A (not so brief) History of the Eastman Computer Music Center

1981 - 2006

(wherein also will be found sundry opinionated observations)

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The early years: 1979 - 1982

The origins of the Eastman Computer Music Center can be traced back to 1968, when Wayne Barlow, professor of composition, founded an electronic music studio at the school.[1] By the end of the 1970s, when Wayne retired and I was hired to update and expand the electronic music program, the Eastman electronic studio consisted of three rooms that each contained a large, modular *Moog 1* analog synthesizer and two or three stereo reel-to-reel tape recorders. The tape recorders were used not only to record the output from the Moogs, but also for tape delays, tape loops and other sound modification procedures.

In the fall of 1979 Professors Joseph Schwantner and Aleck Brinkman and graduate student Robert Gross joined me in undertaking a fact-finding study of the newest resources in electronic music production and the emerging field of digital audio. Because of the high cost of purchasing and maintaining electronic audio equipment, most electronic music studios in the US were in universities, colleges and conservatories, and most, like the Eastman studio, consisted entirely of analog equipment. At a few pioneering computer music studios, such as those at Stanford, Princeton, Columbia and Illinois, composers were making music by programming large mainframe computers that usually were shared by several university departments. Given the five mile distance between Eastman and the University of Rochester River Campus, the prospect of constant commuting between Eastman and the River Campus to piggyback on a university mainframe computer for much of our musical work was not appealing.

During this time digital synthesizers such as New England Digital Corporation's *Synclavier*, played in real-time with plastic piano-type keyboards (the forerunners of today's MIDI keyboard controllers) were beginning to come into vogue. We seriously considered a *Synclavier*-based developmental plan for the studios. Most Eastman composition majors at this time had good or serviceable piano skills, and we had no doubt that most of them would find playing a polyphonic piano-type keyboard more intuitive than typing in long lists of numbers on a computer terminal keyboard. Additionally, although the cost of a well equipped *Synclavier* system exceeded $30,000, this was less than half the cost of most alternative types of digital and hybrid analog/digital systems of the period. However, all four of us were dissatisfied with what we perceived as a limited timbral palette (mostly imitative of orchestral instruments) of the *Synclavier*, and with the characteristic FM "signature" (identifiable sonic quality) of its sounds.[2]

[1] Wayne, who received the first doctoral degree in music composition in the US in 1937, remained a good friend of our program until his death in 1995. Although he found our computer systems somewhat mystifying, he would stop by the studios two or three times every year to chat about the state of digital audio technology and to see our new toys.

[2] Like most other early digital synthesizers, the *Synclavier* produced various types of timbres through fairly simple implementations of frequency modulation (FM) techniques first developed by John Chowning.

During a "field trip" we made to MIT, Barry Vercoe graciously demonstrated for us another possibility that he had implemented in the Media Lab at the school. Barry had written a sound synthesis programming language called *Music 11* that ran in assembler code on the *PDP-11* series of 16 bit mini-computers manufactured by the Digital Equipment Corporation (DEC). Because these mini-computers were much smaller and less expensive (albeit also much less powerful) than mainframes, they could be dedicated to particular tasks, such as making music. A mini-computer could be housed in a normal room rather than in a frigid climate-controlled terrarium, and could be maintained by a small staff. Most importantly, sophisticated, processor-intensive music software such as *Music 11* (the forerunner of *Csound*), derived from the pioneering work of Max Mathews, Jean-Claude Risset, John Chowning and others, could be run on a mini-computer at any time — not just during the wee hours when computer loads dipped on time-shared mainframe systems). And when the computations were done, the resulting soundfiles could be played immediately rather than copied to digital tape for later conversion.

Given the choice of accessibility and ease of performance and maintenance (exemplified by *Synclavier* systems) versus extensibility and quality of sounds (mini-computer systems), we opted for the latter. There would be many times in the next few years when we would wonder why we had voluntarily subjected ourselves to so much aggravation.

In 1980 we installed a PDP-11/34 computer, initially fitted with 128 *kbytes* (sic) of RAM, along with analog/digital and digital/analog converters and other necessary audio hardware. However, it would be nearly a year before this system become sufficiently functional to support classroom instruction, and the first substantial musical works did not begin rolling out until 1982. The PDP-11, the size and weight of a good sized refrigerator, was often unstable, sometimes crashing several times each day, and the installation of new hardware circuit boards often took several days or weeks of work. Robert Gross, who held a staff position at Eastman between 1980 and 1982, handled the administration of this system and wrote most of our initial music software utilities for editing, mixing and manipulating soundfiles. Robert eventually went on to do important work in digital audio at the Skywalker Sound division of Lucasfilm Ltd. and at Microsoft. When he left in 1982, graduate student Craig Harris took over administration duties on the PDP-11. Aleck Brinkman, who, like Robert, had learned computer music programming techniques at Dexter Morrill's studio at Colgate University, completed his *Score11* score file preprocessor during this period. For several years the PDP-11 serviced Aleck's Music Theory programming classes in addition to its computer music functions.

