Reviews

Performances, Exhibitions, and Conferences

International Workshop on Models and Representations of Musical Signals, Capri, Italy, October 1992

Reviewed by Henkjan Honing, Amsterdam, The Netherlands

During the three-day International Workshop on Models and Representations of Musical Signals, papers were presented on physical modeling, nonlinear dynamic systems for modeling and composition, sound editors using graphical representations, and higher level representations of musical signals and their structure. Other papers concentrated on pitch/tone recognition and perception, and even the optical reading of scores.

Two main issues emerged from this wide scope of research, the problem of control and the choice of the proper representations. Each of these issues was motivated by both musical and perceptual concerns. With respect to the problem of control, several papers showed that a powerful model of sound is not enough. One needs a flexible method of dynamically modifying the sound's parameters. Some models get part of this control for free, as in physical modeling, but they still lack high-level musical control. Others models, as some of the nonlinear techniques, lack perceptually intuitive control but are often preferred because of the very distinct and unique sounds they can generate.

In the papers concentrating on the compositional aspects of sound modeling, like those of Agostino Di Scipio, Jonatas Manzolli (Institute of Sonology, The Hague), and Marie-Hélène Serra (CEMAMu, Paris), the aim is freedom and flexibility, while

still having compositional control, a balance often difficult to find. Although these papers distinguished between what were called the micro-level and macro-level of musical signals, the intermediate levels were ignored. These are the levels where a great deal of musical and perceptual information is encountered: the surface level at which one can listen to music, the accents or changes in articulation, the things that happen between notes, how transitions are made, and the small modulations of pitch and amplitude that group or differentiate sounds. Some papers mentioned this level. For instance, Xavier Serra (Barcelona) described recent extensions to his Spectral Modeling Synthesis system, a musically powerful combination of modeling time-varying spectra with a deterministic part (additive synthesis) and a stochastic part (filtered noise). His current research is mainly concerned with exactly this level of musical control. The instrument level, also, is often ignored. I was glad to see it receive attention in the papers on physical modeling by Andrea Paladin (IRIS) and Davide Rocchesso (University of Padua), and Julius Smith (CCRMA, Stanford University).

The first two authors described their recent work on making generalizations and optimizations in the field of physical modeling, by proposing an exciter (nonlinear dynamic system) and a one-dimensional resonator (linear dynamic system) as their basic building blocks. In their current work, the control of the instrument parameters is done by hand and is not part of the model.

There is still much work to be done in terms of the perceptual and musical aspects of control and the tools needed to represent and model them. I was therefore somewhat surprised by Smith's statement at the end of his

invited lecture that he could, with just a few years' work, successfully pass the acid test, by having an audience mistake sounds produced using his artificial, physical model for real acoustic instruments. I am happy to believe him, but I missed his explanation of which problems remain and how he proposes to solve them. After the lecture, I was pleased to read in the proceedings that Smith does acknowledge the control problem, saying that "musical control of digital musical instruments is still in its infancy."

This running theme of control also reigned at the third day's program on Representations of Musical Signals. Guy Garnett (CNMAT, University of California, Berkeley) gave a presentation that started out as a studio report about work being done at CNMAT, but his talk became more relevant when he turned to a discussion of his own work on controllers for conducting. In general the 20-minute lectures (45 minutes for invited speakers) allowed for little improvisation or communication of general insights other than those included in the papers. A workshop atmosphere, however, should foster the presentation of preliminary results and details as well as polished demonstrations; in a workshop one must be permitted to talk about unsolved problems. Roger Dannenberg (Carnegie Mellon University) used the workshop for exactly that purpose, by looking back on his own work on composition systems and the related work of others. Learning from these observations, he now works toward an integration of discrete, event-based representations for music (such as those found in the Max programming language) and a continuous, signal-based approach (as found, for example, in the Music V family of languages). Dannenberg's current research focuses on the con-

trol problems in those data-flow languages.

Curtis Roads gave an overview of his ideas about organized sound and his experience with a wide range of hardly compatible (to put it mildly) software and hardware that he uses in his compositional work. His willingness to dive into many different sound and music tools is laudable. His lecture convinced me of his voracious appetite for sound design; he was one of the few presenters that did not speak while playing sound examples.

