InterPARES 2 Project

International Research on Permanent Authentic Records in Electronic Systems

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1. Introduction

The following is a summary report of information gathered by University of British Columbia Graduate Research Assistants Jennifer Douglas, Carolyn Petrie and Claudette Rocan, from interviews conducted by Jill Teasley as part of the MUSTICA General Study (GS03). Information from each interview was used to answer, when possible, the 23 case study questions developed by InterPARES 2 researchers, creating, in essence, a series of mini-case studies.

Teasley interviewed composers, musical assistants and sound engineers associated with the Groupe de Recherches Musicales (GRM) of the Institut National de l'Audiovisuel (INA) and with the Institut de Recherche et Coordination Acoustique/Musique (IRCAM). These two federally-funded French research institutes are dedicated to the creation and performance of technologically innovative music. The interviews from which the information in this report is gathered are listed in Appendix A. Note that this report refers only to information from interviews for which the 23 questions have been completed.

Citations in the report refer first to the interviewee's ID, then to the number of the answer corresponding to the 23-question template (for example (AM4, 4e) refers to Musical Assistant #4's interview and the reply to question 4e). In the case of information gathered from the interview with the sound engineers, citations refer to the interviewee's ID and the CD track number. The 14 completed mini-case studies are available on the InterPARES researchers' Web site.[1]

2. Electronic documents identified by interviewees

Interviewees referred to a wide range of digital entities, including:

1. Patch interface files (defined as "the instructions for producing, sequencing, and processing sounds" and as "special software that specifies and controls the sound-production on particular computer programs"[2])
2. Reference sound files, as separate files or integrated into the patch
3. DAT recordings (that will be subjected to various treatments)
4. CD recordings of sound sequences
5. Recordings of various sounds to be used in pieces (i.e. samples)
6. Cahier d'exploitation[3]
7. Score in MaxMSP
8. Score in MIDI
9. Annotated score
10. Representations of the score in NoteWriter and ProTools
11. Various text files used to describe procedures, intent, etc.

[1] Available at http://www.interpares.org/rws/rws_research_studies_documents.cfm?cs=GS03. Note: this is on a restricted site.
[2] John Roeder (2006). "InterPARES 2 Project – General Study 03: Authenticity of Digital Music: Key Insights from Interviews in the MUSTICA Project," version 2. Available at http://www.interpares.org/display_file.cfm?doc=gs03_summary_report_ROEDER_v2.pdf.
[3] Available at http://www.interpares.org/rws/display_file.cfm?doc=MUSTICA_IrcamCahierExploitation[PM_J_03-EN].pdf. Note: this is on a restricted site.

12. Electronic files generated by spatialization software (defined as "the assignment of an audio signal…from one loudspeaker to another when performing a piece of recorded music so that the music is perceived to be moving in various directions around a room")[4]
13. CD recordings of final versions
14. DVDs
15. Emails discussing progress, deadlines, etc. (Interviewees state that they rarely use emails to discuss the artistic aspects of the composition process.)
16. Sketches of electronic features (e.g. documentation of composition process)
17. Backup files containing all sound files, sound sources, Pro-Tools files and text
18. Excel spreadsheets (resulting from a process of 'reverse engineering' employed by one musical assistant (AM3) to extract information from a patch prior to migration)
19. "Plan de console" (kept by the sound engineer, it contains all necessary technical information in terms of placement of speakers and microphones, use of the Mac, of any effects, of the MIDI mixer, etc.)
20. Technical file (also kept by the sound engineer)

3. Activities discussed

3a. Composers:

The primary activity in which composers participate is the creation of electro-acoustic music. Composers follow no formal creation procedure; below are provided two examples of the processes involved in the creation of particular pieces of music as described by their composers.[5]

Scenario 1: C4, questions 5 and 6

The composer spends time with children, registering sounds on a DAT tape recorder.

From 30 recorded sequences, the composer works on 5 or 6 target sequences (ciblés) to create new sounds.

The piece is subjected to various treatments and remixing; the composer listens to the resulting recordings repeatedly and describes the sounds.

The composer drafts and polishes the instrumental score.

The recording of the piece is done in two parts; the instrumental section is recorded separately and another recording is made after treatments to the first recording.

[4] Jill Teasley (2005). "InterPARES 2 Project – General Study 03: MUSTICA Glossary." Available at http://www.interpares.org/rws/display_file.cfm?doc=gs03_MUSTICA_Glossary.pdf.
[5] See also C7 question 6.