Despite the frail constitution of of the PDP-11, we eventually got a lot of mileage out of this system. It was used to record sounds from about twenty percussion instruments, the beginning of our *sflib* ("soundfile library") collection of sound samples that today includes several gigabytes of source material for compositional and performance use. The initial versions of many of the programming utilities still in use today on ECMC Linux systems (and, to a lesser extent, on ECMC Windows and Macintosh systems as well) were coded on the PDP-11.

Realization of compositions on this system could be agonizingly slow. Sound synthesis, processing and mixing operations that today can easily be accomplished in real time often required hours of number crunching. By 1983, however, composers such as Craig Harris and JoAnn Kuchera-Morin were realizing musically imaginative, technically innovative compositions on this system that achieved widespread recognition, and the ECMC studios were becoming internationally known as an important new center for electroacoustic music. Robert Morris' *Exchanges*, written for pianist David Burge, was performed by Burge 15 times on venues throughout the United States.[3] Two of the works that I realized on the PDP-11, written for soloists

[3] Bob Morris went on to write five other works in the ECMC studios over the next decade. Although, like many of us, he works today primarily in his own home studio, he still makes regular use of the ECMC studios for particular projects.

Robert Sylvester and John Marcellus and computer-generated sounds, were performed widely, published and eventually released on commercial compact disc albums. In fact, collaborative projects between composers and performers has been a hallmark of the ECMC studios from these early days to the present.

1983 International Computer Music Association Conference

Between October 7 and 11, 1983 the ECMC and Eastman School hosted the 1983 International Computer Music Association conference (ICMC), attended by more than 200 musicians, researchers and developers from North America, Europe and other continents. In addition to several concerts and numerous paper sessions, the conference featured music and lectures by special guests Jean-Claude Risset and John Chowning, a keynote address by James A. Moorer, tutorial sessions, panel discussions, demonstration tours of the ECMC studio and an installation with continuous playing of important electroacoustic works. Concerts included new works by Paul Lansky, Charles Dodge, Horaccio Vaggione, Morton Subotnick, Kaija Saariaho, Carla Scaletti, Dexter Morrill, Trevor Wishart and many other composers, and superb performances by Eastman faculty and student soloists and the Musica Nova ensemble directed by Sydney Hodkinson. Paper sessions included presentations by Barry Vercoe, Lejaren Hiller, John Strawn, James Beauchamp, Curtis Roads, Julius Smith, Miller Puckette, Stephen Pope, Roger Danenberg, F. Richard Moore, Barry Truax and many other important researchers and developers.[4]

During the formative years of the Eastman computer music studios we received generous and gracious technical assistance from many developers and musicians in the field, from several other computer music centers and from individuals and departments within the University of Rochester. (It was especially helpful when we were assisted in becoming a node on the *arpanet* — a forerunner of the internet — during the early 1980s, and could communicate with other developers by e-mail as well as send and receive files and data electronically.) For me, serving as Director of the 1983 ICMC, and for ECMC staff members Craig Harris, JoAnn Kuchera-Morin, Marcia Bauman and Denise Ondishko, who labored for several months to produce this conference, it was a privilege to be able to give something back to the field.

The MIDI Studio

Throughout the 1980s and the early 1990s there was a sharp distinction between the methods used to create music in the two ECMC studios, which at the time were called the *direct synthesis* studio and the *realtime* studio. In the *direct synthesis* studio (ECMC room 52), all sounds were computed on Unix computer systems — initially on the PDP-11, then on its successors, a cluster of Sun-3 workstations and, beginning in 1989, on NeXT workstations. Detailed specifications for fragmentary passages of music were entered at a computer terminal, then computed, then played, revised, recompiled and played again numerous times, then eventually mixed together in software and recorded to a digital recording device (initially a Sony *FC-1* recording systems, and then beginning in the mid 1980s, to DAT tapes).

The *realtime* studio (ECMC room 54), by contrast, was designed to facilitate musical performance. Compositions were constructed by playing musical passages on piano-type keyboards connected to hardware synthesizers. Our first digital synthesizer, a hulking Kurzweil *K250* obtained in 1985 through an anonymous gift, was a remarkable instrument for its time, enabling one to play up to 12 notes at once and to digitally record what was played into an internal sequencer that could hold up to 12,000 notes. However, it was not easy to edit or modify these sequences, primarily because such edits were accomplished by pushing buttons while peering into a small, dim LCD display.

[4] A New York Times review of this conference is available online at *http://query.nytimes.com/gst/fullpage.html?res=9F02E6DD143BF933A25753C1A965948260*

By 1984 we had begun experimenting with MIDI communication between the *K250* and a sluggish Apple II computer system. Only in 1987, however, when we installed a Macintosh Plus computer (1 MB RAM, 8 MHz cpu) running Opcode's *Vision* software sequencer connected to a Yamaha *dx7 II* synthesizer did we begin to obtain musical results in which our users took pride. MIDI had become the basis for most of our realtime applications, and the "realtime" studio became known simply as the *MIDI studio*. By 1992 the studio contained four digital synthesizers —a Kurzweil *K2000*, a Korg *Wavestation* and two *dx7*s —as well as an array of (mostly digital) outboard processing gear, such as a delay line, Lexicon reverb unit and a Bose frequency shifter.