The other issue of primary concern was that of representation: which representations are musically useful and which are perceptually or psychophysically relevant? Dik Hermes (Institute for Perception Research, Eindhoven) gave a talk on the differences between speech and music when looking at intonation. Supported by a number of experiments he stressed the importance of choosing the proper scales when examining data in speech or music signals (an ERB scale for pitch in speech, somewhere between a linear and logarithmic scale, and a logarithmic scale for pitch in music). This general point returned in the talks by Bernard Mont-Reynaud (CCRMA, Stanford University) and Malcolm Slaney (Apple Computer, Cupertino), and in a sense in that by Gerhard Eckel. All three of them use related auditory representations: a spectrogram, a correlogram or cochleogram, with different scales on the vertical and horizontal axes. Each representation was motivated by different interests, for example, sound separation in Slaney's case, or music and sound editors in Mont-Reynaud and Eckel's case. These researchers showed that by choosing the most suitable representation some obscure characteristics fall out automatically. Mont-Reynaud gave a beautiful example of sound

morphology in choosing a spectral representation with log frequency on the vertical axis and periodicity on the horizontal axis, causing a vibrato in the spectrum to be immediately visible. Representation is an extremely useful tool in the understanding of complex processes that go on in auditory perception. In addition to auditory representation, music representation was covered in papers by Antonio Camurri (University of Genoa) and Marc Leman (University of Ghent), Dannenberg, Peter Desain (Nijmegen University) and Henkjan Honing (University of Amsterdam), Stephen Pope (Stanford University), and others.

Proceedings of the 1992 workshop are available from the University of Naples, Dipartimenti di Scienze Fisiche, while the results of the 1991 workshop are available in *Representations of Musical Signals*, edited by De Poli, Piccialli, and Roads, and published by MIT Press (Cambridge, Massachusetts USA, 1991).

*Reviewed by Davide Rocchesso
Paliano, Italy*

The International Workshop on Models and Representations of Musical Signals was held in the Hotel La Palma on Capri, the idyllic isle in the Mediterranean Sea. Sponsors of the workshop included the Department of Physics of the University of Naples Federico II and AIMI, the Italian computer music society. The workshop organizer and local chairman was Aldo Piccialli (University of Naples) (Fig. 1). Members of the scientific committee were Giovanni De Poli (University of Padua), Gianpaolo Evangelista (University of Naples), Aldo Piccialli, Stephen T. Pope (Stanford University), and Curtis Roads (IRCAM, Paris).

The purpose of this workshop was

to discuss advances in models and representations of musical signals, four years after a similar workshop in Sorrento, where the book *Representations of Musical Signals* (MIT Press, 1991) was born. The main topics covered in Capri were models for musical signal analysis, models for musical signal synthesis, representations of musical signals, musical applications, and models of the human auditory system.

During three workshop days, all the speakers and the observers had the opportunity to taste the famous local cuisine and to enjoy some wonderful landscapes in a warm and relaxing atmosphere. In addition, the first day featured a guided tour to the Capri Digital Studios, a state-of-the-art recording studio in a superb hilltop location overlooking Capri. On the second day a Lucullan banquet was held for all the participants.

The rest of this report summarizes the presentations in the six sessions of the workshop.

Fig. 2. Davide Rocchesso.

Sessions 1 and 2: Models for Musical Signals 1

Xavier Serra presented new developments in his Spectral Modeling Synthesis, based on the decomposition of a musical signal into two parts: deterministic and stochastic. The deterministic part can be extracted from a sampled sound via fast Fourier transforms and an algorithm that tracks spectral peaks. The reconstructed signal is then subtracted from the original sound in order to obtain a residual signal, which is modeled by a filtered white noise.

Sergio Cavaliere (University of Naples and IRIS, Paliano) presented research by Piccialli, Cavaliere, Ortosecco, and Basile on modifications of natural sounds using a pitch-synchronous analysis approach. They also synthesize natural sounds by separating the harmonic part from the noisy part of the analyzed signal, but their method performs a pitch-synchronous comb filtering.

