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Preserving the electroacoustic music legacy: a case study of the SalMar Construction at the University of Illinois

In the summer of 2008 the Sousa Archives and Center for American Music (SACAM) at the University of Illinois at Urbana-Champaign acquired the papers of Salvatore Martirano (1927-1995), avant-garde composer, faculty member, and performer; a significant milestone in documenting the early invention and establishment of electronic music in the United States. The acquisition of his papers, and especially the SalMar construction, marked an important point in the Center’s collecting history, which includes the music and personal papers of American performers, composers, and bandmasters such as John Philip Sousa (1854-1932), Herbert L. Clarke (1867-1945), and Claude Gordon (1916-1996). Martirano’s legacy as a composer and innovator in the field of electro-acoustic music challenges archivists to investigate how to appraise, acquire, and preserve the records of composers who, like Martirano, put sounds into bytes and changed how music is created and experienced.

The 2008 acquisition included Martirano’s original music manuscripts and correspondence with friends, family, and colleagues, including renowned composers Milton Babbitt, John Cage, Elliott Carter, Gilbert Chase, Aaron Copland, Luigi Dallapiccola, Paul Fromm, Morton Subotnik, and Igor Stravinsky. The collection also included grants, reviews, scholarly articles, and
ephemera that illustrate his activities as an award-winning composer, performer, leader in the field of computer generated music and as a faculty member at the University of Illinois at Urbana-Champaign. Also included in the acquisition was the Sal-Mar Construction, publicly unveiled in 1970 as the first musical instrument to generate dynamic improvisatory electronic music using analog and digital circuits designed with help from engineers who worked on the University of Illinois' early Illiac supercomputer.

The Sal-Mar Construction is an electronic music instrument that uses analogue modules driven by digital circuits to create spontaneous improvisatory musical works. Sounds generated by the Sal-Mar Construction are controlled by an elaborate touch-pad of binary switches that control both the sound generators and modulators and the paths to the many hard-coded 6-byte instructional logic circuits hardwired into the matrix of sound generators. These control pitch, rhythm, timbre, articulation, duration and dynamics of the sounds produced by the instrument. In order for the SalMar to work, the performer interacts with a horizontal control panel of 291 lightable touch-sensitive switches. According to the Salvatore Martirano webpage at the Experimental Music Studios at the UIUC,

“[t]he most innovative feature of the human/machine interface is that it allows the user to switch from control of macro to micro parameters of the information output. This is analogous to a zoom lens on a camera.
The information output is converted from digital to analog form and is routed to oscillators, filters and amplifiers, whose output is sent to one or more of 24 speakers. Four groups of sounds with independent control of route and rate can be distributed among the 24 speakers so that a traffic of sound is created in the space. All sounds are produced in real-time as the composer/performer according to his own prerogatives chooses a route and functions through a store of pre-programmed information.”

The sound carried by the 24 speakers adds mobility and spatial qualities to the performance experience, and it is one of its most redeeming qualities. The Sal-Mar measures 8' x 4.5' x 2.5' and weighs 400 pounds—excluding the speakers.
Like many donors of faculty papers, Martirano’s family wanted to maintain the connection between his work and the University, and they wanted his materials to be available to the general public for research and performance as early and conveniently as possible. Acquiring the SalMar construction presented an interesting challenge for the archives, mainly in regard to its preservation and access. We found few resources in the archives and digital preservation literature that we could tap into for this. We were challenged to contextualize the relationship between a unique (and now obsolete) music-making machine and its accompanying documentation (research papers, schematics, and photographs), and to preserve its significance and context in the development of electroacoustic music in the United States, as well as its sound as a record of Martirano’s work. Ultimately, we approached the problem as we have done with the rest of the musical instruments in our collections. When offered any artifact or instrument, we make every effort to acquire all materials related to it, so as to contextualize its existence and function within the music-making endeavors of the creator. In the case of the SalMar construction, we pursued the maintenance and operation of the instrument as well as the preservation of the related documentation to preserve Martirano’s legacy.
Musical instruments that relied on electricity to produce sound, such as the Theremin or Ondes Martenot, were invented during the late 19th and early 20th centuries,3 “[t]he path which led to latter-day sound techniques can be traced back to the end of the nineteenth century, when the idea of artificially produced sound was a subject of importance among certain artists, many of them writers.”4 The development of a distinct musical language as well as new compositional techniques during the first decades of the 20th century left composers craving a broader palette of sounds than traditional instruments could produce, and this, in turn, poses new and interesting challenges for the archivists and librarians who are expected to preserve this musical heritage.