Composing and Performing Music

The ECMC MIDI studio has never been designed to facilitate or encourage MIDI emulations of orchestral or acoustic instrument performances, but rather to provide encouragement and support for new, interactive approaches to the composition, performance and the perception and enjoyment of music. Most current ECMC users are far less impressed by a 30 GB library of orchestral instrument samples with 16 velocity layers and a choice of 400 effects plug-ins than by a simple but ingenious "patch," written by one musician, that treats a familiar sound source or a fragmentary rhythmic or pitch pattern in an imaginative, unexpected or uniquely expressive manner. Eastman has always had an abundance of artistically and technically gifted instrumentalists and singers whose performances enrich our understanding and enjoyment of music. Personally —and I think I can speak for almost all ECMC users here —I have no interest in trying to imitate acoustic performing ensembles, or in the substitution of technological shortcuts for the assured musicianship of the many fine players all around us.

Despite the numerous collaborations between ECMC composers and Eastman performers during the 1980s, there was, by the end of the decade, still a lingering suspicion among some performers that "these computer guys want to put us out of work." I believe that one of our most rewarding accomplishments since that time has been the continuous increase in usage of ECMC resources by instrumentalists and singers. Today, nearly half of the twenty to thirty students who use the ECMC studios each year are performers. And during the past dozen or so years performers who have been affiliated with the ECMC studios, including percussionist Patrick Long, saxophonist Randall Hall, trumpeter Jason Price, singer Heather Gardner, marimbist Nathaniel Bartlett and several others have made their mark as performing artists who employ computer music resources to extend the technical and esthetic range of their musical craft. I am very proud of their achievements.

Interactive compositional and performance software applications used in the ECMC studios, beginning with *M* in the late 1980s, then *MaxMSP* beginning in the early 1990s, and including *Pure Data* (*PD*), which many of our users have employed during the past five years, have had a lot to do with this greater involvement by performers, and with collaborative or interactive projects between composers and performers. In such jointly realized projects, the traditional "First I write it, then you play it" roles are not always so clearly delineated. Sometimes there is often considerable creative overlap, as there was in many earlier periods of Western musical history and as exists in jazz and rock music and in most world music cultures, between inventing ("composing") music and performing it. Several of the works included on the ECMC 25th anniversary concert series exemplify these type of collaborative processes.

Plus ca change, plus c'est la meme chose[5]

The explosive growth of digital technologies during the 1990s and into the present century is familiar to all of us and need not be recounted here. Miniaturization of digital circuitry, rapid increases in computing speed and power and the commoditization of computing hardware (and

[5] "The more things change, the more they remain the same."

resulting sharp decline in prices) have made prodigious computing power widely available for musical purposes. Change has been (and continues to be) rapid, and the best hardware platform or software application today may no longer be the most effi cacious, suitable or cost effi cient choice in two or three years.

Former ECMC users who return for a visit after several years absence sometimes remark, "I don't recognize the place." Over the past twenty years our Unix-based software has migrated from Sun (1984) to NeXT (1989) to SGI systems (1994) to commodity hardware running GNU/Linux and open source software (2002). In the MIDI studio we abandoned the Macintosh platform entirely for awhile. In the years around 2001, immediately before and after the introduction of *OS X*, we experienced increasing incompatibility and instability problems with our Mac music software (particularly with the driver for *Pro Tools*, which did not get along well with our other audio software). We also were dissatisfi ed with the high cost and mediocre performance of Mac hardware of this period, and so shifted our MIDI studio operations to Windows systems. This platform migration was not a simple or joyous operation (we lost important applications such as *MaxMSP*), but it did produce a palpable sense of relief within the studio that musical issues could again become paramount, and we could return to productive work.

Time passed. Mac hardware improved, and *OS X* matured into a robust operating system with many excellent audio and MIDI applications, too important to be ignored. For the last four years Macintosh and Windows systems have co-existed peacefully and amicably, side by side, as joint —often almost interchangeable —resources in the MIDI studio. Most commercial music applications today are available in both Mac and Windows versions, and our software base on these platforms is very similar.

Similarly, our principal MIDI and audio software sequencing application has changed several times —from *Studio Vision* to *Digital Performer* to *Logic* to *Cubase*. And within just a few years we migrated from *Pro Tools* to *Nuendo* to simpler applications with a sharper focus on the particular types of editing, processing and mixing operations required for the types of projects most often created in our studios.

The transition of our Unix music software base from proprietary SGI workstations to open source GNU/Linux systems between 1998 and 2002 was perhaps even more arduous and disruptive than our Macintosh hiatus. More than three years of developmental work in shared library and device driver hell elapsed before our Linux system *madking* (a very apt name, during this difficult developmental period) became as usable as its predecessors.

Amidst all of this change, however, we have tried to maintain the original focus of the ECMC, and never let the technology itself become more important than the musical creativity and expression that it should serve. Digital technology is simply is set of tools —the principal tools of our age. When applied to music and the arts with insight these tools can serve (and sometimes even liberate) musical creativity and imagination. But if the emphasis shifts to the technology itself, as in a slavish desire to follow "industry standards" ("If everyone else is using it it must be good!"), or bloated software with hundreds of features that no one ever uses, or academic courses devoted solely to how to use a particular software application rather than to musical issues elucidated by the software, then this same technology can smother or get in the way of artistic creativity, and also suck the fun out of making music.

