STUDIO REPORT
RECENT DEVELOPMENTS AT THE CENTER FOR CONTEMPORARY MUSIC
1981-
MILLS COLLEGE

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ABSTRACT

The Center for Contemporary Music at Mills College is a center of historic importance in electronic music in the United States. Described here are some of the Center's recently developed systems, public and educational programs including research and development in computer music composition and synthesis.

CCM PROGRAMS

— Graduate programs which focus on composition and research in a variety of media, including algorithmic composition, intermedia systems, digital synthesis, real-time computer music systems, music software, performance and experimental aesthetics
— Undergraduate programs in electro-acoustic and computer music
— **Seminar in Formal Methods Series,** now four years old, with prominent guest speakers in various areas including artificial intelligence in the arts perception, experimental aesthetics, systems design, and computer music
— **Artist and Technical Residency Program** with associated workshop and concert events
— **Active performance series** featuring guest, faculty, staff, and student artists in electronic music, inter-media, performance art, and other areas of new music and performance
— **Public Access** policy and community interaction

CCM FACILITIES DEVELOPMENT HIGHLIGHTS

— **HMSL,** a recently developed real-time computer composition and performance language intended for the exploration of formal and perceptual constructs
— diverse music applications of the MC68000 system, including several experimental music software packages, a graphics language, and hardware drivers
— **TOUCHE** keyboard digital synthesizer, with **FOIL-83** and **MetaFOIL** instrument definition languages and a powerful meta-compilation environment

— research in performance input structures and devices
— integration of studios and instruments using various data communication and synchronization formats (including MIDI/SMPTE), and inter-studio audio and digital communication
— hybrid synthesis environments, with languages like **PATCH-IV** and **MASC** (developed by Dan Kelley)
— applications of the Mills College VAX 11/780 Berkeley UNIX BSD 4.2, and the Hewlett-Packard 64000 logic development systems
— continued use of various microprocessor systems in individual development projects
— multi-track recording studio projects

Examples of work realized recently at the CCM will be played at the conference, and the staff and general facilities will be described.

1. INTRODUCTION

The following is a brief description of recently developed programs and activities at the Mills College Center for Contemporary Music. The period begins roughly in the fall of 1980, when several new staff members came to the Center (including the current Director, David Rosenboom), and several new projects and programs began. During the past four years, there has also been substantial modification of the studio facilities and pedagogical emphases, in part to reflect the interests of faculty, staff, and students there, and in part as a natural response to evolving artistic visions.

2. CURRENT STAFF AND FACILITIES OVERVIEW

The current CCM staff includes: David Rosenboom, Director, and faculty member; Larry Polansky, Technical and Administrative Staff, principal software developer, and faculty member; Scot Gresham-Lancaster, Technical Director; Richard Povall, Technical Assistant, studio manager, hardware designer, and principal recording engineer; Maggi Payne faculty member in recording studio techniques; David Heintz, filmmaker, performance artist, faculty member in film. All of the staff

members are active composers and performers. In addition, there are five Graduate Assistants whose responsibilities include software and hardware development, studio maintenance, public access and CCM administration, concert production, informal and formal teaching, working with guest composers and members of the community, and much more. At present there are about 40-50 undergraduates enrolled in CCM classes, and 25-30 graduate students working toward an M.F.A in Electronic Music and the Recording Media at the CCM. There are another 10-12 graduate students working toward either the M.A. in Composition or the M.F.A in Performance and Literature who use the facilities regularly, as do a large number of students, public access users, and members of the Bay Area (and international) artistic community who are involved with the activities of the CCM in some way.

There are at present five main studios in use:

  — hybrid computer music studio
  — multi-track recording studio
  — hybrid electronic music studio
  — dubbing and editing studio
  — film studio

In addition, there are several workshops and development rooms, for both staff and students, a main administrative office containing extensive archives, computer facilities, technical and program documentation, several "lounge areas", and a fully equipped concert hall (not part of the CCM proper) which has been wired for electronic and multi-media performances.

3. PROGRAMS

3.1 CLASSES AND SEMINARS

3.1.1 ELECTRONIC MUSIC There are four classes currently offered in electronic music, two on the undergraduate level and two on the graduate level. The undergraduate courses cover the basics of acoustics and psychoacoustics, analog and computer music, with substantial emphases on practical studio techniques, experimental music, the literature of electronic music, live performance and "homebrew" electronics, and the role of women in the field (Mills is a women's college on the undergraduate level). The graduate Seminars in Electronic Music deal with current techniques in programmable electro-acoustic media and their allied experimental art forms, including systems theory, computer assisted instruments, music algorithms and programming languages, circuitry, signal processing and synthesis, communications theory, and performance input structures. In addition, a graduate/undergraduate Research Seminar in Music Theory explores the frontiers of our understanding in formal musical perception and includes an introduction to music computation as an important medium and tool for experimentation. These classes meet in the CCM and make frequent use of the many guest artists who visit the CCM, as well as the special expertise of other staff members.