Martirano’s work is an example of the contributions made by avant-garde composers to concert music in the mid-twentieth century. The first electroacoustic music studios were housed in national radio stations and universities in Asia, Europe, and the Americas, specifically established as research centers for the creation of new music. Throughout the 1950s, research and composition centers were established in Cologne (1952), Tokyo (1953), Milan (1955), Warsaw (1957), London (1958), Santiago de Chile (1958), and the University of Illinois at Urbana-Champaign (1958). It is only fitting that the records of the people and the institutions where this cutting-edge work be documented and preserve for future study and enjoyment. The question is, how do can we accomplish this?
Today electroacoustic music is created mostly in a digital environment, using proprietary hardware and software or homegrown technology. Most importantly, it is not scored or stored on paper. From Monteverdi to Beethoven and Wagner, musical notation on paper played a vital role in preserving the sonic experience of the western world, and the survival of manuscript sources is why today we are able to recreate musical works written centuries ago. As different as the sound of any of these electroacoustic music works can be to compositions from previous centuries, one could investigate if the process that leads to the final composition of an electroacoustic work follows what composers have been doing since the early days of musical creation. How did the ability to organize and rearrange music electronically, and the incorporation of these new tools, change the creative process? Whatever the answer to these questions, it is beyond doubt that the documentary output (in terms of paper and electronic documents) has changed dramatically over the past 60 years. There are some who advocate preserving the whole spectrum of the creative process, from its conception to the realization through performance. “It is impractical to separate individual instantiations of a performance from the process of their creation and unrepresentative to force them to fit this model of archives. Instead, we should explore models that encourage records to evolve and be contested as performance itself constantly develops and is reinterpreted.”5 This is what should concern archivists and librarians who care for electroacoustic music collections, because
the software tools used by composers are mostly proprietary; a large number of musical works are destined to become obsolete if no action is taken either by their composers or by archivists overseeing the preservation of their work. Hugh Taylor advocates for changing the “traditional” archival mindset of what constitutes a record to include those tools that represent actions taken by their creators. “I like to see archival materials as not just configurations on various media, but as tools that include not only those wonderful legal ‘instruments’ designed for very specific juridical responses that the study of diplomatics helps us to clarify, but any archival material which, being the record of an action, produces a response in another person or even the same person.” He then continues: “[a]s with all material culture, the tools may become obsolete, but we fail to do them justice if we do not perceive them as the powerful implements they once were.” The SalMar Construction, in this case, is a record of Martirano’s work and evidence of his creative output, which would not be complete if we had chosen to only capture one performance in a separate recording.

There is another issue to consider regarding the preservation of electroacoustic music which Bruce Pennycook has summarized from the composer’s point of view: “the practical realities of creating, supporting, and circulating this genre of works has indicated that for the vast majority of these kinds of pieces few performances have occurred without the presence of the composer… Thus the question: who will turn the knobs when I die?” This
additional layer of complexity for documenting born-digital music that is so
dependent on the creator for its dissemination and access affects how we plan for
its preservation, and visibly calls for measures to be taken at the point of creation.
Since there is no format standard for acquiring and preserving performing arts
documentation, “[t]he question of how performances should be represented,
however, is still widely contested. Some methods such as writing, photography
and video recording predominate but none has become the de facto standard.”
This leaves archivists collecting artists’ records to develop their own policies to
better steward these materials into the future.