Davide Rocchesso (University of Padua) (Fig. 2) presented research done with Andrea Paladin (IRIS). They studied physical models of musical instruments using simple digital waveguides and nonlinear exciters. They showed that it is possible to

implement complex synthesis structures that simulate dispersive resonators and dynamic exciters on new real-time processors, in particular, the MARS workstation by IRIS.

The announced lecture by Daniel Arfib and Richard Kronland-Martinet (CNRS-LMA Marseille) was replaced by a videotape that surveyed important signal representation techniques in time, frequency, and time-frequency domains.

Dik J. Hermes (Institute for Perception Research, Eindhoven) showed some differences in pitch perception of speech and music in both static and dynamic situations. He pointed out the different scales of measurement one must use to tune speech and singing.

Jonatas Manzolli (Institute of Sonology, The Hague) presented musical examples of his software FracWave, based on nonlinear dynamic systems. Marie-Hélène Serra (CEMAMu, Paris) presented Iannis Xenakis's sound synthesis software GENDY. This program for *stochastic dynamic sound synthesis* applies stochastic variations on the time and amplitude points of an initial waveform.

The presentation by Yee On Lo (Stanford University) emphasized the need for timbral interpolation between acoustic and electronic materials. He and Dan Hitt have implemented a sound synthesis technique called *kinematic synthesis* in which every timbre is situated in a three-dimensional space.

Imma Ortosecco (University of Naples) presented musical applications of nonlinear iterative algorithms, developed with the composer Giancarlo Sica. A first group of experiments used nonlinear maps controlling duration and frequency of two additive-synthesis voices. A second group of experiments used granular pitch-synchronous synthesis,

Fig. 3. Julius Smith.

where a map controlled the frequency of an impulse generator applied to a Kaiser window.

Julius O. Smith (Stanford University) surveyed a decade of research at the Center for Computer Research in Music and Acoustics (CCRMA) at Stanford (Fig. 3). Smith, the inventor of digital waveguides for music, told about their applications in reverberators and synthesis by physical models. Waveguide structures have good numeric properties even in time-varying cases; therefore, they are suitable for real-time performances.

Session 3: Models for Musical Signal Analysis

Giovanni De Poli presented some interesting results on musical signal analysis using chaos theory. The new method of chaos theory has been applied by Angelo Bernardi, Gianpaolo Bugna, and Professor De Poli to characterize typical behaviors of tradi-

Fig. 4. Malcolm Slaney.

tional musical instruments: periodic steady state, multiphonics, and chaotic sounds. Two different fractal dimensions were applied to distinguish the attractor in the phase space and to give an indicator of turbulence over time.

Alan Peevers (University of California, Berkeley) presented a new simulation environment for prototyping applications of digital signal processing. The system is based on a graphical object-oriented simulation environment and on a real-time prototyping tool kit written for the Silicon Graphics Indigo computer.

Malcolm Slaney (Apple Computer, Cupertino) delivered a lecture/demonstration using an Apple Macintosh Powerbook computer and its graphic and sound resources (Fig. 4). In Slaney's auditory modeling system, sound is transformed into a two-dimensional map of neural firing rate as a function of time and place along the cochlea. Then Slaney showed the evolution of signals in terms of time, frequency, and periodicity with QuickDraw moving images of correlograms.

Gianpaolo Evangelista lectured on applications of the wavelet transform for the representation of musical sig-

Fig. 5. Bernard Mont-Reynaud.

nals. In particular, he described a new representation in which signals are split in an asymptotically periodic trend and aperiodic fluctuations at several scales. The transform is realized by multiplexing signals over a number of channels and wavelet-transforming each channel individually.

Bernard Mont-Reynaud (Stanford University) (Fig. 5) delivered a lecture/demonstration on the Apple Macintosh computer of his SeeMusic, an interactive program for visualization and segmentation of sound using a multiscale analysis approach. The display method that Mont-Reynaud has proposed represents an innovative method of resolving the old contradiction between time and frequency resolution in spectrum analysis.