Art and Technology

Professional colleagues and prospective students sometimes are surprised to discover that there is no academic major, or minor, or even concentration, in the area of "Music Technology" or computer music at Eastman. The reasons for this decision have been encapsulated above. We believe that there are important and exciting applications of computer technology available to composers, to performers, and to music theorists, scholars and educators. But the emphasis

should always be on excellence in composing, in performing, in scholarship and pedagogy.

The creation of electroacoustic music is a much faster and technologically easier process today than it was ten or twenty years ago, and the acoustical quality and clarity that can be achieved today is appreciably better. But the very best *music* being made with today's improved tools is probably no "better" than the most imaginative music created more slowly (and therefore, some would argue, more thoughtfully) during the infancy and adolescence of electronic and computer music techniques. And, owing to the low cost and easy availability of computer music resources today and the resulting exponential increase in the sheer number of musical works created with these resources, the "signal-to-noise" ratio (the ratio of exciting, engaging, thought-provoking works to forgettable and derivative compositions and performances) is probably "worse" today than twenty or thirty years ago.

(Hmmm. Re-reading the preceding paragraph it sounds uncomfortably like the grumpy remonstrations of an aging geezer lamenting the lost good-old days when you really had to work to create electroacoustic music. Hmmm.)

Music that is fresh and alive generally reflects not only certain values, paradigms and issues of its time, but also the technologies of its period. I feel very fortunate to have access to the powerful tools digital and audio and compositional tools available today. But access to "bigger, faster, easier" technologies rarely, in itself, leads to the creation of "art that makes you smile inside." At best, the technology can only open potential windows to artistic discovery, which often remains a slow, challenging, unpredictable and therefore all the more fascinating a process. (On the other hand, any potential window to artistic discovery is hardly to be disdained.)

Drawing closer

During the last 15 years the previous clear-cut differences in working procedures and capabilities in our two studios have narrowed considerably, and in certain areas have practically disappeared. During the 1990s very high quality Macintosh and Windows music software became available from commercial vendors. Many types of sound synthesis, signal processing, editing and mixing operations formerly possible only on our high end Unix workstations became usable as well on cheaper commodity PCs. (Indeed, the Mac itself even became a Unix workstation, at least "under the hood.")

Powerful sound processing applications such as *Reaktor*, *SuperCollider* and the *Composers' Desktop Project* as well as highly extensible signal processing applications and plugins have become an increasingly important part of the resources of the MIDI studio. Many user projects consist primarily of mixing sounds created by synthesis and sound modification techniques —procedures similar to those also being employed in that "other" studio around the corner—rather than of generating or layering MIDI tracks. In reality, the term "MIDI studio" has become too restrictive, belying the much broader range of applications and projects now serviced by this studio.

Over in room 52, meanwhile, a majority of tasks now are performed in real time, often with mouse-based graphical applications similar to Windows and Mac GUIs, sometimes with MIDI input, sometimes with no direct sound synthesis. The term "direct synthesis studio" became anachronistic several years ago, and we generally refer to this studio now simply as "the Linux studio."

In addition to the increasing overlap in functions between these two studios, the computers in these studios also have been physically linked for several years. All nine of our desktop computer systems are connected by high speed (gigabit) Ethernet LAN hardware, enabling users to "fly" projects and sounds back and forth very quickly from one computer system to another. A recording of a saxophone made on Macinstosh system *wozzeck* may be moved to Linux system

madking for sound modification, mixing with synthesized sounds and multi-channel spatialization, and then transferred to Windows system *gesualdo* for recording to a DVD-Audio disc. There are no longer any "walls" between the studios.

Two approaches to software, and to making music

Although the walls may have tumbled, however, there remain some very important and, we believe, salutary distinctions between the two ECMC studios. Although the types of musical tasks performed in these studios are sometimes quite similar, the *manner* in which these tasks are performed is often quite different. And the choice of what method or approach one adopts to perform a procedure can have a profound effect on the kinds of expressive and structural possibilities that present themselves, and thus on the final musical results.

In the MIDI studio we attempt to provide users with the very best commercial Windows and Macintosh audio software and hardware for the types of creative projects that the studio is designed to support —projects that encourage musical innovation and imagination (rather than imitation) as well as technical excellence. This is not necessarily the same audio software and hardware one is likely to find in a commercial recording studio or postproduction house. It is important for students to become familiar with representative examples of popular professional music software applications because these applications are so widely used, and therefore comprise benchmarks against which one can assess the merits of newer and alternative types of music software. Moreover, many of our students —especially those who eventually go on to do commercial film and television work, or work in recording studios, or teach in schools where the curricula are geared toward preparing students for these types of career paths will be expected to be thoroughly familiar with the "industry standard" tools of digital audio production.

Many of the most widely used commercial musical applications are designed as comprehensive packages, incorporating tools commonly used at various stages in the evolution of a musical project, with an accessible, "easy-to-learn," professional-looking graphical interface that often emulates the look of hardware audio equipment. Most importantly, these applications generally present the user with quick access —often in the form of exploding menus —to many common procedures for tweaking, modifying and layering individual sounds and complete audio tracks.

