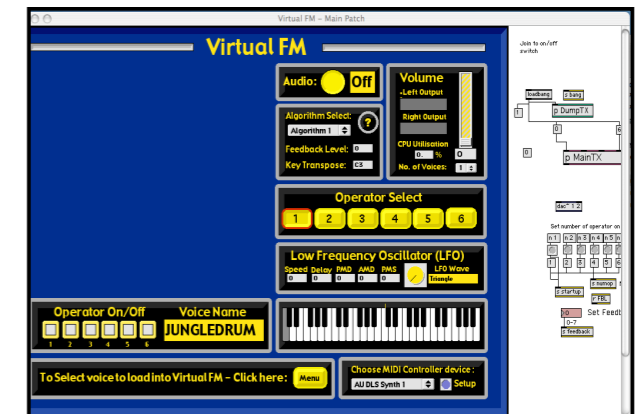
•FM Synthesis :

- Modulation of a waveform by another waveform (both in the audio range)
- Original implementation by Yamaha (under patent)
- Results in « complex » sounds, not produceable by another means



FM Synthesis issue

- Since 1995 (patent expiration), hardware not maintained
- Several tries to port or emulate FM Synthesis on different systems
- Previous attempts software emulation :
 - By Ipke Starke, November 1998
 - By Colin Yates, December 2001
- Attempts not satisfying for the composer
- Approach chosen in 2008:
 - Record each FM Synthesis sound on the original hardware (fortunately available) according to the limited set of parameters in use in *Diadèmes*



FM Synthesis issue

- Comparison with other works using the same hardware :
 - *Madonna of Winter and Spring* by Jonathan Harvey (also 1986)
 - Porting realized in 2006 using emulation by Native Instruments (not done at Ircam)
- Two different forms of emulation :
 - *Diadèmes* : recording of original sounds, and use of a software sampler
 - *Madonna of Winter and Spring*: FM Synthesis emulation

Other issues

- For harmonizer, panning, reverberation and echo:
 - Preference given to a modern effect
- A migration has been realized
 - The composer prefers in this case the last version of the same effects

FM Synthesis issue

- Different points of view
 - Composer (evolving point of view)
 - Scientist: model (modulation of a waveform by another waveform)
 - Software developer: algorithm
 - Issue: how to cope with these different point of views, regarding « authenticity »?

Authenticity in CASPAR

- Authenticity is a process (Mariella Guercio, University of Urbino)
- CASPAR defines Authenticity Protocols (AP)
 - Each one composed of several steps (AS)
- Must be executed at different steps according to the lifecycle of the object (access, migration...)
 - Each execution is composed of different execution steps (ASE)
 - The overall result should lead to an evaluation of the authenticity
- Defined accordingly to a Designated Community

Considerations on Authenticity (1)

- Need to attach different AP to different steps of the lifecycle. Example:
 - AP1 <-> Migration of component
 - AP2 <-> Maintenance
- Different AP for context
 - Dependent on the work in which is used (example of FMSynthesis)
 - Dependent from the point of view of the community
 - Developers
 - Musical assistant
 - Curators

Considerations on Authenticity (2)