Session 4: Musical Applications

The composer Agostino Di Scipio led off the musical presentations with a lecture on microstructural time modeling of sound. Di Scipio uses asynchronous granular synthesis for his

Fig. 6. Gerhard Eckel.

compositions. In addition, he uses chaos theory and nonlinear maps to design sound events at different levels. He played some musical examples realized in collaboration with the Centro di Sonologia Computazionale (CSC), University of Padua.

Gerhard Eckel (Fig. 6) presented SpecDraw, an interactive system for sound signal manipulation by means of graphical representations, developed at IRCAM, Paris. With this software one can see sonograms and perform typical editing operations on them (draw, cut, paste, etc.). Composers can directly hear and see the effects of the modifications. In this way it is easy to test physical properties and perceptual theories. For example, Eckel illustrated the extraction of a voice with vibrato from an orchestral texture.

Curtis Roads presented compositional applications of advanced signal representation techniques. He focused his attention on waveform microsurgery in the time domain, analysis/resynthesis with a McAulay-Quatieri tracking phase vocoder, and cross-synthesis by fast convolution. On the basis of numerous experiments, he proposed guidelines for ef-

Fig. 7. Giancarlo Sica (left), with Giovanni De Poli.

Fig. 8. Antonio Camurri, with Bernard Mont-Reynaud in the background.

fective use of convolution techniques. He also played, for the first time in public, examples of a method of sound transformation involving convolutions with clouds of sonic grains. These clouds act as the impulse responses of virtual, statistically defined spaces.

Session 5: Representations of Musical Signals 1

Alessandra De Vitis and Antonio Pellecchia (Centro Ricerche Rome) delivered a studio report. CRM is a multidisciplinary center where scientists and musicians work together; this interaction has led to the realization of FLY30, a digital signal processing environment running under the Microsoft Windows operating system.

Sergio Vitulano (University of Salerno) proposed a solution to the problem of automatically generating MIDI files by optical reading of musical scores. Vitulano, with R. Distasi and M. Nappi implemented a two-level system: an image processor reads the image and identifies the objects contained in it, producing a MUSICA file. (MUSICA is a language by Debiassi and De Poli.) Then a translation module generates the MIDI file.

Henkjan Honing (University of Amsterdam) presented the latest developments of a work done with Peter Desain (Nijmegen University) and recently published in *Computer Music Journal* 16:2. They propose a solution to the problem of linking continuous controls of parameters to a discrete, note-based composition framework. Their solution generalizes each control function to a function of more parameters, each reflecting a different aspect of time.

Stephen T. Pope (Stanford University) presented SmOke, an object-oriented representation, description

language, and interchange format for musical parameters, events, and structures. This language had been designed for programmers and musicians working with multimedia tools who are interested in the design issues related to music representations. SmOke manages a large family of signals, events, and structures, ranging from samples to compositional algorithms. SmOke programs may be viewed as a declarative and procedural description.

Giancarlo Sica (University of Naples) (Fig. 7) gave a musicological lecture on problems related to computer-based representation of musical processes. He investigated the concept of form in twentieth-century music and its relations with processes running in a computer. Moreover, he examined problems related to notation and user interfaces from a compositional point of view.

Guy E. Garnett (University of California, Berkeley) surveyed techniques for control-signal representations, with applications in sound synthesis and music performance. In this framework, Garnett presented current work at the Center for New Music and Art Technologies (CNMAT), where the Apple Macintosh program Max has been extended to allow real-time control of digital audio devices. Garnett also described the computer network setup at CNMAT, where all nodes of the local network have access to signal processing hardware re-

sources. Another research field at CNMAT is real-time neural networks for gestural-signal classification and for sound synthesis.

Session 6: Representations of Musical Signals 2

The last session opened with the presentation of a work by Stefano Daino and Mauro Falcone (Fondazione Ugo Bordonis, Rome). They realized a system for the recognition of music played by a tonal instrument. The system uses a bank of filters for data compression and a neural network for classification, in a way that was said to be similar to the human ear and brain.

Antonio Camurri (University of Genoa) (Fig. 8) presented research done with Marc Leman (University of Ghent) on the automatic recognition of tone centers by means of a hybrid representation of musical knowledge. In symbolic representations, music images can be thought of as components of a symbolic database that are manipulated by symbolic engines. In nonsymbolic representations, tone recognition is modeled using attractor dynamics or force fields.