When we were presented with the opportunity to care for Martirano’s
pioneering work in the field of music composition as well as computer science,
the fact that a recording of the instrument would not provide the equivalent
experience and the spatial arrangement of its sound made the decision to preserve
the instrument in working condition very clear. We follow this approach with all
our artifacts, but this is, of course, neither scalable nor practical for all artifacts in
all archives, and any decision must be made with caution and take into account
the contextual information that accompanies the musical instruments in the form
of correspondence, scores, photographs, concert programs, performer’s diagrams,
etc. In the case of the Martirano papers, this additional documentation can be
found in Series 3: Sal-Mar Construction and YahaSALmaMac, ca. 1967-2000,
where the bulk of materials pertaining to the design and building of these
instruments is intellectually arranged within the collection. The Martirano papers were described as follows\textsuperscript{11}:

Series 1: Music, ca. 1947-1995
Series 2: Correspondence, ca. 1932-1999
  Sub-series 1: Contracts, Publishing, and Royalties Correspondence
  Sub-series 2: Personal and Professional Correspondence
  Sub-series 1: Sal-Mar Construction
  Sub-series 2: YahaSALmaMac,
Series 4: Publicity and Performance, ca. 1950-1995
  Sub-Series 1: Publicity, Marketing, Media Coverage, and Interviews
  Sub-series 2: Performances, Lectures, and Panels
  Sub-series 3: Published and Unpublished Research
Series 5: Photographs, ca. 1927-2004
Series 6: Family and Personal Papers, ca. 1927-1952

The contents of Box 21, for example, are a tangible and preservable document that speaks to the inner workings of the SalMar, especially Folder 5: Circuit Diagrams and Notes, Wiring Lists, and Component Specifications, ca. 1970-1976. These are the materials that Martirano produced in the process of designing and building the Sal Mar, which are the closest to an “operating manual” as one can
get, in addition to photographs and recorded audiovisual performances which can help in recreating the functionality of the instrument and speaker placement for future performances.

[Image 2 – SalMar Construction Wiring list for Manual Octave Selector]
1. Card types identified with two letters and numerals as needed. Numerals assigned sequentially.

2. "Floating" assemblies to be treated as cards.

3. Mnemonic code to begin:
   - AT = attenuator
   - DI = diode
   - FL = filter
   - OS = oscillator
   - DE = delay
   - RE = register
   - Other codes added as needed.

4. Every contact point in the entire assembly must have a unique description:

   Section - Row - Position - Pin
   Letters: No
   No

   N = patch
   P = 4X150 section of patch
   R = 150 PC card positions
   S = small patch (8x6x)

[Image 3 – Documentation Covenant for SalMar Construction Circuit Diagram]
Preservation frameworks for electroacoustic music

In the broader area of electronic records preservation, a number of government-funded and international research initiatives have shifted the focus from institutionally created records to other types of records such as social science research data, geospatial data, works of electronic arts, and personal papers: for example, the InterPARES\textsuperscript{12} or International Research on Permanent Authentic Records in Electronic Systems project, the NHPRC funded electronic records projects and research fellowships\textsuperscript{13}, the PARADIGM\textsuperscript{14} or Personal Archives Accessible in Digital Media project in the UK, and the Institut National de l’Audiovisuel (INA) in France.

Of particular interest, the second phase of the InterPARES project embarked upon the long-term preservation, access, and authenticity issues of interactive digital music among other manifestations of electronic records\textsuperscript{15}. In 2004 this research team partnered with the MUSTICA initiative as a case study\textsuperscript{16}. The research group consists of an international collaboration between UCLA's Center for Information as Evidence, and two music research institutions in France, the Institut de Recherche et Coordination Acoustique/Musique (IRCAM), and the Groupe de Recherches Musicales (GRM), a subunit of the INA. Within the InterPARES framework, the MUSTICA initiative focused on providing preservation and access guidelines for interactive digital music commissioned by
the IRCAM over the past 35 years. The project developed an interactive system to catalog and enable access to the different components of 69 works by 48 different composers. The case study also served as a starting point for the development of guidelines for the production, maintenance, and long-term preservation of records; one set for individual creators, and another set for archivists and records managers.\textsuperscript{17} The research team also published a policy framework document for institutions and individuals that create and manage electronic records.

