Making Music with Csound for the Macintosh

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ABSTRACT

A musical demonstration of the current capabilities and newest MIDI features in Barry Vercoe's Macintosh version of Csound. Drawing from classroom and laboratory use at the Berklee College of Music, the talk will focus on the educational implications of the current package, and ways to efficiently integrate the software into today's commercial MIDI-based workstation environment. Further, the extension of Csound through commercial and public domain DSP software will be discussed and featured. Excerpts from the Csound Anthology and student compositions will serve to demonstrate some of Csound's newest capabilities.

1. AN EDUCATIONAL PERSPECTIVE

Without a doubt, Barry Vercoe's Csound has established itself as one of the most powerful software synthesis and signal processing packages. Over the years, Csound has served as an excellent educational and research tool, but not a particularly effective compositional or performance tool. Recent advances, however, particularly in the area of RISC-based computers, have brought about the near real-time performance of even the most complex Csound orchestrations, thereby transforming Csound into a more interactive environment in which to explore compositional ideas. Until now, Csound has yet to find its place among professional musicians in commercial film and recording studios; that is, until Barry Vercoe and his graduate students, Dan Ellis and Bill Gardner, ported Csound to the Macintosh.

Before Csound for the Macintosh, few commercial musicians were exposed to the program. With the recent addition of a MIDI File interpreter and a set of MIDI-based unit generators, Csound is coming into use by a wider range of Macintosh-based professional musicians. Certainly, it will take time for commercial musicians to fully understand the inherent power of Csound; but a new generation of commercial synthesis is being trained today at the Berklee College of Music, where for the last three semesters Csound has been required of Sound Design majors and electable by all. The enthusiasm for this course has been overwhelming, and the musical results have been both surprising and inspiring.

1.1 Csound?

The Macintosh port of Csound allows the commercial and professional musician an opportunity to explore and create in a virtual synthesis environment; to better understand the psychoacoustic basis of auditory perception; to rediscover some of the historical approaches to sound design; and most importantly, to develop synthesis algorithms and hybrid synthesizer schemes that are readily available commercially. Csound is a unique opportunity for the modern composer/designer to create systems that are inherently expressive. Thus, from an educational standpoint, Csound provides the framework for a deep conceptual and theoretical understanding of music synthesis and digital audio. Furthermore, Csound offers the student a glimpse of a musical future whose sounds and structures are formed only by their understanding and imagination.

1.2 For the Macintosh?

The Macintosh is ideally suited for Csound because of the diverse and powerful music software that already runs on this platform. Other important factors are the readily available and reasonably affordable high quality A/D and D/A converters and digital I/O boards. Further, graphical waveform editors, spectrum analyzers and a number of powerful public domain signal processing packages further extend the power and utility of the Macintosh version of Csound. The speed of the Quadra, MacII,TV or even SE30 is quite reasonable for both private and classroom use.
2. THE BERKLEE PERSPECTIVE

To many, Berklee represents a musical trade school with an emphasis on pop music. Admittedly Berklee is career oriented. However, it is this very career orientation that drives Berklee's pursuit of a leadership role in music technology. This has resulted in the development of the most effective classroom environment for the study of contemporary musical "instruments" and contemporary musical ideas. Thus Berklee's commitment to the comprehensive understanding of today's music technology would naturally include the study of a powerful and open software synthesis environment such as Gound because Gound provides the framework for the broader possible training of future professionals in this rapidly changing technologically driven music business.

2.1 The Berklee Labs

The Music Synthesis Department at Berklee consists of three teaching labs — with twelve Macintosh-based MIDI workstations in each, plus two performance labs — and a dedicated recital hall with large Macintosh-based MIDI workstations in each. It would be easier to list the Music programs that the department doesn't own rather than all the ones we do. Needless to say we have at least one copy of everyfing and usually 36 copies of the main programs such as Opcode's Vision™, and Galaxy Plus™, DigiDesign's Soundcraft [II]™ and Codia's Music Print™ to name but a few.

The size of the class is limited to twelve students, so that each individual sits and works at their own station. The stations are equipped with about a half dozen of the newest samplers and synthesizers, and each Macintosh is equipped with sixteen bit stereo MIDI and L/0 converters and a large hard disk for digital audio and Gound work.

2.2 The Berklee Gound Classroom Approach

The initial classes consist of a thorough analysis and modification of the tutorials from the Berklee Gound Workbook. From a teaching station at the front of the room, the professor's original instrument design and edits are projected onto a large screen.

The instruction and the students' understanding of Gound grows through shared electronic instruments, a blackboard, and a projector. Each class is a collaborative setting, a "work in progress." The students respond to the professor's suggestions and make decisions about the final product. The students are encouraged to experiment and to modify and improve the original tutorials provided in the workbook. The students are encouraged to be creative and to explore the possibilities of Gound in their own way.

2.2.1 Making Music

Although a good part of the semester is spent exploring Gound's many unit generators, the ultimate goal is to make music with Gound. The students are introduced to a variety of working methods targeted at the efficient generation and exploration of sample and synthesized sound material. This includes, but is not limited to, the use of unit generators as a tool for creating and manipulating sound. The students are encouraged to experiment and to modify and improve the original tutorials provided in the workbook. The students are encouraged to be creative and to explore the possibilities of Gound in their own way.