Roger Dannenberg (Carnegie Mellon University) concluded the workshop with a lecture on the opposition between discrete-time events and continuous-time signals in music practice. According to Dannenberg, a

Fig. 1. Conference organizer Allen Strange (photo: Patte Wood).

designer of music composition languages must integrate both signal and event representations and manage them in the same way. To satisfy this requirement, Dannenberg proposed a new data type, called a "timed stream," which consists of a sequence of events, each consisting of a time, a function name, and a set of actual parameter values.

1992 International Computer Music Conference, San Jose, California USA, 14–18 October 1992

Reviewed by Doug Keislar et al.

The 1992 International Computer Music Conference (ICMC) took place in San Jose, California, 14–18 October 1992. Below, we present reviews of the conference as a whole (with special reference to the paper sessions), written by Paul Berg (organizer of the 1986 ICMC), Rob Duisberg, and Carla Scaletti. Following these general remarks are separate reviews of each of the eight concerts, for which we thank Bob Pritchard, Todd Winkler, Rick Taube, Mara Helmuth, Jon Berger, Jon Hallstrom, and Brad Garton. We also provide a review of the one concert that was included among the official preconference activities: the CCRMA concert on Monday, October 12th.

In the weeks preceding the conference, a number of other concerts sprang up in conjunction with the ICMC, which were not part of the conference proper. Owing to the last-minute nature of some of these events, and to space limitations in this article, we were unable to arrange for reviews of these performances. They included an evening

with Paul Lansky at Mills College, a dance performance with music by Michael McNabb, a "Lounge Lizard Night" at a local nightclub (with improvisation by Emily Bazar, Wendy Burch, Joe Catalano, Chris Chafe, Barry Hall, Stanley Jungleib, Fred Malouf, Dan Oppenheim, and Greg Powers), and a concert of new electroacoustic music from Mills College (including works by John Bischoff, Chris Brown, Phil Burk, Steve Curtin, Alvin Curran, Ed Osborn, Jeanne Parsons, Maggi Payne, and Wendy Reid). Even excluding these supplementary events, the reader will find an ample quantity of computer music reviewed in the following pages (as anyone who has ever attended every one of an ICMC's concerts can attest!).

Our thanks go to Patte Wood for the photos sprinkled throughout this report.

*General Remarks by Paul Berg
The Hague, Netherlands*

Recent ICMCs have been preceded by tutorial sessions for those new to the field or not specialized in the subject of the tutorial. A smart thing for a future organizer to do would be to include a tutorial on "How to Survive an ICMC." For those not trained in elementary survival and advanced selection techniques, finding a path through the dense thicket of activi-

ties can be challenging. However, the organizers of this year's ICMC, with Allen Strange as chairman (Fig. 1), did the near-impossible. They created an oxymoron: a relaxed ICMC.

All of the necessary ingredients (paper sessions, concerts, etc.) were well organized and humanely scheduled, and attention to details such as an official ICMC beer brewery brought welcome relief. The extensive industry support was also a new element this year.

Besides the schedule, the other thing everyone complains about every year is the choice of music. I shall leave the aesthetics of this year's choice to the reviewers of the particular concerts. Overall, the concerts seemed rather well balanced in their representation of various genres and approaches to computer music. Included were outdoor pieces on a knoll, improvisation and live electronics, text/sound, tape, Western instruments, non-Western instruments, inexpensive electronics, and expensive equipment from state-supported European laboratories. The recurring problem of tape music (some people always feel there is too much or too little tape music, depending on their perspective) seemed to be fairly treated this year as well.

In general, the 1992 ICMC was very enjoyable and successful, even though the cliché image that some Europeans have of California's being one big beach party did not prove to be true.

This conference could mark a turning point in computer music as well: a turning back to the future. The papers, taken as a whole, seemed to reflect an attitude toward computer music research reminiscent of the early 1970s. There were important exceptions, of course, including the role of cognition in computer music, and the design and use of interactive systems and instruments. But many of