The development of a preservation and access strategy for the SalMar construction and, by extension, its musical output, finds its roots in archives literature that deals with preservation of music materials as well as digital preservation. The archives literature that specifically addresses the appraisal, arrangement, description, preservation, and use of music materials in archives is scarce\textsuperscript{18}. Judith Brimmer defines these materials as “records of the different stages of musical composition prior to publication, although they are commonly defined simply by their format—music written by hand, not printed.”\textsuperscript{19} This definition should include all materials—paper-based, and in electronic format, also including artifacts and musical instruments—that share the same provenance and document a composer’s artistic expression and the context of his/her music-making activities. As part of a cultural expression, these records are dependent on other materials such as concert programs, reviews, and performance schematics,
in order to understand the context in which these compositions were performed and provide a well-rounded view of their relationship to society and their profession as a whole.

Musicians have also addressed the problem of access to electroacoustic works. Composer Brent Lee, who is part of the InterPARES research group, notes that “[t]he digital revolution has affected all stages of traditional music creation, from the sketching and notation of compositions to recordings of performances; also, new forms of uniquely digital music involving computer-aided algorithmic composition, interactive environments, and digital sound synthesis have created corresponding new varieties of digital documents.” He has outlined three possible avenues for preserving digital music documents in what he calls a “bewildering array of formats”: the raw data formats, the audio files where the music is recorded, and the notation formats used throughout the creative process. In the case of the SalMar construction, the acquisition and preservation of notation formats and auxiliary documents (sketches, technical diagrams, etc) has proven to be vital. The documentation that accompanies the SalMar is the only means of understanding how it works and of maintaining the Sal Mar construction in working condition. Other composers and performers have expressed their concern for future access to their electroacoustic works. The most important concern is the realization that relying on proprietary software and hardware does not lead to maintaining access to the repertoire, even a few years after a work was
first composed\textsuperscript{22}. A gap between creators and “preservers”, centers on expertise, whether technical or “artistic”, mainly because knowledge of equipment and software developed decades ago is still needed to embark upon preservation and access initiatives.

**Looking Ahead: Archival Issues and Electroacoustic Music**

Looking at established digital preservation practices would be a natural first step in the process of defining strategies for preserving electroacoustic music. More specifically, there is the need for archivists to build collaborative relationships with the composers (creators) to better inform both the development of appropriate repositories, as well as encouraging them to produce archive-ready records for the ultimate goal of future archival accession\textsuperscript{24}. The body of work that emanated from the InterPARES 2 project\textsuperscript{25} provides a theoretical background on which to build on specific recommendations for the long-term preservation of electronic records created for the performance of electroacoustic music. These documents touch upon authenticity as a vital characteristic of electronic records, which is also worth exploring in the context of born digital music. In the context of musical works, what would be the original or authentic\textsuperscript{26} document of a musical composition? More specifically, in the case of electroacoustic (purely computer-based) and mixed electronic (musical instrument plus electronics) works, which file is the authentic one? In an environment where the composer
revises and adapts the distinct portions of what constitutes the score and parts of a work for a performance, it is not easy to identify which version of the work should be kept for posterity. This is why it is important to be familiar with the types of documents and workflows utilized by composers in the course of their work, and maintain auxiliary documentation such as photographs, reviews, stage diagrams, etc., so as to be able to determine how the work was intended to be performed. Now that there are tools and institutional policies addressing the capture, preservation, and access of digital materials, it is time to incorporate materials that go beyond institutional records and personal papers.

A few initiatives have been directed at saving electroacoustic music masterpieces, reformatting these materials and reissuing the sound recordings as the solution to the long-term preservation and access problem for born digital music. This route, however, does not always incorporate vital information contained in the accompanying materials that are often part of an archival series such as concert programs, performer’s instructions, hardware/software specifications, etc. which are vital for the recreation of the original performance experience. The context in which the musical work was created then becomes as important as the work itself, and actually informs the work’s future access by either the archivist or the user.
The question of “original order” comes into the foreground at this point since the relationships between the distinct series must also be maintained in a digital or mixed environment to better represent the composer and his/her work. At the Sousa Archives and Center for American Music, we strive to preserve both the instruments and the music of our collections, since the one cannot exist without the other. In the case of the SalMar construction, both the sounds and the musical instrument are highly valuable as artifacts and sonic documents of a not so distant past when music and technology were first coexisting as a viable research and aesthetic endeavor. Preserving the artifact that materializes computer technology and music composition is a priority for us, as well as keeping it functional for research and performance. We think of music as a document that can only be accessed via the musical instrument, with a recording becoming its surrogate. We should find avenues that can carry this viewpoint over to the digital realm, especially when attempting to preserve our musical heritage. It is important to identify the documentary output of the compositional process in electronic format, which up until now is only represented as paper-based scores and sketches; and establish how these formats behave in a digital preservation environment.

