ABSTRACT
The Center for Experimental Music and Intermedia (CEMI) is a research center housed within the Division of Composition Studies at the University of North Texas College of Music. CEMI provides opportunities for artistic creation, research, teaching and learning, collaboration, and performance. CEMI strives to provide an environment that supports every kind of time-based artwork that current technology makes possible. CEMI's programs and activities focus on education, performance, and collaboration. CEMI's busy annual season of events includes concerts, workshops, lectures, and demonstrations. Presentations and residencies by guests from around the world invigorate CEMI's activities. As the state of the art changes, CEMI is adapting to new opportunities and needs: notably, support for intermedia, spatialized sound, and live performance; complementation of home studio systems; and access for non-traditional users. CEMI facilities are maintained and developed not only to reflect but also to advance the state of the art. CEMI faculty and students produce an increasingly diverse range of work, exploring new directions in intermedia, interaction, and spatialized music as well as traditional electroacoustic works.

2. PROGRAMS AND ACTIVITIES
Education, performance, and collaboration are at the heart of CEMI's mission. CEMI staff develop programs and facilities with a view toward bringing people together to teach, learn, create, and collaborate.

2.1. Education
Studies at CEMI are within the Division of Composition Studies at the UNT College of Music. Composition students can pursue BA, BM, MA, MM, and DMA degrees. A DMA with concentration in computer music media is available. Courses cover history of electroacoustic music, fundamental techniques, intermedia and performance art, and topics in acousmatic, interactive, and other types of work.

The approximately 80 students in the composition degree programs are immersed in a large and vibrant College of Music, with over 1600 students and more than 1000 concerts per year.

Figure 1. CEMI student Stephen Lucas, video studio.
2.2. Performances and Presentations

MEIT provides a venue for performances and presentations by CEMI researchers and guests, including lectures, demonstrations, and open rehearsals. CEMI's busy concert schedule includes the "Centerpieces" series, featuring electroacoustic music by North Texas composers; the "CEMI presents" series of themed electroacoustic concerts and guest artist performances; and electroacoustic performances in the annual series of concerts given by Nova, the contemporary music ensemble at UNT.

2.3. Collaborations and Guest Artists

Collaborations with students in mathematics, engineering, visual arts, radio and television, and other areas of the University of North Texas are ongoing. A new graduate degree in the College of Engineering offers opportunities for collaboration in such areas as sonification of mote sensor data, translation between facial movement and speech, and assistive technologies.

CEMI brings in a wide variety of guests each year. In the past two years, CEMI has hosted residencies by Philippe Manoury, Miller Puckette, John Chowning, and Mario Davidovsky, and Jin-Hi Kim, including concerts of their works, lectures, and master classes. In the past year, Barry Moon, the Nonsense Company, Elizabeth Hoffman, and Richard Dudas also gave guest lectures, demonstrations, and classes.

Figure 2. guests Miller Puckette and Philippe Manoury in MEIT; CEMI TA Dave Gedosh in the background.

For several years, CEMI has hosted Residence prizewinners from the Bourges Concours, most recently Maxence Mercier and Diana Simpson. The prizewinners have enjoyed month-long residencies with a studio of their own, resulting in new works and opportunities for dialogue with the CEMI community.

3. CURRENT AREAS OF DEVELOPMENT

As technologies and aesthetics continue to evolve, CEMI is adapting to new opportunities and needs. Five of these are of particular importance, and are addressed in detail below: visual media, spatialized sound, performance preparation, complementation of home studios, and access for non-traditional users.

3.1. Intermedia

A pioneering center for intermedia performance, CEMI has continued to support integration of visual media and performance arts with electroacoustic composition.

One of the CEMI studios is optimized for video production and intermedia work. Another is currently being upgraded for media collaborations, expanding on its earlier scoring and MIDI orchestration role.

The Merrill Ellis Intermedia Theater (MEIT) provides flexible infrastructure for intermedia performance. This includes multiple projection on a 270° wraparound video screen as well as an extensive DMX/MIDI controllable stage lighting system, both of which are in the process of being upgraded.

3.2. Spatialized Sound

Surround audio, multi-channel mixing, and live diffusion have been an important focus of research at CEMI since the early 1990's. Four of the CEMI studios currently include 8.1 audio systems, and the 3-dimensional 16.1 audio system in MEIT will be expanded to 24.1 (adding a ring of eight "distant" speakers facing upward/outward) in the coming year.