A large part of the CCM educational experience, however, takes place on a highly personal level.

Graduate students work with staff, faculty, members of the community, and perhaps most important, each other, in an atmosphere of considerable aesthetic and technical freedom. Much effort is made to ensure significant access by all qualified students to facilities whenever possible, and many students contribute greatly to the Center's resources in hardware and software design and implementation, and documentation. Students also help in important ways to shape the pedagogical and artistic approaches of many aspects of the program.

3.1.2 SEMINAR IN FORMAL METHODS This Seminar series, now four years old, is directed by Larry Polansky and David Rosenboom, and has been funded alternately by the Mills College Music Department and the National Endowment for the Arts, as well as receiving smaller funding from other sources. The aims of this series have been to encourage a community of minds and ideas at the CCM centering around notions of formal methods in the arts, experimental aesthetics, new designs in electronic music systems, and music languages. The series has been enormously successful, both in attendance and in the quality of presentation and discussion. There have been around 30 guest speakers, and often informal seminars are given in the same time slot by CCM staff, focusing on topics more endemic to the students at the Center itself (programming language and machine architecture workshops, for example, or on the intricacies of a given device).

A partial list of past guests in the series (Fall 1980 - Spring 1985) includes: David Rothenberg (twice), Lynx Crowe (twice), Edgar Coons, John Myhill, Iannis Xenakis, Kenneth Gaburo, John Snell, Don Buchla, James Andy Moorer, John Bischoff, Chris Mann, George Lewis, Phil Stone, Dan Kelley, Heinz Von Foerster (twice), Douglas Hofstadter (twice), Michael Schippling, Chris Brown, David Wessel, Phil Burke, Jim Horton, Ron Kuivila, Tim Perkis, and others.

Talks in the series have included discussions of psychoacoustics and music perception (Wessel, Coons); formulations of musical languages (Rothenberg, Rosenboom, Polansky, Crowe, Burke, Kelley); design of small systems (Buchla, Brown, Kuivila, Schippling, Lewis); examinations of natural language (Gaburo, Mann); and even what might be termed pure "systems theory" (Von Foerster, Hofstadter). Others (like Xenakis' memorable lecture) evade easy classification. All talks have been recorded, and a project already underway, and for which we are seeking funding, is to transcribe and edit selected seminars for a limited edition. Hopefully, this will happen in the near future. The **Seminar in Formal Methods Series** is expected to continue, and we are hoping to expand our scope to include such issues as information theory, intonation systems, cognitive modeling and experimental psychology in the arts, and abstract and radical logical and meta-mathematical thought.

3.1.3 ARTIST AND TECHNICAL RESIDENCY PROGRAM In 1984-5, with the partial support of the National Endowment for the Arts, a tripartite residency program was established, which we hope

and expect to continue in future years. The intent of the program was to bring in artists/technical innovators for short periods of time to complete some "project" at the CCM, of their own choosing, but with significant collaboration and support from CCM personnel. Our goals were multiple — we wanted to enlarge the artistic community which the Center supports, we wanted to interact, learn, and share ideas, in significant ways, with selected artists. We wanted the Center's students and technical resources to benefit as much as possible from the expertise, ideas, and skills of these guests. As a kind of tentative format, we tried to select artists in each of three specified areas: the recording studio, small computer music systems, and performance (not necessarily electronic). We "opened" the Center to each of the three guests, and expected in return that they do some teaching (both formally and informally), interact with students as much as possible (that is, be a physical and mental prescence at the Center), and give some kind of public presentation (of their own design) at the end of their tenure.

The program was highly successful. The three artists invited for 1984-5 were Charles Amirkhanian, David Mahler, and Ron Kuivila. Mr. Amirkhanian worked intensively with Richard Povall and others in the recording studio, and produced a new work, **Martinique and the Course of Abstractionism**, which he presented along with other works new and old in a public lecture/concert. David Mahler worked each night for a week with the Mills Contemporary Performance Ensemble and its Director Larry Polansky, and produced a concert of his work (most arranged especially for the group). Ron Kuivila participated extensively in sophisticated technical development of various systems at the Center. He performed a concert of his own music and a new piece realized at the Center, in collaboration with Larry Polansky, using the **HMSL** system, entitled **Buka Bucha** (wordplay on the name of the digital oscillators' designer and the Javanese inspiration for the form of the work). Each of these three spent what can only be described as happy and productive periods at the CCM, teaching subjects ranging from software event scheduling algorithms and input structures (Kuivila) to beginning electronic music and polka (Mahler).