Scenario 2: C3, question 6

The composer's interest in a particular poet and a particular painter inspire him to begin working on the piece.

The composer creates a preliminary sketch of the interaction between voice and electronic effects, which leads to the development of the first sketch of the piece.

The composer analyzes the poems and paintings that inspired him, making photocopies and marking them with ideas and commentary. This analysis influences the writing of the score.

The patch is generated using Max/MSP and OpenMusic.

The composer completes the score.

The composer works on the electronic aspects of the piece.

3b. Musical assistants

The primary activities in which IRCAM's musical assistants participate are assisting in the creation of a piece of electro-acoustic music, and migrating pieces as they are needed by IRCAM. There are no formal procedures to follow for either of these activities, but an example of the process for creating a musical work from the point of view of the musical assistant is provided below, as is an example of the process followed in migrating works.

Scenario 1: AM6, question 6 – Stages for creating a piece of music

Determine the arrangement of the piece: At this stage, the composer and musical assistant will work together to determine how the piece will be arranged. The composer will have his or her idea of how the piece should sound, and the musical assistant will tell the composer what it is possible to achieve, and will figure out how a desired sound can be achieved. Together, they will determine the types of tools and treatments they will use. Documents that result from this phase include: synopses of the arrangement from a technical point of view (usually created in Max/MSP); schemas for placement of speakers; a synopsis of the 'architecture' of the programs for spatialization and treatment; sound files that provide examples of different sound treatments; sketches, etc. The musical assistant will also create a document that explains to the composer how to annotate his score so that the musical assistant can translate it technically.

Write the score: After writing the musical score on his own, the composer will give the musical assistant a text file that is essentially a chronological list of the effects he wants using the system of annotations the musical assistant has provided. The musical assistant then creates a score in Max/MSP to correspond with the composer's score.

Finalize the programs and controls: At this stage, the musical assistant works with sound engineers to simulate the program to test its strength and sound, to make sure that the program is in good working order, and to ensure that the piece sounds the way it is supposed to. Documents

that result from this stage are mainly in the form of notes about adjustments that will have to be made to the program. Any modifications to the program are backed up. There might be an exchange of emails discussing changes or problems. There is also a list of all the materials necessary for the concert (for example a mixing console), a score in MIDI format, and the final patch.

Rehearsal: The finalized piece is played. The musical assistant may take notes about any last adjustments, but these will usually be handwritten.

Scenario 2: AM2, question 6 – Stages in migrating a piece of work

Identify data format and machine used for data creation.

If no instructions exist regarding how to read the program in question, it is necessary to decode the data and identify the system used. This can involve contacting the musical assistant who first worked on the composition.

Gather all components necessary to re-create the piece. This stage can be difficult as some components may have been kept by IRCAM and others by the composer and/or original musical assistant.

Discuss with the composer or original musical assistant their level of acceptance for any possible changes in sound resulting from the migration.

Re-create sound through new technology, while respecting the sound of the original.

4. Description of recordkeeping systems

Although composers and musical assistants do, to varying degrees, understand the importance of a formal recordkeeping system, the interviews make very clear that no such recordkeeping system currently exists.

4a. Composers

As a group, the composers reveal very little interest in recordkeeping systems. One mentions making regular backups of his work, explaining that each day's work is backed up to both the local hard drive and the IRCAM network, and that the information technology department also makes regular backups of the network (C2, 4). This composer also admits that he is not interested in the systematic organization of his papers (C2, 4e). Another admits that he does not spend much time arranging his records in a 'proper' order (C4, 19s).

Each composer appears to develop his own method of organizing the records he does keep, with one describing an organization based on record format (C1, 4d), and another making reference to 'general files' that are marked to allow for easy identification and association with a particular work, but which do not correspond to any formal organization schema (C3, 18c). Only one

composer described a more systematic organization explaining that he organizes digital entities in files that correspond to particular projects. For each project, he keeps files for administrative documents, correspondence, entities and documents resulting from the composition process, and documentation relating to performance. Inside the files, entities are organized chronologically and by version. Project files are organized chronologically in relation to other projects. This particular composer keeps documents that he creates at home (primarily paper documents) in files at home, and documents created at the institution in files at the institution. Though he places great importance on saving all elements related to his work, his system for organizing these elements seems to have resulted from convenience and habits formed through ad hoc processes (C7, 4f).[6]

Many of the composers keep journals and log books containing descriptions of sounds, sketches and ideas; however, this practice never seems to be undertaken in a systematic manner, and journals and log books are consulted infrequently following the completion of a piece. For example, one composer explains that he may keep tapes of his experiments with sounds, as well as log books that contain descriptions of sounds and pieces, but he says that though he keeps these he may not know where to find them, and may not use them. At the time of the interview, this particular composer was working on a catalogue of sound examples, scores and descriptions of sounds that he hoped to publish one day as a book (A2, 18).