We can much learn about acquisition and appraisal from allied professions such as the museum community, where appraisal practices incorporate the artistic merits into the concept of value. Rethinking archival appraisal in light of the
aesthetic nature of these records could provide future generations of archivists with the theoretical framework for acquisition decisions for electroacoustic music. Appraisal decisions for the acquisition of music collections must take into account the work of the composer, his or her relationship to the atmosphere in which the creative process took place (i.e., a faculty member at a university, a work commissioned by an external organization to celebrate a milestone, etc.), and the type of work he or she was creating in relationship to their profession, in order to ascertain the enduring value of an artistic work within the framework of archival practice.

Future development of descriptive practices for these types of collections should help in shaping viable preservation best practices for born digital music. How are we identifying our holdings of archival music materials in finding aids and catalog records? Are we describing items at the series or collection level, or are we describing items individually? These are important information since it is the principal access point of the materials for the users, and the uniformity of our descriptive practices should enhance our preservation efforts.

While it is a difficult task to accurately quantify all archival material housed in libraries and archives across the United States in the same manner as libraries have done with bibliographic databases such as WorldCat for published materials, we should work towards standardizing descriptive practices for music
materials in archives in order to better serve both our users and the materials we care for. The most recent effort to crosswalk content standards for music description was Richard Smiraglia’s book on AACR2 and APPM for music materials\textsuperscript{27}. Now that Describing Archives: A Content Standard (DACS), the content standard for the description of archival materials, has been fully adopted by the archives community as a standard, we should move ahead in fine-tuning its application to special types of materials and exploring crosswalks between descriptive standards\textsuperscript{28}. Identifying electroacoustic music collections and outlining their extent and scope is a necessary step in addressing their preservation and long-term access problem, and the same should apply to any other type of cultural record.

\textbf{Conclusion}

The path that we chose to take to preserve the SalMar Construction and Sal’s legacy has been a unique one. The decision to keep the SalMar operational and to run it periodically was something that fell within our local practice, and these continue to inform future appraisal and preservation needs for the Sousa Archives. Music and aesthetically driven records call for reevaluating best practices and adapting them to the specific needs of the repository and its users. We wouldn’t have made this choice if the accompanying papers didn’t include documentation on the SalMar (in the form of diagrams, articles, photographs, and
schematics) that will play a vital preservation role in the future. Preserving records that emanate from atypical creators calls for inventive solutions, and the decision based on both the needs and use of the records and professional standards and best practices. So far, the instrument is housed in a temperature and humidity controlled environment, and the archives’ staff runs periodic maintenance checks on the instrument, which can coincide with scheduled visits from the public, in order to be able to identify any problem as it arises, and not when it is too late.

There is still much ground to cover in the area of administration and management of music archival materials, and now that creators are transferring their skills to the digital realm we must find the way to acquire, arrange, describe, and preserve these. Identifying how these materials are created and how composers manage their records during the active stage of their lives can help us fine-tune how to treat them when they enter an archival stage, where the composer is no longer involved in providing access to the files.

As mentioned before, there are no single, universally-agreed-upon standard in the area of performing arts documentation, and this is an area where archivists and librarians could contribute to, as stewards of our cultural heritage. We should work on establishing best practices based on the ability to recreate or regenerate any work of art, since the experience is also part of the record as a whole. In the case of the SalMar construction this is vital for its preservation and
long-term access, and should serve as an example of how to approach the issues encountered in the crossroads of creativity and technological exploration.