In addition, the new MIDI unit generators are introduced which allow Gound composers to be realized using a commercial sequencer or music notation program. Finally, the use of MIDI-based samplers to play Gound generated timbres is also demonstrated. From some combination of the above tools and techniques, short compositions are generated by each student and submitted as final projects.

Removable cartridge drives at each station allow the students to store long runs eliminating the need to recompile them, and digital I/O at each station provides the means for long term archival and retrieval of files for later compilation and composition.
2.2.2 Making Art

Although the highly "artistic," sometime "academic," and often "exotic" nature of most of the composition that is produced using software synthesis programs such as Csound may seem at odds with the stated musical goals of the Berklee College — "to prepare and train professional musicians for today's commercial market," still a number of surprisingly innovative extensions of pop forms, some excellent tutorial instruments and instructional models, and a few very nice pieces have resulted from its inclusion in the curriculum.

Given that the Csound course at Berklee is only one semester long, the scope is focused primarily on the expansion of sound design into areas of musical design. However, aesthetic and compositional issues do still present themselves, particularly in the context of the CED-based studies of works by Risset, Dodge, Lansky, Chowning, Darkow, Troux, and others. In these instances, classroom discussions move from the way a certain sound might be designed in Csound, to the way that specific sounds are employed in the musical design of the particular composition.

Further, developing a broad "non-commercial" aesthetic through the innovative compositional use of commercial technology is the entire focus of a required course in the Music Synthesis curriculum entitled: Computer for Synthesis (ms140). This course, which employs the texts Learning to Compose by Austin and Clark, and Steven's New Directions in Music, stresses, and usually succeeds, through a progressive set of focused original compositional exercises, to guide the student toward a broad and all encompassing definition of music as "Organized Sound." Thus, by the time that students enroll in the Csound course, they are well equipped to appreciate the compositional possibilities of Csound, and to explore them in a musical and artistic way.

2.2.3 Directed Studies

After taking the Csound course (ms107), many majors continue their Csound research during a final semester of Directed Studies (ms211). Last year's Csound-based thesis projects included: Robert Whalen's Virtual Speculations; Tim Power's Exploring Vocal Synthesis; and Gregory Haines' Understanding Randomness. This year, projects include: Heather Jennings' Virtual Tuning through Csound; David Sun's Csound Library of Psychoacoustic Instruments; Corey Keeler's Cross Synthesis Studies; and a collaboration between John Lamar and John Buckhardt entitled - Interpreting Vernon's Csound with OpCode's MATM.

2.3 Why it works

The Csound course at Berklee works for two reasons. First, the immediate feedback that the student gets from working along with the professor contributes to a quicker and deeper understanding of the subject. Not only is the Csound course, but the entire Music Synthesis program at Berklee works because it supports active learning through individual access to a common station. Second, the course works because virtually all the students can continue doing Csound on their own Macintosh computers at home. In the lab they gather to help each other better understand the advanced synthesis and signal processing ideas which are covered weekly. They also meet to share their triumphs and exotic auditory constructions. Because Csound now runs on virtually any Macintosh, most students continue running jobs even when they are not working in the Berklee labs.

2.4 Why it's important

For Berklee students, Csound is particularly important. Until now, it could be argued that there is no better place that the Music Synthesis Department at Berklee to learn how to make beautiful sounds with oscillators, and yet know absolutely nothing about how an oscillator actually works. Quite frankly, it is this author's belief that this situation is not unique to Berklee, but rather represents the norm in many other colleges and conservatories, particularly given the predominance of commercial sample-players and synthesizers with thousands of stored preset voices that are commercially available.

Csound is important because it gives the music synthesis student at Berklee a glimpse into the research labs at CCMA and IRCAM; it lets them stand on the shoulders of giants such as Chowning and Risset; and it lets them look into the future as they model and explore music synthesis techniques that are not yet, and may never be, commercially available.
3. FUTURE DIRECTIONS FOR MACINTOSH-BASED CSOUND

Over the past year a number of suggestions have been made for future extensions of Csound for the Macintosh. What follows is a list of the currently planned extensions and several of the long-term goals.

3.1 Currently planned enhancements

The current goals for Csound include: an update from Think™ 4.0 to Think™ 5.0; support for background processing; the integration of all associated analysis programs such as psound, specanal, beton, etc.; FIR filtering; an integrated word processor; and working versions of Snek and Scream.

In addition, two Csound publications are currently in the works: The Berklee Csound Workbook by Richard Boulanger — including annotated examples from the Csound Anthology and over 30 Tutorials (available by January 1993); and Making Music with Csound by Barry Vercoe and Richard Boulanger — a theoretical and practical insight into the unlimited power and musical potential of Csound including a C20 ROM with audio examples, orchestra and scores, reference manual, source code, and the complete Csound Anthology (available by August 1993).

3.2 Long-term goals

The long-term goals for the Macintosh version of Csound include: an icon-based Csound orchestral compiler, a version of MAX™ with Csound unit generator objects, and a real-time version of Csound running on Apple's HISC-based Macintosh.

4. ACKNOWLEDGMENTS

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