Since this three-fold specification of artists was successful, we plan to continue it in the future, but will by no means make it restrictive. In addition, we intend to try and ensure a better representation of women, video, and multi-media artists in the future.

3.1.4 PERFORMANCE SERIES Over the past four years, we have tried to strike a healthy balance between bringing in guest artists and encouraging performance by CCM personnel. With the support of the NEA and the Music Department, we have each year been able to bring in several guest performers, covering a wide variety of styles. A partial list of these includes: Malcolm Goldstein, Iannis Xenakis, George Lewis, David Behrman, Kenneth Gaburo, Salvatore Martirano, Margaret Fischer, Andrew Newell, Repercussion Unit, Carl Stone, Ron George, David Dunn, Daniel Goode, Anthony Davis, Roulette, Alvin Lucier, Katrina Krimsky, Joan LaBarbara, Western Front Society,

David Pate, Gordon Mumma, Trichy Sankaran, The Partch Ensemble, Walter Zimmermann, J.B. Floyd, and many others.

This year's guests include: David Tudor, Michel Waiswiscz, Linda Montano, Larry Wendt, Richard Teitelbaum, Doug Hall, and others.

In addition, CCM and Mills College faculty concerts occur frequently. In recent years, works by composers Lou Harrison, David Rosenboom, Charles Shere, Maggi Payne, Jody Diamond, and others have been heard. With the retirement of Lou Harrison, who will sorely missed (both personally and artistically), we are fortunate to have added Anthony Braxton to our faculty in 1985. All CCM and master's candidates in composition are required to give thesis concerts, and these are always at a professional, often at a visionary, level. Depending on enrollment, there might be between 10-15 of these in a given year. Informal concerts by students and staff are also quite common, as are concerts by outside groups simply using the Mills facilities, with "friendly" technical support from the CCM.

3.1.5 PUBLIC ACCESS PROGRAM

The CCM has continued its long-standing and historic committment to community public access. The recording studio, hybrid electronic music studio, dubbing and editing studio, film studio, and other facilities (by special arrangement) are open to the public at very low cost. In addition, the CCM provides technical assistance from staff and graduate assistants. This public access policy is geared to, though not restricted to, non-commercial artists in general, since there is a perceived need for an advanced, well-equipped facility that will inexpensively serve the needs of experimental artists. There has been considerable public use of these studios by outside users in the past few years, including record and theater companies, independent composers, electronic music students, and electronic music students.

Personnel at the CCM often collaborate with outside artists for various inter-media projects. Some recent groups and artists with whom the CCM has collaborated include: George Coates Performance Works, Chris Hardiman and Antenna Theater, Paul Dresher, Margaret Fischer and Bob Hughes, OP, OPtion and SoundChoice Magazines, the San Francisco Exploratorium, KPFA Pacifica Radio, Opus One, Alvin Lucier, Records, Tellus Cassette Magazine, the American Music Center, the Just Intonation Network, the Berkeley and San Francisco Symphonies, and many others. On the average, several studio tours and demonstrations a week are given to classes from other institutions, artists, researchers, teachers from all over the world. All of the CCM events are open to the public, and the CCM maintains a policy of administrative cooperation with other centers, arts agencies, and performance organizations in the Bay Area and nationwide.

4. SOME RECENT TECHNICAL DEVELOPMENTS

4.1 HMSL

HMSL, Hierarchical Music Specification Language, is an experimental compositional, performance, and research computer system developed recently at the CCM by Larry Polansky and David Rosenboom, with assistance from other CCM staff and students. This language is described in some detail elsewhere in these proceedings (by the same authors). HMSL, and it's theoretical ramifications are a significant part of the technical and artistic development at the CCM over the last two years — a part of our general concern with music languages and experimental approaches to musical artificial intelligence. HMSL is currently being used in classes, by composers, and by CCM personnel in a wide variety of contexts and applications.

HMSL runs on a general purpose 68000 based S-100 environment, with full graphics, sound, and I/O capabilities. This software and hardware configuration also supports more general research in signal processing, artificial intelligence, synthesis, and live performance.

4.2 THE TOUCHE

The TOUCHE digital synthesizer, developed by David Rosenboom and Buchla and Associates, is an important performance, composition, research, and educational facility at the CCM. The TOUCHE at the CCM runs the languages FOIL-83 (an instrument definition language) and Meta-FOIL (a meta-compilation environment), both written by David Rosenboom. Plans exist for the interfacing of the TOUCHE to HMSL.

