

The Musical Acoustics Research Library

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Abstract: The Musical Acoustics Research Library (MARL) is a collection of independent archives or libraries assembled by distinguished groups or individuals in the field of musical acoustics research. MARL is directed by representatives of each member collection, in conjunction with the Center for Computer Research in Music and Acoustics (CCRMA) at Stanford University, which maintains the contents of each library. Currently, MARL is comprised of the Catgut Acoustical Society Library, the Arthur H. Benade Archive, the John Backus Archive, and the John W. Coltman Archive.

BACKGROUND

“There is an urgent need for an international library on musical acoustics – a place where the present body of information, which is scattered all over the world, can be assembled, stored, organized, catalogued, and made computer available. This should also be a place where new findings in musical acoustics can be added with an active information center for research and correspondence.”

C.M. Hutchins
1 May 1990

The Musical Acoustics Research Library (MARL) has its origin in the vast acoustics research collection of the Catgut Acoustical Society (CAS). These files were assembled over many years by CAS and housed in the home of its founder Carleen M. Hutchins. In the late 1980s, CAS began an effort to establish an appropriate long-term residence for the collection, such that it could serve as a valuable reference source for the musical acoustics community at large. In 1992, the Center for Computer Research in Music and Acoustics (CCRMA) at Stanford University was selected as the repository for this library.

In conjunction with the establishment of the Catgut Acoustical Society Library, CCRMA and CAS encouraged the idea of having the personal archives of Arthur Benade and John Backus at the same site. Both were world leaders in the study of wind instrument acoustics. The personal files of John Backus were acquired in 1995. An agreement for the establishment of the Arthur H. Benade Archive at CCRMA was reached in 1997. In autumn 1996, representatives of CAS and CCRMA, together with Virginia Benade, established the Musical Acoustics Research Library at CCRMA in order to provide a single point of reference for the various collections. The most recent addition to MARL, the John W. Coltman Archive, was founded in April 1998. The archives of three of the most prominent wind instrument acousticians of our time, together with the extensive string instrument resources of the Catgut Acoustical Society Library, position MARL as a primary musical acoustics reference source in the world.

Organizational activities of MARL are directed by Gary P. Scavone, with faculty representation by Max V. Mathews and Chris Chafe, the director of CCRMA. MARL is a collective and each member/group representative is encouraged to take part in policy decisions. CCRMA, as an equal partner in MARL, is committed to helping establish the library as an important resource of musical acoustics knowledge for the entire global acoustics research community. A World Wide Web

(WWW) site¹ has been created for MARL, which will serve as the primary means for disseminating information to the public about the various collections.

THE CATGUT ACOUSTICAL SOCIETY LIBRARY

The Catgut Acoustical Society was established in 1963, growing out of a collaboration which began in the late 1950s between Carleen M. Hutchins, Frederick A. Saunders, John C. Schelleng, and Robert E. Fryxell. An informal gathering of twelve members in May 1963 at Hutchins' home was described in the first CAS *Newsletter* of 1 May 1964. One year later, a CAS meeting in New York City was attended by nearly fifty people. Since then, CAS has grown in both membership and activities. The society seeks to stimulate pioneering research in acoustical principles and the application of these principles to the making of fine stringed instruments, including the Violin Octet.

From its founding, CAS began compiling an extensive collection of acoustics research files, which were sometimes donated to the society upon the death of one of its members. By 1990, this collection had grown to encompass nearly 50 file drawers of information, including published and unpublished papers, detailed laboratory notebooks, photos, correspondences, miscellaneous writings, and meeting reports. The agreement reached with CCRMA in 1992 set in motion an effort to preserve this collection for future generations, as well as to increase its accessibility to the global musical acoustics research community.

The transferal of the CAS library to CCRMA, as well as the cataloguing of its contents, is currently in process. Fully searchable World Wide Web pages² have been created which outline the library contents for those files on location at CCRMA. In addition, an online index to the Catgut Acoustical Society Newsletters and Journals (1964 - 1994) has been made available on this site. Current file drawers exist for such people as Louis Condax, Robert Fryxell, Felix Savart, John Shelleng, and Melville Clark. The collection also includes a complete set of the CAS Journal publications, and two Benchmark volumes of definitive papers in violin acoustics.