4b. Musical assistants

In general, the musical assistants seem to give more thought to recordkeeping. For example, one interviewee reveals that he keeps documents that result from each stage of his work process because they could prove useful in the future, because they contain 'tools' that he may be able to reuse, and because they are a reflection of his work (AM6, 18). Another interviewee explains that once the patch has been finalized, he makes two backups: one, an 'exploitation' backup that includes the patch, a 'library' that contains all the objects used to assemble the patch, and an index with instructions on how to open and launch the patch; and the other, a production backup, which is much larger and contains all the files and objects that were necessary to make the composition (e.g., sounds, sound sources, analysis of sounds, Pro-Tools files, correspondence about the piece and all files created in the studio). The 'exploitation' backup becomes the property of IRCAM, while the assistant keeps the other on either his laptop or his home computer (AM5, 17, 18). Other musical assistants confirm that documentation resulting from the creation or migration of any given work, as well as the digital components that make up the work, may be stored partly at IRCAM, partly on the composer's personal computer and partly on the musical assistant's personal computer (AM2, 6 and AM8, 20).

When asked whether musical assistants are required to leave certain types of documentation with IRCAM when they are finished working on a piece, one assistant points to the difficulty of putting into practice a set of standards for documentation as each piece of music is unique and is created according to the composer's unique vision and creative process (AM8, 20). Though IRCAM has a system of boxes for storing items related to different musical works, there is currently no standard for what kind of documentation should be saved in the boxes. Often composers and musical assistants will keep their own personal 'archives' even though the

[6] See also C7, question 18.

material may legally belong to IRCAM, and this practice has, in fact, allowed IRCAM to recover works it might otherwise have lost (AM 8, 18).

In general, the musical assistants seem to organize the items they save based on the project to which they belong, and then according to the stage of the project at which they were produced (AM6, 4e). Though there is no formal procedure for backing up work, backups are generally made onto CD ROM at the end of each large stage of work. One assistant explains that he makes more backups the closer the project is to completion, as he believes the risk of losing material increases as the project progresses (AM5, 13). One assistant notes that each IRCAM assistant is allotted storage space on IRCAM's mainframe network, and makes mention also of backup audio files stored on CD ROM that are kept by IRCAM's archives (AM 3, 18)

4c. ***Sound engineers:***

The third group of people interviewed, the sound engineers, seem to make use of the most thorough recordkeeping system, though once again this system appears to be one of their own making and not one that is formalized or required. The sound engineer starts a folder for each composer whose pieces he works on, and within that folder creates sub-folders for each of the composer's pieces. The sub-folder will contain (in no particular arrangement) a "fiche technique" (technical file) and a "plan de console," which contains all necessary information in terms of the types and placement of speakers and microphones, use of the Mac, of any effects, of the MIDI mixer, etc. (IS1, Track 1). Annotated scores are also saved so that there exists a history of information about the mixing of the piece, though the interviewees also note that this practice is dependant on the particular piece; for some pieces, it is essential that the score be followed precisely, while for others such attention will be less necessary (IS1, Track 4). Plans of the set-up of the room in which a piece was originally performed are saved, as are lists of materials used in performance and production. All the above-mentioned documentation is saved to a server accessible only to IRCAM (IS1, Tracks 4 and 5). Importantly, the interviewees explain that the sound engineers are really only responsible for saving the technical elements of a piece, and point to the boxes mentioned above as a more systematic and complete way of saving the other various elements of a piece (IS1, Track 13).