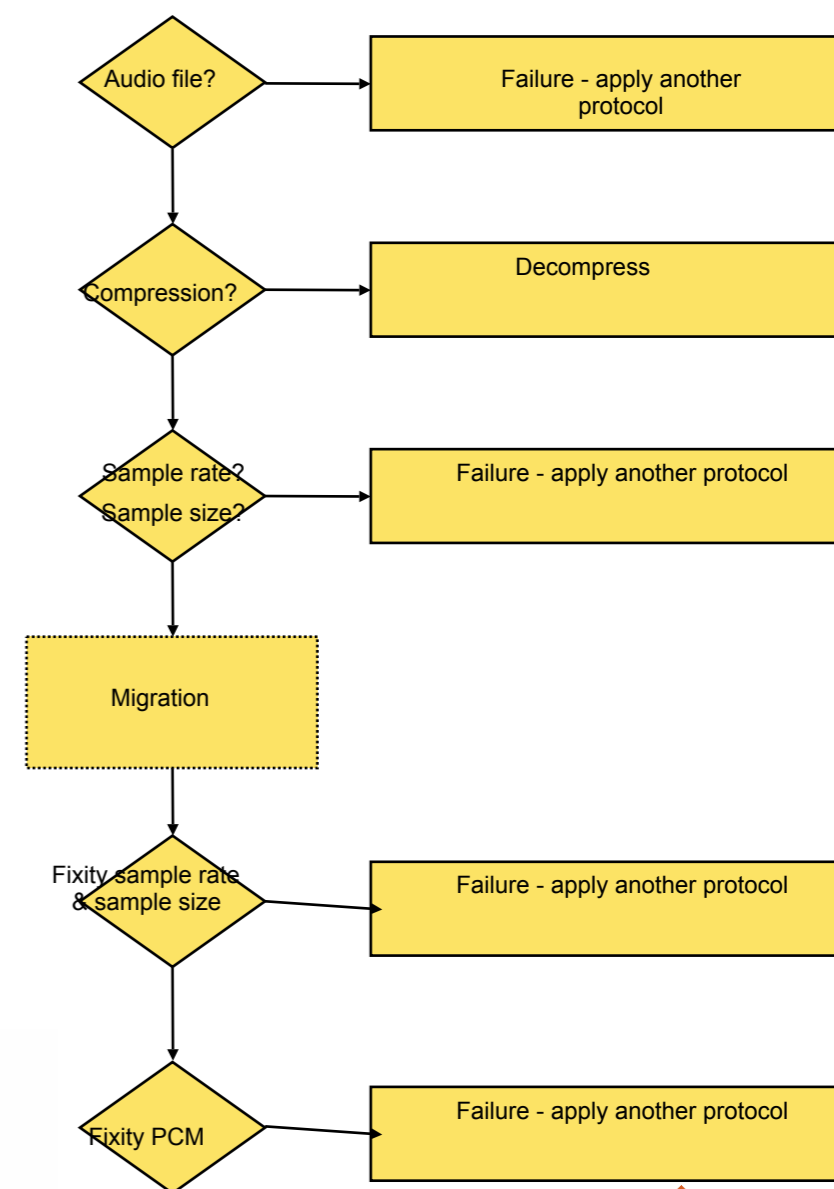
- End users unable to create « Authenticity protocols » from scratch
 - Different roles for curator and musical assistant
- Need to have templates and customization
 - Curator creates templates
 - Musical assistant customize
- An example of an authenticity protocol template, for an audio processing effect migration (AFX1 -> AFX2):
 - Provide sound samples in input (SI1.. SOn)
 - Provide sound samples in output (SO1 .. SOn)
 - Apply AFX2 to SI1..Sin (get SO2..SOn)
 - Compare SO1..Son with SO2..Son according to features F1..Fn
 - Customizable :
 - Samples
 - Features

Authenticity protocol #1

- Case : maintenance (audio file)
 - Compute fixity
 - Verify provenance

Authenticity protocol #2

- Case : migration of audio file, from format f1 to format f2
- AS1 - before migration : verify semantics (is it an audio file) ?
 - Yes : continue
 - No : failure - apply another protocol suitable to the right semantics
- AS2 - verify file not compressed
 - Yes : continue
 - No : uncompress (or return to analog!)
- AS3 - before migration : verify availability of source sampling rate and sampling size in target format f2
 - Yes : continue
 - No : failure - apply another protocol
- AS4 - after migration : compute fixity of sample size and sample rate
 - Yes : continue
 - No : failure - apply another protocol
- AS5 - after migration : compute fixity of Pulse Code Modulation from audio files
 - Yes : continue
 - No : failure - apply another protocol



Authenticity protocol #3

- Case : migration of an audio effect (AFX1 -> AFX2)
 - Ingest phase (AP1):
 - AS1 : Define a list of audio samples in input (using predefined audio samples 1khz sinusoid...)
 - AS2 : Apply to them the audio effect AFX1, and store the output audio samples
 - AS3 : Define the comparison features (with range) that are to be validated when executing AP2
 - Migration phase (AP2):
 - AS1 : Apply to input audio files the migrated audio effect AFX2 and store the results
 - AS2 : Compare the audio samples resulting from AFX2 to those resulting from AFX1, according to features defined in AP1

Conclusion

- From Mustica to MustiCASPAR:
 - Management of the archive lifecycle:
 - Support of Ingest and Access based on Representation Information
 - Support of Provenance, Context
 - Support of notifications (unavailability of components, changes in the knowledge...)
 - Support of Authenticity
 - Conforms to standards:
 - CIDOC-CRM (RDF) for Description
 - XFDU for packaging
 - OAIS...

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