Some open source applications unabashedly imitate or borrow from popular commercial titles. But the Unix audio programs and utilities written over the years by ECMC staff for use on our systems (most of which are still in use today), as well as many of the open source musical applications that ECMC users find most useful and creatively stimulating, have a very different paradigm, almost the opposite of the commercial "big tent" model. These programs are intentionally limited to performing one type of operation, or a group of closely related operations, quickly and efficiently. They have a small footprint, loading and executing quickly, and often can be easily interconnected (scripted) or run in quick succession, so that the musical output of one utility becomes the input to the another program.

Such modular, optimized utilities enable users to quickly create their own, unique types of signal chains to generate, process and combine musical material and ideas. Users also are encouraged to create their own programming and algorithmic tools and compositional aids, and to modify or extend existing software for particular new purposes.

In short, MIDI studio users are urged to make fresh and original use of available software (most of it commercial, but some of it open source or shareware). By contrast, Linux studio users are encouraged to develop their own tools.

There are advantages and disadvantages to both of these approaches to music software. Commercial applications, written by professional programmers whose livelihood depends upon widespread acceptance of their efforts, often streamline and standardize procedures for

performing common tasks, and often are more intuitive to use (at least initially) and better documented. On the down side, they frequently are overstuffed and slow, too much alike, and frequently suffer from abysmal or non-existent technical support (which makes no money for the vendor) and from obnoxious registration, copy protection and marketing mechanisms, such as hardware dongles, or granting access to the program to only one user account on the system. Most importantly, perhaps, these applications are proprietary. If you find or suspect a bug or hardware or software incompatibility in the application, or want to extend the utility of the application in some new direction, you probably will be dependent upon the manufacture to address this need. It could be a long wait.

With open source software the source code to programs and applications is freely available, and can be modified and extended to suit an individual's needs —either by the user herself (if she has some programming skills) or by other members of the open source community. Open source software generally is written by users themselves (often by musicians, in our case) and has a very active user community that shares information —an environment similar to that of the early days of computer music.

On the other hand, open source software is sometimes more difficult to install and configure than commercial software; is sometimes more hardware-dependent; often doesn't look very pretty (since "eye candy" may be of little interest to the developer); varies more widely in quality (from excellent to buggy to worthless) and often is poorly documented.

For musicians who learn how to program in order to create their own musical toolchests, conceptualization of musical works and devising tools with which to realize these works can become a continuous, circular process. In the process of working out technical procedures while programming, compositional ideas sometimes emerge unexpectedly, or are seen with a newfound clarity. For a musician, however, programming also can become a tar pit, consuming far more time than originally anticipated and draining one's creative energies —time and energy *not* spent on making music.

In 2004 staff member Kevin Ernste consolidated all of the ECMC and open source software used on our Linux systems into a *Turnkey Audio* distribution. This package, which currently is maintained by Mathew Barber and is used today in conjunction with the comprehensive and well-maintained *Planet CCRMA* package distributed by the computer music center at Stanford University, enables ECMC users —and anyone else with an internet connection —to download and then quickly install and configure an almost exact clone of the music software on our flagship Linux system *madking* onto their own personal computer.[6] At no cost, our students can work at home with all of the same software they employ in the ECMC Linux studio. And when they leave Eastman, they still will have access to updated versions of this software. We are also pleased to have heard from many musicians with no connection to Eastman who have found our software, documentation and tutorials to be useful.

Choreographing sounds

Alternative approaches to music making in the two studios extends beyond software issues. Multichannel audio (the use of four or more loudspeakers, generally placed near the front and near the room), *ambience* (creating the illusion of particular types of rooms, spaces or environments in which music is heard) and spatialization of sound sources ("choreographing" musical sounds, so that they seem to emanate from various perceived locations within the listening environment) have become important resources in electroacoustic music as well as in commercial recording and multimedia presentations.

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[6] See the *DOWNLOADS* link on the ECMC home page at:
http://ecmc.rochester.edu/ecmc

The most commonly used approach to employing these three related resources is *5.1 surround* format, in which sounds are panned between three front and two rear loudspeakers, and very low frequencies from all channels are routed to a subwoofer.[7] The MIDI studio has been configured for 5.1 playback in order to acquaint students with localization procedures they may encounter professionally, not only in film music production, but also in SACD (*Super Audio Compact Disc*) and DVD-Audio releases of musical albums.

But *5.1 surround* is only one of several approaches to spatializing sounds throughout a room, and to many of us not one of the more effective methods. The Linux studio is equipped with 12 loudspeakers designed primarily for sound spatialization by means of *ambisonic* processing, a conceptually simple but powerful set of procedures first developed in the United Kingdom. A four speaker array is used for quadraphonic front-rear spatialization, while an eight speaker system (with four speakers above ear level and four speakers below ear level) provides full 3-dimensional localization capabilities.

Mosaic

We strongly encourage or —for students who follow the full two year ECMC sequence in computer music techniques —compel students learn how to use a wide variety of commercial and open soft music software and to move back and forth freely between our Windows, Macintosh and Linux computer systems. Only through familiarity with a broad range of hardware and software options, and of alternative approaches to employing digital audio resources, can one make informed choices.