5. Use of standards/metadata

Throughout the interviews, there is very little mention of any standards employed in either record creation or record preservation, though both composers and musical assistants choose equipment and techniques partly on the basis of which systems, components or procedures are considered standard in a technological sense in an attempt to ensure longer term stability of the digital entities they create (AM2, 5a). When interviewees do refer to standards, it is mostly to say that standards would be very difficult to implement in an environment where it is not possible to speak about a representative work as all composers work in different ways and have different ideas (AM6, additional comments and AM8, 20). The only explicitly defined standard was referred to by the sound engineer. He explained that recordings of performances intended to be kept at IRCAM for reference purposes are recorded in stereo, whereas recordings that are made to be sent outside IRCAM for further refinements are made onto multiple tracks (IS1, Track 4).

6. The difficulties involved in the preservation of digital music

Migration of musical works, or the digital components of those works, is the primary method of long-term preservation discussed in the interviews. There were no references to other factors in preservation, such as the stability, temperature and relative humidity of storage spaces. Musical pieces are migrated when they are wanted for replaying and the original cannot be played due to technological change (AM8, 19b). In fact, due to time and resources constraints, it is generally *only* works that are going to be played again in concert that will be migrated (AM5, 19b and AM2, 19). Reasons given for preserving digital and non-digital components of the musical pieces, as well as documentation created during composition, include: to enable future performances of a piece of music; to preserve evidence of various techniques and their evolution; and to allow continued access to tools that can be used again.

Due to the nature of electroacoustic music and the methods by which it is created, migration is not a perfect solution. In the first place, composers point out that as a result of changing technological demands and constraints they have had to make use of a wide variety of programs. The use of diverse programs results in a sort of 'hybrid entity' that causes considerable compatibility concerns (C2, 5 and C3, 5a). These concerns are compounded by the general lack of documentation about the composition process and technological techniques used during composition (C4, 6). One composer explains that only treatments considered to be original are described in detail (C4, 9), and musical assistants frequently lament the fact that there are seldom any written documents telling them how to re-create pieces (AM2, 9). Even when documentation does exist, it is not kept together in any systematic manner. When it comes time to migrate a piece, the musical assistant might find that IRCAM has some components of the piece, while the composer may have others, and the original musical assistant still others; as one assistant admits, it can be difficult to find all the necessary components of a piece and there is, therefore, usually a degree of guessing once a certain amount of material has been gathered (AM2, 6).

Besides the practical difficulties involved, migration poses problems of data modification. With electroacoustic music, the problem of data modification is particularly significant. One interviewee makes the point that the technological components of a work and its intellectual aspects are completely entwined. The piece sounds (and looks, when video technology is also involved) the way it does because of the nature of the technology used to create it; thus, if the technology changes, the look and feel of the piece may also change. In some cases this change might be considered acceptable, but in others the composer might feel that the changes have altered the nature of the piece so significantly that the altered piece must be considered as a different or new composition (AM7, 4c). The interviewees display different attitudes toward the changes in musical works that result from technological evolutions. One composer notes that though small changes might result from migration, these would not be noticed by anyone but himself, and so do not alter the nature of his work (C1, 10). Another, acknowledging that his work will need to be modified to continue to be compatible with new programs, hopes that these necessary modifications might actually allow him to better represent the ideas he wishes to convey in his music (C3, 19a). The musical assistants interviewed appear to be less comfortable with the change that results from migration. One points to the ethical difficulties involved in migrating compositions; when moved to new systems, compositions may sound different and because he considers this a re-interpretation of the original composer's work, he insists that an

assistant must not update any sounds without the original composer's input and consent (AM5, 21).

Indeed, composers, musical assistants and sound engineers all make clear that if works are to be preserved exactly as they were meant to sound, the direct input of the original composer, and possibly of the original musical assistant, will most likely be required. Composers see themselves as the 'masters' of their works,[7] and believe that they alone are responsible for all decisions regarding sound, including the fidelity of a migrated version to an original piece, and for answering any questions in relation to the scope and nature of any piece (C2, 15 and C3, 15). However, it is the musical assistants who know how to work with the technology involved, so that while the composer is responsible for conceiving the piece, the musical assistant is the only one who can render the sounds the composer envisions executable by the computer (AM6, 15 and AM3, 15). If the original composer and/or musical assistant are able to contribute their knowledge and experience to the migration process, then it can be assumed that the final migrated piece is sufficiently true to the intent and effect of the original. One assistant interviewed did not feel that any of the pieces at IRCAM that have not yet been migrated are in any danger of becoming "unsaveable" as all the composers and musical assistants are still alive (AM 3, 19).