4.3 INPUT STRUCTURES

An important area of research interest is computer music input structure devices, and several experimental devices are presently in design and construction stages. Since a major focus of the CCM has always been on the design and implementation of small, computer based performance devices, we are always seeking new and radical ways to communicate with these machine intelligences. Much of the design of HMSL, for example, assumes a generalized notion of stimulus/response that enables the system to communicate with a wide variety of input devices, some kinetic, some not (as in the case of biofeedback input, for example). David Rosenboom's work with the TOUCHE and other systems has explored these ideas as well. We encourage students to investigate, by their own hardware and software experiments, alternate modes of musical data representation and performance communication systems, and many students have designed their own instruments to further their own particular compositional vision.

(4.4 STUDIO INTEGRATION)

Alll of the studios are now linked by audio and digital lines, and we are continually seeking to improve and expand this communication network. We are currently implementing various data communication and synchronization formats.

including SMPTE and MIDI, to facillitate an even broader range of communication and control possiblities.

4.5 HYBRID ENVIRONMENTS

The CCM's facilities include several analog-digital hybrid environments, which include PATCH-IV, an analog control language designed and written by Lynx Crowe of Buchla and Associates, and MASC, written by Dan Kelley of San Jose State University. PATCH-IV is implemented on an S-100 8080 microprocessor system with a special single-board 6502 based keyboard control system (built and programmed at the CCM). MASC runs both on the S-100 68000 system (co-resident with HMSL) and on an S-100 based Z-80 system in the hybrid analog electronic music studio. That studio is used in large part by undergraduates and public access users, and as such offers an advanced and experimental facility that is open to novices as well as advanced users. In addition, other systems, including ones based on the Macintosh and other more commercially available systems, temporarily reside in various studios for educational, compositional, and experimental purposes. One example of an unusual educational experiment in hyrid systems, was the use of software commercially available for the MacIntosh to control envelopes and other standard functions of an analog synthesiser, in a beginning electronic music class.

4.6 APPLICATIONS OF THE VAX AND HP64000 LOGIC DEVELOPMENT STATION

Music software currently running on the Mills College VAX 11/780 includes the UCSD CARL system, MPL (an algorithmic composition language contributed by David Worrall of Australia), a VAX version of FORTH, and a variety of software written by CCM personnel. The VAX system is used extensively for documentation, research, communication and the teaching of music software. We are currently planning a version of HMSL written on the VAX, in C, and one for the MacIntosh written in the SUMAC environment. The CCM has benefitted from the enthusiastic support of the Mills College Math and Computer Science Department, and there are now several VAX terminals at the Center. In addition, we plan to use one of the VAX lines for data communications with HMSL.

The Hewlett-Packard 64000A logic development station was a donation from Hewlett-Packard to the college, and its use is shared by the CCM and the Math and Computer Science Department. It has proved invaluable as a tool for complex hardware design, implementation, and debugging. We also plan to use it in its 68000 emulation capabilities, C implementation, and software performance analysis functions.

4.7 OTHER USES OF MICROPROCESSOR SYSTEMS

The CCM maintains a small computer development laboratory for use by graduate students and staff in research and experiment. The use of special and general purpose microprocessor systems for performance instruments is quite common at the Center, and some recent examples have included

work by Chris Brown, who built his own signal processing instrument as part of his Master's Thesis, which was a set of works for instrumentalists and electronics called **His Master's Voice**; Phil Stone and James Mckee, who produced a concert entitled **On a Wing and a Song** which featured a hang-glider controlled computer synthesis instrument; Toyoji Tomita; and Richard Povall, who developed his own computer controlled switching system for a major video and mixed media work, **Coming of Age.** Many students have integrated the use of more commercially available microprocessors, like Commodores, Macintoshes and Apple II's into their performance and compositional work, and some have made significant hardware or software advances on these systems. The Macintosh has been used recently, for example, by Scot Gresham-Lancaster, in an accurate realization of the complex, "free style" just intonations of faculty member Lou Harrison's **At the Tomb of Charles Ives.**

4.8 RECORDING STUDIO PROJECTS

The Multi-Track Recording Studio, which is adjacent and connected via audio and control lines to the Hybrid Computer Studio, is one of the most frequently used facilities at the CCM. Many commercially released albums and tapes have been realized there over the years, and this continues to be true at the present time. Recently, we have replaced the main multi-track deck and mixing board with newer, more state-of-the-art facilities, and plans include automation and digital recording equipment, as well as a full, integrated video facility in the studio. Some recent works realized in the studio include David Rosenboom's and Jaqueline Humbert's **Daytime Viewing;** Larry Polansky's **V'leem'shol** and **Four Voice Canons;** Chris Brown's **Alternating Currents;** James Tenney's **Septet for Six Electric Guitars and Bass;** Jay Cloidt and Marina La Palma's **IXNA;** Richard Zvonar's **soul murder,** and many other works by both CCM personnel and members of the community. Maggi Payne teaches a class, jointly offered to both music and communications students, in recording studio techniques, and frequent seminars in advanced use of the facilities are held by Richard Povall and Scot Gresham-Lancaster.