Over time, most ECMC staff members and most of our student users develop a special affinity for one or another computer platform and for particular software applications because they discover that these particular resources tend to stimulate their musical imaginations in special ways, or provide a working environment that proves to be especially productive. Fortuitously, our staff members tend to develop quite different preferences, and as a result different areas of particular expertise. At the same time, each staff member is conversant with the "big picture" —the full range of ECMC hardware and software resources, and how these resources fit together within our creative and instructional programs.

All of this makes working in the ECMC studios much more interesting and much easier. If we all had the same preferences, we would probably all come up with the same solution when a problem arises, and because of our shared (and therefore redundant and limited) perspective this quite likely might not be the best possible solution.

Additionally, a vast amount of musical software and hardware is available today —more than any one person could use, master or retain. I don't want to try to be Mr. Wizard, or spend all of my time reading manuals and trying out every new digital audio resource. I'd rather spend some of that time composing, conversing with friends and sipping a glass of fine wine, secure in the knowledge that if some hot new digital thingamajig comes along, one of my ECMC colleagues will let me know all about it.

An aside: Knowing too much

Fifteen years ago very few students entered our computer music classes with little or no prior experience working with computers. Many were initially wary or uncomfortable when compelled to sit in front of a monitor and keyboard, and a period of acclimatization was often necessary. Today, of course, most students entering these classes have abundant experience using computers, some since early childhood. In fact, some entering students already have assembled their own personal computer music studios. Ironically, although perhaps not really surprisingly,

[7] The *.1* indicates that the sixth speaker, the "sub," uses only the lowest ten per cent of the full audio bandwidth, or frequency range. 6.1, 7.1 and 10.1 systems also are sometimes employed.

there are occasions in which this very familiarity can actually complicate or hinder, rather than facilitate, a student's mastery of new concepts and techniques.

Students who already have assembled their own audio hardware and software, or perhaps have worked in a recording studio, or play in a rock band that makes heavy use of electronics, often have invested a considerable amount of time and effort (and sometimes also money) in mastering particular digital audio resources. They may have developed a commitment to these resources, and may find it hard to let go and take a fresh, unbiased look at alternative approaches to music making with computers.

This situation does not arise very often. Most ECMC students, regardless of their prior background (or lack thereof) in computer music techniques are eager to explore digital audio resources in a very free and open manner. But some of the students who have gotten the least out of our courses have been those who came in with the "best" preparation. Something was missing, and although they did their assignments and passed the course I was unable to teach them much of any significance.

ImageMovementSound

The Rochester *ImageMovementSound* festival (*http://www.imsrochester.org*) began with a hybrid "film exhibition/concert" show that experimental animation filmmaker Stephanie Maxwell of the School of Film and Animation (*SOFA*) at the Rochester Institute of Technology and I curated and presented before a standing-room-only audience of 500 in Eastman's Kilbourn Hall on March 19, 1997. Showcasing innovative techniques in computer-generated and live acoustic musical production and in experimental animation and live action filmmaking techniques, this show was repeated in September on the visiting artists series at Colgate University.

The following year Stephanie and I made contact with Susannah Newman, graduate co-coordinator of the Department of Dance at the State University of New York, Brockport, and the three of us mapped out a framework for future *IMS* productions. Now in its eleventh season, the *ImageMovementSound* festival sponsors the creation of multimedia works collaboratively conceived and realized by groups of two or more artists from Rochester area universities. Over a period of six months of often concentrated work, teams of filmmakers, video artists, composers, performing musicians, choreographers, dancers, painters, graphic and media artists (and sometimes artists from other disciplines as well) from Rochester area colleges and universities work closely together to create innovative multimedia works for screen and live performance.

Each spring the resulting works are premiered in multiple performances at various venues in and around the Rochester area. These shows are produced by the participating artists themselves, supplemented by technical assistance from ECMC staff for audio playback and sound reinforcement. A hallmark of the festival since its inception has been a coming together not only of artists of diverse talents, interests and disciplines, but also of similar diverse audiences for cinema, music (concert, jazz and popular), and dance, and of the simply curious —people open to the exploration of thought-provoking alternatives to formulaic commercial media and eager to share in art that is challenging, unexpected and alive.

Well over 100 works have been created for presentation on *IMS* festivals. Many of these works subsequently have been exhibited or produced on international film festivals, concerts and a wide variety of other venues. A good number have gone on to win prestigious awards and have attained widespread recognition, and some have led to ongoing collaborations between artists after they have left Rochester.[8]

[8] An article titled *Animated Image, Animated Music* that Stephanie Maxwell and I wrote on collaborative processes in some our own film/musical compositions, included in *The Sharpest Point: Animation at the End of Cinema* edited by Chris Gehman and Steve Reineke and published by *XYZ Artists* and the *Ottawa International Film and Animation Festival*, may convey some more of the

Take it outside, folks

IMS festival performances are only one of a growing number of activities supported by the ECMC outside of our studios and, often, outside of the Eastman School. Most of these activities involve concert performances and related functions sponsored by the ECMC, by the Eastman Composition Department and by the *Ossia* new music ensemble, but also include faculty and student recitals as well as performances and readings presented by various other Eastman ensembles (such as *Musica Nova* and student groups. At these events —which typically number three or four venues per month throughout the school year — ECMC staff provide services such as recording, amplification and sound reinforcement, audio playback and live electroacoustic sound generation.