The musical assistants interviewed frequently argue that if they are to be able to re-create a piece exactly as it was meant to sound without the physical presence of one of the original players, they require a perfect description of that sound, but that such a description is exceedingly difficult to provide (AM7, 19a). The sound engineer echoes this concern, explaining that the nature of a piece, especially in terms of mixing and balance, is difficult to transmit in a written form. A CD recording of the piece that has been well mixed might help, but generally, a sound engineer who is unfamiliar with the piece will not be able to re-create its precise sound with only the patch and a plan as guides (IS1, Track 6). Throughout their interview, the sound engineers continually stress that the problem lies in transmission, in the ability to convey to a person who was absent from the original creation process the intended effects of the music.

One musical assistant spoke of the empirical nature of migration and of the element of craftsmanship that exists in it due to the fact that each piece is very complicated and reflects the mind and ideas of the musical assistant who put it together. Because there is no standard way of organizing the hierarchy of elements within the patch, each musical assistant will do what works best for him and for his vision. Then, the musical assistant who works on migration has to determine how the original musical assistant conceived the hierarchy and try to put the pieces back together (AM8, Additional comments). As such, in addition to being familiar with the software used to create the original patch and with updated software, anyone working on the migration of one of these pieces of music must be very familiar with the way in which composers and musical assistants conceive and construct this type of music (AM8, 15).

One other method of preservation that was discussed was the long-term maintenance of the machine on which the patch was created and of the machines and instruments which allowed for the creation of different sounds. In fact, some assistants, sceptical about whether digital components can be maintained through technological change, saw this as the only method of re-

[7] In this context, it is interesting to note that composers frequently refer to migration as a boring task (e.g., C7, A2).

creating a piece (AM7, 19). The original programs used to create the pieces should also be maintained, these assistants argue, because even when a program can be successfully moved to a newer computer, the piece may sound different due to the enhanced capabilities of the newer machine (AM2, 5a).

One of the musical assistants interviewed predicts that electronic music will be more difficult to re-create than music from other centuries and worries that preservation must be continuously undertaken if the electronic music create today is to survive into the future (AM3, additional comments).

Only one of the composers whose interview is examined in this report was not directly associated with either GRM or IRCAM. Interestingly, he was the only interviewee discussed in this report who cited the expense of migration as a barrier to preservation (A2, 19a).[8]

7. What needs to be preserved[9]

Nearly every interviewee insisted that the material currently being preserved is insufficient if musical works are to continue to be accessible over time, and if they are to accurately represent the original composer's intent. The most frequently mentioned need was for the preservation of a reference sound file, which would include a recording of the performed piece as well as of the various sounds used in the piece. One composer considered a reference sound file integrated with the patch as the only means of ensuring the continued preservation of his original intentions, even after his death (C2, 10), and the idea was frequently mentioned by the musical assistants interviewed.

Composers and musical assistants also stressed the importance of the continued preservation of the patch, since with the death of a patch comes the death of a piece; as such, the patch should be updated frequently to ensure its survival (C3, 19a). One musical assistant also stressed the importance of source codes (AM3, 6). One composer explained that he prioritizes certain components as essential to the continued access to his work, and includes among these components sound and synthesis samples and spatialization strategies (C1, 4a).

As mentioned above, composers frequently save journals or notebooks that include descriptions of sounds and techniques used, as well as sketches of scores and spatialization. This practice is far from systematic, and some of the composers admit that they rarely consult these notebooks after a work is finished (C1, 7); however, given the repeated desire for complete descriptions of sounds and techniques, a more thorough retention of these types of documents may prove very useful.[10]

The sound engineers interviewed suggest that a recording of the original performance and an annotated score provide the best possibility for the accurate re-creation of a piece, but, as

[8] The interviewee was not interested in the "uninspiring" task of migration, and expressed regret that the services of a musical assistant to this type of work were so costly.
[9] For a more complete treatment of this topic, see Roeder, "Authenticity of Digital Music," op cit.
[10] One composer explains that creating truly useful descriptions of sounds can be very time-consuming, so that he begins to feel that he is spending more time on the log-books then on his music (A2, 19a).

described above, remain sceptical about the ability of even these records to convey a composer's intent.