Diffusion can be planned and rehearsed at an 8-bus mixing board in each of the 8.1 studios, and a 16-bus system in MEIT. CEMI staff are developing a new hardware/software system for routing, mixing, and diffusion in MEIT (and eventually the studios).

3.3. Performance Preparation

Live performance with electroacoustic, interactive, and intermedia systems requires integration of microphones and other hardware; thorough testing for robustness; extensive rehearsal; and careful preparation for setup and presentation in new venues.

Figure 3. CEMI TA Jing Wang with erhu in rehearsal.
CEMI facilitates these tasks by dedicating one of the 8.1 studios to live performance work. Necessary equipment for a piece can be set up for extended periods, so that composers and performers can experiment and rehearse the pieces they are to present.

In MEIT, expert technical support and ample rehearsal time support performances of new works. A dedicated CEMI laptop facilitates transport of pieces from studio to MEIT, and ultimately to other venues.

3.4. Complementation of Home Studios
Many students, particularly those working at an advanced level, invest substantially in home studio environments. This presents an interesting challenge: CEMI hardware and software need to match students' home environments sufficiently that projects can move back and forth easily between home studios and CEMI; at the same time, it is critical to target resources toward needs students cannot fulfill in their home studios.

The CEMI studios address this issue firstly by including a substantial base set of software in all studios, which students are encouraged to include in their home systems. Additional software is distributed among the studios: for example, while all the studios include Digital Performer, some include ProTools, others Nuendo, and one includes Cubase to maximize compatibility with home systems.

The high quality audio and video monitoring systems in the labs allow critical listening and viewing not generally possible in home studios. The features described in sections 1.3.1 – 1.3.3, and the software, hardware, and infrastructure they entail, provide a vast range of opportunities that brings students into the studios to do advanced work.

3.5. Access for Non-traditional Users
The typical CEMI studio user has traditionally been a composer enrolled in a degree program, or an invited composer or researcher in residence. There are numerous artists and researchers in other areas of music, arts and sciences who can benefit from the opportunities of the CEMI facility, and we strive to engage them in collaborations. At the same time, we recognize that wider access exposes the studios to a variety of risks, which must be minimized.

In collaboration with the General Access Computing Laboratory within the College of Music, CEMI is piloting a new protocol for support and access in the former scoring and orchestration lab. This jointly maintained studio with an extended range of hardware and software will be made available to students outside of composition. With adequate provisions for training, supervision, and security, this should set a strong precedent, and foster more collaborative projects.

4. FACILITIES
CEMI maintains six studios and the Merrill Ellis Intermedia Theater. Our goal is that they should both reflect and advance the state of the art. MEIT functions as a venue for public presentations and a proving ground for new works; CEMI's six studios provide environments for teaching, learning, development, and rehearsal.

4.1. Studios
All of the CEMI studios provide a comprehensive suite of software for sample editing, digital signal processing, audio editing and production, and real-time interaction, along with high-quality audio and video hardware. Each is further enhanced for a specific set of functions. Detailed software and hardware lists can be found at http://cemi.music.unt.edu/what.html.

The video production studio features 8.1 surround monitoring and a large plasma display. Software includes Final Cut Pro, DVD Studio Pro, LiveType, Motion, Compressor, Soundtrak, Nuendo, Jitter, and audio and video plug-ins including TC Powercore.

The 8.1 audio production and teaching studio also has a plasma display, as well as Nuendo, TC Powercore, Waves Gold, and other specialized audio software.

The 8.1 interactive music development space includes numerous MIDI controllers, TeaBox and iCube hardware, and a Yamaha Disklavier.

The 8.1 scoring, orchestration, and collaboration studio features a Digidesign 002/ProTools system and numerous sample libraries and virtual instruments.

The 2.1 audio production studio includes Cubase in addition to the standard software set. The sixth studio, also 2-channel, is a sampling room featuring a modified Wenger sound module and a ProTools workstation.

4.2. Merrill Ellis Intermedia Theater
A 2000 square foot modular "black box" environment, MEIT provides flexible infrastructure for audio, intermedia, and live performance. An immersive environment is provided for with 3-dimensional surround audio (Genelec and Adam speakers) and multiple-projector surround video capabilities. A computer system is set up for multi-channel, intermedia, and interactive performance.
For live performance, the hall features an extensive DMX/MIDI controllable lighting system, a small portable stage and dance surface, and other features for live performance. Three balconies provide opportunities for unusual performance configurations. A Yamaha MIDI grand is maintained in the theater.