To support these services the ECMC maintains a collection of audio and computer equipment expressly for remote use that includes two laptop computers loaded with audio and MIDI applications, 21 loudspeakers, two mixing consoles, an array of condenser and dynamic microphones and preamplifiers, compact disc and DVD playback decks and various other audio equipment.

In addition to our desire to support concert presentations within the school and within the community, and the much greater portability and ease of setup of computer and audio equipment today, there are other, equally or even more important reasons why an increasing amount of ECMC activities take place outside of our studios.

☞ Twenty years ago computer music concerts primarily featured the playing of tape pieces. Electroacoustic works "for unaccompanied computer" remain an important, unique and often fascinating genre. Today, however, a majority of electroacoustic works involve live performance elements, which may include interactions between performers or between performers and "machines;" or the processing (alteration) of sounds produced by instrumentalists and singers; or performers playing computer-based instruments; or film, dance or other forms of multimedia production; or instrumental performances of compositions realized in part or in whole by computer-assisted compositional techniques; or any of a number of other interactive computer music resources that have been developed since the founding of the ECMC studios. Such music is not "complete" until it is performed.

☞ We want to *get this music out into the world* —onto the concert stage, but also in new and sometimes unconventional venues such as libraries and museums, or even (who knows?) shopping malls or muffler repair shops, where the music will find new audiences. Let the birds out of the cage!

☞ We're just plain out of space in the ECMC studios, and are anticipating an eventual move to expanded quarters as part of the School's five year strategic plan, currently under development. At present, some of the our creative and instructional activities simply cannot be performed within the overcrowded confines of the ECMC studios, and so must be accomplished somewhere out in the great wide world beyond these confines.

Who are these people?

Unlike some computer music centers, the ECMC staff has always consisted primarily of Eastman graduate students pursuing masters and doctoral degrees in composition, in performance and in other musical and academic disciplines. These students receive a graduate award stipend in return for ten to twelve hours of work each week in the ECMC studios and on remote functions. (Should you hear rueful chuckling or groaning sounds nearby, these probably are the incredulous responses of some of our current graduate teaching assistants to my 10-12 hour

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philosophy and flavor of *IMS*. A link to this article is available at:
http://ecmc.rochester.edu/allan/writing.htm

weekly timecard estimate. Naturally this figure does not include unpaid overtime.)

These staff members teach certain topics (and sometimes entire classes) for the two ECMC computer music courses; provide weekly individual lab instruction to students in these classes, as well as ongoing technical support to ECMC faculty and continuing student users; maintain the hardware, software, system administration, user accounts, security and the networking capabilities of our eleven computer systems; maintain and repair our audio hardware; build (and frequently re-build) our Windows and Linux computer systems from component parts; write audio and general purpose programs and utilities for use on our systems; research and provide expertise in particular areas of hardware, software and audio resources; develop new capabilities for the studios, such as our recently installed eight channel playback system; serve as audio and recording engineers and as computer operators on our concert, recording and other remote operations, and as liaisons with ensembles, faculty and students in the scheduling and planning of these remote gigs.

Obviously the wide range of musical and technical resources and activities detailed on the preceding pages would be unthinkable without the extraordinary capabilities and contributions of these staff members who, although still students, already are also highly skilled professionals in many areas of computer technology and audio production. However, technical know-how is by no means the their most salient contribution to the ECMC or to the Eastman School. Above all else, they are fine musicians, and bring to each of their tasks a remarkable *musical* command and understanding that motivates and informs all of their work.

Many of our former staff members and students currently are directors of computer music studios, or teach electroacoustic music techniques, or incorporate their knowledge of these techniques within their teaching of composition, performance, theory or other areas. Others are applying their knowledge of electroacoustic resources within careers as solo performers or freelance musicians, or as members of performing ensembles; many work in film, multimedia, television, digital or interactive media, or as software developers or as audio engineers; some work with dance companies, and some are involved in arts administration. In order to be able to practice their art, musicians today often must be versatile, and entrepreneurial, and capable advocates for their art and for themselves. And often, there is no way to anticipate the kinds of bounces that a musical career will take.

Music

Much of this rambling memoir has seemed to focus on *things* —equipment, facilities, technology, software and the like. However, when I reflect upon the twenty-five year history of the ECMC, all of this paraphernalia is rarely what comes to my mind. What I do remember, often with indelible clarity, are particular electroacoustic compositions and multimedia works created by ECMC users, and memorable interactive performances involving computer music techniques that have been presented on concerts sponsored by the ECMC and by various other ensembles and individuals within the School.

I will not recount these compositions and performances (there are far too many), nor attempt to compile a top ten list, which would be a futile, hare-brained undertaking. Instead, I will simply state the obvious: far and away the greatest achievement of the ECMC during the past twenty-five years has been the music.

A whole LOT of music has come out of this place . And some of it has been music of substance, of daring, of wit, of surprise, of mystery, or of unanticipated beauty; but also music that may bewilder, challenge or even rankle the ear or the mind. Music that is not dead.