8. Authenticity/ accuracy/ reliability

John Roeder's report, "Authenticity of digital music: key insights from interviews in the MUSTICA project," provides an excellent analysis of the concepts of authenticity, accuracy and reliability as they are understood and interpreted by the composers and musical assistants interviewed.

As mentioned above, composers and musical assistants differ in their opinions on how much change to sounds after migration is acceptable, and how much change constitutes a new interpretation of the original piece. One musical assistant has suggested that one method of ensuring the best possible success in re-creating original sound is to rely more on software like Max/MSP that can and will evolve, but that can also be maintained on different machines, rather than relying on 'commercial' instruments and machines, whose sounds and effects may be impossible to re-create if this hardware breaks or becomes obsolete. When this assistant was asked what criteria he uses to judge whether a migrated piece is 'identical enough' to the original piece, he replied that when Max/MSP is used to re-create a piece composed using Max, the older and newer technologies are conceptually similar enough that there is no possibility of a fundamental change to the piece; sound quality might increase, but because an old Max patch and a new one are made from very similar technical processes, the same effects and sound are achieved (AM8, additional comments).

Appendix A

List of MUSTICA Interviews

Code:
A - autre/other (musicologist, computer scientist, etc.)
AM - assistant musical/musical assistant (IRCAM)
C - compositeur/composer (INA and IRCAM)
GRM - employee of Groupe de recherches musicales (GRM) at INA
IS - ingénieur de son/sound engineer (IRCAM)

No.	Interviewee Code	Length of Recording	Transcript/Notes	23 Questions completed
1	A1	30 mins		
2	A2	1.5 hrs		done
3	A3	1.2 hrs		
4	A4	30 mins		
5	AM1		done	
6	AM2	29.6 mins		done
7	AM3	1.5 hrs		done
8	AM4	1.2 hrs		
9	AM5	2.1 hrs		done
10	AM6	1.1 hrs		done
11	AM7	1.2 hrs		done
12	AM8	1.0 hrs		done
13	C1		done	done
14	C2	1.1 hrs	done	done
15	C3	1.5 hrs		done
16	C4			done
17	C5	2.3 hrs		

No.	Interviewee Code	Length of Recording	Transcript/Notes	23 Questions completed
18	C6	2.3 hrs		
19	C7	1.7 hrs		done
20	C8	2.37 hrs		
21	C9	3.1 hrs		
22	C10	3.49 hrs		
23	C11	2.95 hrs		
24	C12	2.5 hrs		
25	C13	4.0 hrs		
26	C14	3.17 hrs		
27	C15	2.2 hrs		
28	C16	2.1 hrs		
29	GRM1	2.6 hrs		
30	GRM2	26 mins		
31	GRM3	1.0 hrs		
32	GRM4	1.4 hrs		
33	GRM5	5 mins		
34	GRM6	54 mins		
35	GRM7	1.4 hrs		
36	IS1	41.1 mins		done
36	Total hours of recording	57.73 hrs	3 done	11 done

General Study 03

MUSTICA Glossary

Jill Teasley

6 March 2005
(Version 2)

Terms

Please see the GRM English Web site, http://www.ina.fr/grm/presentation/mots.en.html, for definitions of the following terms:

Musique concrète
Musique électronique
Musique expérimentale
Musique électroacoustique
Musique acousmatique

Acousmographe:
Software developed by the GRM to graphically represent sounds and to thereby allow annotations of a sound's graphical representation. The GRM is presently testing the use of the Acousmographe, and the software may be marketed commercially in the future. (Information from http://www.ina.fr /grm/outils_dev/acousmographe/index.fr.html)

Acousmonium:
A loudspeaker orchestra; an orchestra of many different sizes and styles of loudspeakers developed by François Bayle, the second director of the GRM, to diffuse (or play) recorded music in concert. Using the Acousmonium, a composer can devise creative ways of spatializing his music; that is, making the music sound as though it is moving in space, by changing the assignment of the audio signal (or signals, in the case of a stereo or multi-track recording) from one loudspeaker to another. The music played on the Acousmonium is frequently what is referred to as "la musique acousmatique" (see above).

AIFF:
The type of sound file created using Macintosh computers.