THE ARTHUR H. BENADE ARCHIVE

Arthur H. Benade (1925-1987) was a physicist whose work focused especially on the acoustics of woodwind and brass instruments. His entire career (1952-1987) was spent as a professor at Case Institute of Technology/Case Western Reserve University, Cleveland, Ohio. Benade supplemented his formal acoustics knowledge with experience gained from playing modern and historical instruments. He was an accomplished clarinetist and flute player. He also used whatever he could find of the vast informal and anecdotal knowledge that has traditionally guided craftsmen and players. His collection of over 130 wind instruments helped him trace design changes in winds from the classical era to the present. As his understanding grew he tested it via the design, construction, and modification of instruments; some that he made or modified have been used by leading players and manufacturers.

Benade's highly original work led to greater understanding of mode conversion in flared horns, a realistic yet mathematically tractable model of the bore of woodwind instruments based on the acoustics of a lattice of tone holes, development of the concept of cutoff frequencies for isotropic and anisotropic radiation from a woodwind instrument, and clarification of both linear and nonlinear processes in musical instruments and their interrelationships. He explored the dynamics of musical sound radiation, transmission behavior of sound in rooms, and the nature of auditory perception

¹<http://www-ccrma.stanford.edu/CCRMA/Collections/MARL/>

²<http://www-ccrma.stanford.edu/CCRMA/Collections/MARL/CASL/>

processes associated with hearing in rooms and concert halls. He was the first researcher to attempt to treat the entire tonal production process in wind instruments as a single entity comprised of the influence of the player's windway, the behavior of the instrument's reed, air column, and radiation, the actions of the room on the sound, and the response of the player's aural and neurological sensory equipment.

Benade's writings include numerous scientific papers and two books: *Horns, Strings and Harmony* and *Fundamentals of Musical Acoustics*. Dover Books has issued reprints of both volumes. He was invited to write two articles for Scientific American magazine and entries for the American Institute of Physics Encyclopedia of Physics, the New Grove Dictionary of Music and Musicians, and the Academic Press Encyclopedia of Physical Science and Technology.

Benade received the Acoustical Society of America's Silver Medal (for musical acoustics) and Gold Medal (for overall excellence in acoustics). He served as the Acoustical Society's Vice President and also chaired its Technical Committee on Musical Acoustics. He was a President of the Catgut Acoustical Society; a member of the Technical Advisory Committee of Pierre Boulez's Institute pour Recherche et Coordination Acoustique/Musique in Paris; an advisor to the Dayton C. Miller Collection of Flutes at the Library of Congress; and an Honorary Member of the National Association of Band Instrument Repair Technicians. He gave talks before many scientific, educational, and musical organizations in the USA and Europe, including a series in Stockholm sponsored by the Swedish Royal Academy of Music and the Plenary Session Lecture in Musical Acoustics at the 9th International Congress on Acoustics in Madrid. Benade died in Cleveland, Ohio, in August 1987 at the age of 62.

The A.H. Benade Archive consists of his writings, research files, correspondence, and miscellaneous course notes, consulting projects, etc. The process of organizing and cataloguing the contents of the archive was only recently begun by Virginia Benade, the archive's representative. A fully searchable World Wide Web site³ has been created which details Benade's published work (books, papers, and abstracts) plus much that remains unpublished, including some papers and book chapters, material Benade circulated among his colleagues in acoustics, outlines of talks he gave, and slides he made to illustrate his lectures. The various aspects of this WWW site will be updated in an ongoing manner.

THE JOHN BACKUS ARCHIVE

John Backus was a research physicist who trained under E.O. Lawrence at the Berkeley Laboratories and was on the faculty of the University of Southern California from 1945 to 1980, where he did research on gaseous discharges in strong magnetic fields. In addition, he organized elementary courses in musical acoustics, thus bringing his special interests in music into the laboratory. He was a fine musician, playing the bassoon, clarinet, other woodwinds, and the piano as well as conducting local orchestras. John received the Acoustical Society of America's Silver Medal (for musical acoustics) in 1986 "for pioneering research on the acoustics of woodwind and brass instruments and for bridging the gap between acousticians and musicians." John was an enthusiastic climber, having led climbs of all 268 mountains on the qualifying list of the Hundred Peaks Section of the Sierra Club ... six times each!

Backus' acoustic research interests were evident from an early age. His senior thesis at Reed College was on the building of an electronic music generator, one of the first in existence. It involved the construction of a mechanical harmonic analyzer in the machine shop, and from then on he continued to build much of his own research equipment. He investigated the acoustics of

³<http://www-ccrma.stanford.edu/CCRMA/Collections/MARL/Benade/>

both reed and brass instruments. His greatest contribution was to provide fundamental data on the nonlinear flow control properties of woodwind reeds. Also he greatly improved the capillary method for measuring the input impedance of air columns - a method widely exploited by many researchers. Backus devoted much time and effort to developing synthetic reeds for woodwind instruments, and he succeeded in producing clarinet reeds that were judged by reed experts to be of excellent quality.