The 25th anniversary concert series that the ECMC is producing this year is intended to provide a window into the richness of this music. Works by internationally celebrated

electroacoustic composers, and representative works by some composers who learned at least some of their craft in the ECMC studios; performances by outstanding players, including, again, some ECMC alumni; and participation in a few of these performances by distinguished researchers and developers in the field who have opened the doors to many new compositional and performance resources, and helped to make possible some of the works on this series.

For another window into all this music, one can go to the *ALUMNI* page of the ECMC web site at: *http:/www.ecmc.rochester.edu/alumni*
From this page, click on the links to some of our alumni which often will take you to their individual home web pages, some of which include playable *mp3* excerpts as well as information on their recent works and activities.

Some special friends

Composer **Vladimir Ussachevsky**, a pioneering figure in the development of electroacoustic music between 1959 (when he founded the Columbia-Princeton Electronic Music Center) and his retirement in 1980, was also an Eastman alumnus. In the decade after his retirement Vladimir would visit the ECMC studios every so often, and I always enjoyed our conversations. He maintained a keen interest in all aspects of electroacoustic music, and was always eager to discuss new resources in the field and to hear recent compositions that made use of these resources, including compositions by ECMC students. During his final decade he also traveled frequently to Russia and to eastern Europe, where he donated computers and audio gear to new music centers and to individual composers who otherwise had no means of obtaining such equipment.

A year or so after Ussachevsky's death in 1990 I was surprised to learn that he had left a generous bequest to the ECMC studios in his will. Yearly interest from this trust enables us to purchase equipment (such as our eleven Genelec loudspeakers) and to support functions that otherwise would be beyond the resources of our Eastman budgetary allocation.

Collaborative projects between composers and performers have been a hallmark of the ECMC studios for more than twenty years, and some of these projects have involved works commissioned by or written expressly for Eastman faculty performers such as David Burge, Robert Sylvester, John Marcellus and John Beck. The Eastman faculty performer who has been most ambitious and instrumental in initiating such projects is **John Graham**, Professor of Viola.

John has actively sought out both faculty and student composers, attending recitals and forums by Eastman undergraduate and graduate composition majors, *IMS* festivals and other concerts and events that would afford him the opportunity to become acquainted with music by our our young composers. At Graham's request, six ECMC composers have written works that John has premiered and added to his recital repertoire. These works employ a wide range of electroacoustic resources as well as innovative writing for the instrument, including live computer processing of the viola, interactions between the solo and computer parts, extended techniques and improvisation. The compositions are remarkably different in character, structure and technique (which delights John), and highlight some of the many facets of his virtuosity, consummate musicianship and unique performing abilities.

Graham has performed these works while touring in China, at Aspen, in Sante Fe and on several other venues, and his interpretations of a work often vary considerably from one performance to the next. All of these good things have happened without a dime of institutional or foundation support, through the enterprising and persuasive efforts of a consummate musician who cares deeply about the music and art of his time.

I have been fortunate to have been granted several sabbatical leaves during the past two decades in order to pursue compositional, research, performance and other professional projects and, in the process, to catch a breath. In my absence ECMC staff members **Craig Harris** (1987), **Patrick Long** (1996-7), **Greg Wilder** (2000) and **Kevin Ernste** (2004) have stepped in as acting directors of the ECMC to teach (or to coordinate the teaching of) my classes and to assume administration of the day-to-day operations and long term planning for the ECMC studios and programs.

During each of these periods, Craig, Pat, Greg and Kevin not only kept the place humming smoothly, but actually left the studios in better shape than they had found them, restructuring and adding vital new components to the curricula of the two classes, undertaking new developmental initiatives to enhance the capabilities of the studios, and updating and replacing equipment and software to which I had grown overly accustomed or paternally forgiving, but which they found antiquated or inadequate, or for which they found better or simpler alternatives. For their conscientious oversight of the ECMC programs and for their initiative in bringing a fresh perspective and leadership to these programs, I and all of our faculty and student ECMC users are indebted to each of these fine musicians, whom I am proud to be able to call my friends.

Sensing a whiff of complacency or entropy beginning to creep into our ECMC operations last year, I applied for another sabbatical leave, which has been granted for a six month period beginning in January, 2007. With flawless timing, I managed to schedule this leave to coincide with one of the busiest periods in the history of the ECMC —during our special 25th anniversary celebration concert and event series, which also will be a time of uncommonly rapid turnover in the ECMC staff.

Three of our current staff members, **Paul Coleman**, **Matthew Barber** and **Scott Peters e n** are jointly assuming responsibility for administration of our instructional and creative programs during this period of intensive activity and change. Matt, Scott and Paul will be assisted by our other current staff members, Baljinder Sekhon, Tiffany Ng, Robert Pierzak and Christopher Winders. All are talented, bright young professionals who have remarkable abilities and the potential to make significant contributions to the musical community. And all are my friends.

The ECMC studios are in very capable hands. When I return next September it will be with considerable anticipation to see what changes and improvements they have implemented in our programs, and to hear some of the new music that has been created in the ECMC studios while I was away.

October, 2006