There is a need to investigate how collections of mixed electronic and paper-based materials are being managed, and how this impacts arrangement and description practices. We should also be open to broaden the meaning or “record” as these activities move artists and composers to explore different workflows and documentation practices within their craft, and the SalMar construction and Sal Martirano’s music and personal papers are an interesting example of how these groundbreaking activities and accomplishments are preserved for generations to come. Witnessing the mainframe boards erupt into sound is an experience that cannot be replaced by any surrogate sound recording of this one of a kind musical instrument.

Abstract

In the summer of 2008 the Sousa Archives and Center for American Music at the University of Illinois at Urbana-Champaign acquired the papers of Salvatore Martirano (1927-1995), avant-garde composer, faculty member, and performer, a significant milestone in documenting the early invention and establishment of electronic music in the United States. This case study examines how the new electroacoustic compositional techniques present in Martirano’s papers and his ground-breaking electronic music instrument, the SalMar Construction,
dramatically challenged the archivists to explore access and preservation practices for this unique cultural record. Contextual plays a key role in the preservation of electroacoustic compositions and instruments, considering that these tend to become ephemeral works of art once the composer ceases to maintain them in working order.


6 An informal survey I conducted in the summer of 2008 asking college and university archivists and music librarians about their collection and preservation strategies for such materials showed that the institutions that collect electroacoustic music collections are not prepared to address the material’s preservation needs, and their planning is still at an early stage. Given that the software tools used by composers are mostly proprietary, a large number of musical works are destined to become obsolete if no action is taken either by the composers or the archivists overseeing the preservation of their work. See Cuervo, Adriana P. 2009. “Ephemeral Music: Electronic Music


11 The arrangement of the collection was attained following the principle of original order, where the materials were kept following the organizational structure devised by the creator.

12 The InterPARES project focuses on “developing the knowledge essential to the long-term preservation of authentic records created and/or maintained in digital form and providing the basis for standards, policies, strategies and plans of action capable of ensuring the longevity of such material and the ability of its users to trust its authenticity”. http://www.interpares.org (accessed November 20, 2010).

The PARADIGM research project focused on born digital personal papers of politicians in the UK and proposed guidelines for their acquisition, access and preservation:

http://www.paradigm.ac.uk/index.html. The project ended in 2007 and informed the development of the FutureArch project at the Bodleian Library at the University of Oxford in the UK

http://www.bodleian.ox.ac.uk/beam/projects/futurearch, where the project team is developing a system for the lifecycle management of hybrid (digital and paper based) archival collections.

(accessed November 19, 2010).


For a description and a theoretical framework of the project see Bachimont, Bruno et al,

“Preserving Interactive Digital Music: A report on the MUSTICA Research Intitiative,” in Proceedings of the Third International Conference on WEB Delivering of Music (WEB ’03),

The guidelines are available online in the form of booklets from the InterPARES website at


See for example, Cabezas Bolaños, Esteban. “La Organización de Archivos Musicales Marco Conceptual” Información, Cultura y Sociedad 13 (2005): 85; and Brimmer, Judith. “Providing a national resource: The management of music manuscripts in the UK,” Journal of the Society of Archivists 26.2 (Oct. 2005): 215. While there are a few titles published over the past 50 years in North American journals that address particular concerns of music collections in an archival
setting, the existing literature does not adequately support archivists and music librarians that are working with these types of materials.


21 Ibid, 195.


26 Authenticity, in the archival sense, is defined as “The quality of being genuine, not a counterfeit, and free from tampering, and is typically inferred from internal and external evidence, including its physical characteristics, structure, content, and context.” See, Pearce-Moses, Richard. A Glossary of Archival and Records Terminology. http://www.archivists.org/glossary/ (accessed December 6, 2010).


28 There are XML based encoding tools for encoding music scores, like MusicXML available at http://www.recordare.com/xml.html This tool, however, is not an open-source schema so its implementation should be approached with caution. On the other hand, the imminent release of the Resource Description and Access to replace AACR2 should illuminate the development of description of music materials across platforms. For more information on RDA, see http://www.rdatoolkit.org/background (all links accessed November 15, 2010).