His publications appeared in a broad spectrum of journals, ranging from *The Physical Review* to *The Journal of Music Theory*. He contributed twelve papers, plus numerous abstracts, letters, and reviews, to the *Journal of the Acoustical Society of America*. He is best known for his textbook, *The Acoustical Foundations of Music* (W.W.Norton, 1969), one of the first available texts on musical acoustics. John Backus died on 28 October 1988 in the UCLA Medical Center at the age of 77.

Shortly after the establishment of the Musical Acoustics Research Library at CCRMA, the John Backus Archive was created by combining files previously organized by CAS together with materials acquired from the Backus estate in Los Angeles. The John Backus Archive consists of published papers, correspondence, laboratory notebooks, book revision notes, and files with regard to his synthetic reeds. A fully searchable World Wide Web site⁴ has been created which details these contents.

THE JOHN W. COLTMAN ARCHIVE

Dr. John W. Coltman, physicist and retired research executive of the Westinghouse Electric Corporation, has devoted much of his spare time to the study of the flute in its musical, historical and acoustical aspects. His research in musical acoustics has contributed significantly to what is known today about the behavior of the flute and organ pipes. In his professional career Dr. Coltman has received many honors for his invention and development of the x-ray image amplifier, now universally used in medical fluoroscopy. He is a member of the National Academy of Engineering, holds 22 patents and has published some 70 technical papers.

John W. Coltman received his bachelor's degree in physics at Case (now Case Western Reserve University) in 1937 and his Ph.D. in nuclear physics at the University of Illinois in 1941. Immediately afterward he joined the Research Laboratories of the Westinghouse Electric Corporation, engaging in wartime research in microwave magnetrons. Later he invented and developed the x-ray image amplifier. For this work he has received the Longstreth Medal of the Franklin Institute, the Roentgen Medal of the German Roentgen-museum in Remscheid, Germany, and the Gold Medal of the Radiological Society of America.

Coltman took up the study of the flute in early school years, playing in college and graduate school, and has continued as an active participant in amateur musical activities. While a student at Case his acquaintance with Prof. Dayton C. Miller sparked an interest in the acoustical and historical aspects of the instrument, and in the 1950's he began a collection of instruments of the flute family which now numbers about 200. A little later he started inquiries into the mechanisms of sound production of these instruments, establishing a small laboratory in his home to pursue this work as a hobby. Several of his papers on this subject have contributed significantly to what is known today about the acoustics of the flute and organ pipe.

The John W. Coltman Archive is the most recent addition to MARL and contains published papers, reports prepared as papers, reviews, correspondence, laboratory notebook material, and computer programs. Dr. Coltman has only recently begun the process of cataloguing the contents of his files. The John W. Coltman Archive World Wide Web site⁵ is in its early stages of development

⁴<http://www-ccrma.stanford.edu/CCRMA/Collections/MARL/Backus/>

⁵<http://www-ccrma.stanford.edu/CCRMA/Collections/MARL/Coltman/>

and will be updated as the cataloguing process continues.

MARL ACTIVITIES

The primary ongoing activities of MARL are centered on the development of a uniform databasing system to record the sub-collection catalogue information, as well as the creation of World Wide Web (WWW) pages for the dissemination of the library contents to the global musical acoustics community. The MARL WWW pages currently provide Internet access to overviews of the materials available at CCRMA. When requests for particular documents are received, those documents are being scanned and converted to Portable Document Format (PDF) files using Adobe Capture[®] software and subsequently linked to appropriate locations within the MARL WWW pages. The files at CCRMA are also available for on-site perusal by appointment.

MARL activity is coordinated at CCRMA by Gary P. Scavone and organizational decisions are made by agreement among the representatives of each member collection. Activities are ongoing for the addition of new collections to MARL.

ACKNOWLEDGEMENTS

MARL is a collective and thus it is necessary that a note of appreciation be expressed to all the collection representatives for their substantial efforts involved with this project. Many thanks to Virginia Benade, John Coltman, Patricia Lamkie, the officers of CAS, and Joan Miller, who alone has undertaken the monumental task of cataloguing the entire contents of CASL. Further, Virginia Benade, John Coltman, and Thomas D. Rossing made indirect contributions to portions of the text of this paper.