DAT:
Pronounced "D. A. T." or "dat." Acronym for digital audio tape, a magnetic tape developed by Sony that was widely used in the 1980s and 1990s by professional sound studios and musicians for backing up data and recording music. DAT can only be used on DAT players. The DAT format is now becoming obsolete and other technologies have overtaken it in popularity. (Information from http://audiotools.com/dat.html)

Diffusion:
The means of performing a recorded piece of music via a broadcast or loudspeaker system, whether by broadcasting it over a radio or other network or in playing it in concert. Diffusion is a term that is frequently used by GRM members and affiliated composers when they describe the method by which GRM music is performed.

Enceinte:
French term for loudspeaker; synomymous with "haut-parleur."

Haut-parleur:
French term for loudspeaker; synonymous with "enceinte."

MIDI:
Acronym for Musical Instrument Digital Interface, a protocol that allows electronic devices (usually synthesizers, but also computers, light show controllers, VCR's, multi-track recorders, etc.) to interact and work in synchronization with other MIDI compatible devices. (Definition from "About MIDI," http://www.midi.com)

Patch (m):
The file that serves as an interface for a composer using a program such as Max-MSP (or, prior to the development of Max-MSP, Max).

Ring modulator:
Fr. *Modulateur en anneaux*. "A ring modulator is a simple device that can be used to create unusual sounds from an instruments [*sic*] output. It effectively takes two signals (each with some frequency), and produces a signal containing the sum and differences of those frequencies. These frequencies will typically be non-harmonic, so the ring modulator can create some very dissonant sounds." (Definition from http://www.harmony-central.com/Effects/Articles/ Ring_Modulation/)

Spatialization:
The assignment of an audio signal (or signals, in the case of a stereo or multi-track recording) from one loudspeaker to another when performing a piece of recorded music so that the sound of the music is perceived to be moving in various directions around a room. The spatialization design for a piece of music can become an important element of that piece's identity (the C2 interview recording includes an interesting discussion of spatialization).

Syter:
The sound-processing system developed at the GRM in the 1970s and used by C4 and other composers.

WAV:
The type of sound file created using computers with Microsoft Windows operating systems.

Software programs (open-source and commercial)

AudioSculpt:
An Ircam product.

CSound

Digital Performer (a.k.a., "Performer")

Diphone:
An Ircam product.

Finale:
A music notation software program.

GRM-Tools:
Plug-ins to audio software such as Pro-Tools. Developed by the GRM and distributed by Joel Chadabe of the Electronic Music Foundation.

Jitter:
"A set of 133 brilliant video, matrix, and 3D graphics objects for the Max Programming environment."[11] C3 used Jitter in the composition that he discussed in the MUSTICA interview with him.

jMax:
An Ircam product developed principally by Norbert Schnell. An alternative to Max-MSO, jMax is a visual programming environment for building interactive, real-time musical compositions. jMax is no longer being developed, as Max-MSP has proved to be more popular.

Kyma

Max:
A visual programming environment developed at Ircam in the 1980s by Miller S. Puckette and named after computer music pioneer Max Matthews.

Max-MSP:
Max with digital signal processing capabilities. Developed by Cycling '74 under an agreement with Ircam, Max-MSP one of the most popular audio design software applications in the world.

MetaSynth:
A sound design programming environment.

Modalys:
An Ircam product.

NoteWriter:
A music notation software program developed by UBC professor Keith Hamel.

OpenMusic:
An Ircam product.

[11] From the Cycling '74 Web site products page, http://www.cycling74.com/products/index.html.

Pure Data or pD:
Developed by Miller S. Puckette as an open-source alternative to Max-MSP.

Pro Tools:
The leading professional audio production workstation system. Developed by Digidesign.

SuperCollider

Organizations

Cycling '74:
The American software company that makes Max-MSP.

Digidesign:
The American software company that makes Pro Tools.

GRM:
Le Groupe de Recherches Musicales. Established by Pierre Schaeffer in 1958 within the framework of the ORTF (Organisation Française de la Radio et de la Télévision). In 1975, the GRM was made part of the Institut National de L'Audiovisuel (l'INA). The GRM and l'INA are funded by the Ministry of Communication.
See http://www.ina.fr/grm/presentation/index.fr.html for more information.

INA:
L'Institut national de l'audiovisuel. Funded by the Ministry of Communication. The GRM is an agency of the INA. See http://www.ina.fr/index.fr.html for more information.

Ircam:
L'Institut de recherche et coordination acoustique/musique. Established in 197 under the Ministry of Culture. Ircam and the GRM are two distinct organizations and that Ircam is not part of the INA. See http://www.ircam.fr for more information.