5. CEMI STAFF

All of the six resident faculty of the Division of Composition Studies are involved with music technology, and work with students on computer music and intermedia projects. Three of the faculty are recent hires: composer, violinist, and computer musician Andrew May joined the faculty in 2005 and currently serves as CEMI Director; flutist and computer musician Elizabeth McNutt joined the faculty at the same time and directs the Nova contemporary music ensemble; and composer, trumpeter, and intermedia artist David Bithell joined the faculty in 2006.

Senior faculty members are composer and computer musician Jon Christopher Nelson, former CEMI Director and current Associate Dean for Operations; composer and intermedia artist Joseph Klein, Chair of the Division of Composition Studies; and composer Cindy McTee. Composer and intermedia artist Philip Winsor is not currently in residence, but remains on the faculty.

Current CEMI TA’s are graduate students Gregory Dixon, David Gedosh, Gary Knudson, and Camilo Salazar. Their research areas include electroacoustic composition, intermedia, live interactive performance, and networked media and interface systems.

5.1. Faculty research specialties

David Bithell has interests in multimedia, experimental music theater, improvisation, and creative transcription. He is currently pursuing research in robotic instruments and computer-controlled lighting systems. He is a founding member of the sfSounds ensemble.

Joseph Klein’s interests include graphic score representation, intermedia composition, and fractal aesthetics. His recent works include a collaboration with poet Alice Fulton for spoken word and 8-channel tape.

Andrew May is best known for interactive chamber music. His research includes tools for multidimensional audio tracking, statistical analysis, data improvement, improvising automata, and score following.

Elizabeth McNutt’s interests include performance of experimental and virtuosic repertoire, including computer music; collaboration with composers to develop new works; improvisation; and research on practical and aesthetic issues of new music performance.

Cindy McTee, widely known for her orchestral works, recently fulfilled a Dallas Symphony commission with a work involving 8-channel computer music. Her recent work reflects interests in psychology, literature, and aesthetics.

Jon Christopher Nelson’s research includes granular synthesis, including real-time models; diffusion, including graphically controlled spatial modeling; and DSP algorithms including physical modeling reverberation. Recent projects have involved data sonification and documentary film scoring.

6. RECENT COMPOSITIONS

The primary output of CEMI is in the form of music and intermedia compositions and public performances; research focuses on support of artistic projects. Works by CEMI faculty and students were presented in the past year at the SEAMUS National Conference, the International Computer Music Conference, Electronic Music Midwest, Florida Electroacoustic Music Festival, the Bourges Synthèse Festival, the Sonorities Festival in Belfast, and other US and international venues.

6.1. Selected recent faculty compositions

David Bithell: The President has his Photograph Taken for trumpet, video, and live electronics, 2005; work in progress for ensemble and computer-controlled lighting.

Joseph Klein: Zwei Parabeln Nach Franz Kafka for narrator, choir, and 2-channel tape, 2006; Three Poems from Felt (after Alice Fulton)—spoken word with 8-channel computer music, 2005.

Andrew May: Wandering Through the Same Dream, 2005, for two clarinets and live interactive computer system; A Room Full of Ghosts, 2006, for piccolo and 8-channel live interactive computer system.

Cindy McTee: Einstein’s Dream, 2005, for string orchestra, percussion, and 8-channel computer music.

Jon Christopher Nelson: Just After the Rain, 2006; Objet Sonore / Objet Cinetique, 2007, both for 2-channel tape; Anger Stone, 2006, with video artists Dave Ryan.

6.2. Selected recent student compositions


Dave Gedosh: Guitar Construction, 2006, 8-channel computer music.


Chapman Welch, Cyclic Math Shred, 2005, for electric guitar and live interactive computer music.

Stephen Lucas: Steel Spattered Atrophy, drumset and 2-channel computer music; His Arthropod Numbness, 2006, video and 5.1 audio.

Nick Bober, Box, 2006, 2-channel computer music.

Chris Polcyn, Kick, 2006, 8-channel computer music.

Camilo Salazar, Siluetas, 2006, 2-channel computer music.