

nity to hear a wide range of computer music, and this year was no exception. The papers set a new standard for polish and professionalism, to say nothing of their deep content. Computer music's future looks promising, to judge from the range of fascinating activity demonstrated this year in Ann Arbor. We hope to have caught up on most of it before the 1999 conference at Tsinghua University, Beijing (for information see the Web site at <http://www.cs.ust.hk/icmc99/>).

Digital Audio Effects 1998, Barcelona, Spain

Workshop on Digital Audio Effects, Barcelona, Spain, 19–21 November 1998.

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The first of a planned series of European COST-G6 workshops on digital audio effects (DAFX) was held in the beautiful city of Barcelona in November 1998. COST is an inter-governmental cooperation initiative aimed at coordinating nationally funded research efforts. A COST action on digital audio effects (see the Web at <http://www.iaa.upf.es/COSTG6/>), chaired by Daniel Arfib (see Figure 4), was started in the fall of 1997 and has supported the organization of DAFX98.

Hosted by Xavier Serra of the Audiovisual Institute of the Pompeu Fabra University, the DAFX98 workshop brought together an interesting blend of musicians, multimedia artists, scientists, and engineers for a dialog about the state of the art

in digital audio processing. The facilities of the Pompeu Fabra University were superb. The hall chosen for the workshop was adjacent to the Reflection Hall, a place of reflection and meditation which was commissioned to the world-renowned Catalan artist Antoni Tàpies only three years ago.

No less than 56 presentations were scheduled over the 4 days of the workshop. The main topics included filtering, delay, modulation, audio coding, spatialization, software-development strategies, and spectral processing. The workshop also allowed poster sessions, installed demonstration systems, book stands, and product stands. The effort it takes to solicit these peripheral services is well appreciated. An excellent 285-page proceedings volume was distributed at the opening of the workshop. The papers are available online at the conference Web site, <http://www.iaa.upf.es/dafx98>.

The first set of presentations dealt with filtering, modulations, and delays. It was interesting to have mixed perspectives on these topics, as they were given by researchers from universities and multimedia industries, as well as by musicians. Classical subjects such as reverberation and chorusing were touched upon, and the speakers faced often-neglected aspects such as compensation of nonlinearities and shaping of the reverberation decay.

A very intense afternoon was spent on presentations on sound spatialization. Virtually all facets of the topic were addressed by some of the contributions, including the design of head-related transfer functions, recreation of virtual acoustics, rendering via sets of loudspeakers, and design of knowledge-based interfaces for controlling existing spatializers.



The sessions on spectral processing and time-frequency scaling occupied the most conspicuous section of the workshop, as one might easily expect since the conference chairman, Xavier Serra, is the main author of the well-known spectral modeling synthesis (SMS) program, and his group is one of the most active in this field. Several presentations were related to sinusoidal representations of sounds and how to improve aspects such as frequency estimation, feature extraction, and robustness to time- and frequency-scale modifications. Much attention was drawn to the definition, extraction, and manipulation of high-level attributes derived from spectral models, especially within the framework of expressive modeling of musical material.

Three presentations were dedicated to different aspects of audio coding, with special focus on the popular MPEG standards. It was clear how the interest of the audio-coding community is drifting from

perception-based compression of raw material to structured descriptions of algorithms for sound generation and modification, with the perspective of dealing with content-based models in the near future.

Several presentations were dedicated to software systems. Most of them were descriptions of software tools, which can be useful to music composers and sound designers. However, a couple of presentations raised general software issues that should be considered when designing and sharing audio effects.

A useful feature was a final session that compared the architectures of several signal processing chips by E-Mu, Motorola, Texas Instruments, Analog Devices, and AT&T. Two independent speakers gave in-depth comparisons of different processors and architectures, while a third talk discussed issues of very-low-cost DSP chips for the mass multimedia market.

Other presentations do not fit perfectly into any of the categories listed so far, as they touched miscellaneous topics. Some of them were surveys reporting years of research and experience in audio processing from outstanding centers, scientists, and composers. Surely, this conference provided the approximately 130 participants a consistent common framework based on past scattered experiences, so that it will be easier to push the research toward further achievements to be presented at the forthcoming DAFX events.

The participation of companies and publishers with their own stands and delegates reflects a general interest in the topic of digital audio effects, such that future initiatives similar to DAFX98 are definitely encouraged.

The workshop included two con-

certs with works by Curtis Roads, Eduard Resina, Jean-Claude Risset, Teruyoshi Kamiya, Joan Sanmarti, and Jorge Sad. Curtis Roads's new piece *Half-life* was synthesized from sound particles generated through pulsar synthesis. The material was further processed through what seemed like several generations of granulation, resulting in structures of small sound atoms organized according to different principles. The work was organized in three parts with a variety of expression forms, ranging from pointillism to rhythmic structures and broad layers of intertwining textures.

Eduard Resina's *Menstruació*, completed the day before the concert, combined original Catalan written material, performed by the singer/actress Nina, with computer-processed transformations of voice fragments recorded from her interpretation of the text. The distinct sexual flavor of the text was well presented to the audience by Nina, who made excellent use of her stage props: including a toilet bowl and an inflatable human-size doll. The work was packed with symbolic intent, and the descriptions of the conflicts and ambiguities in the relationship between the sexes came to a high point with the generous application of ketchup, which was immediately followed by the humorous twist of mopping the stage.

Teruyoshi Kamiya was responsible for the work *Dance of Stone*, written during 1997 and 1998. The music consisted for the most part of sounds inspired by the legend concerning the musician Kui, who lived in China during the Shun dynasty. In addition to the tape music, three dancers were part of the performance, which appeared somewhat lacking in clarity of intention and correlation in the choreography.

Jean-Claude Risset's work *Invisible*, composed in 1994, was for soprano and tape. Mr. Risset's masterful use of computer music tools makes for an extremely well-balanced timbral blend of synthesized sounds, processed samples, and live singing voice, which was performed by Pilar Jurado. Compositionally, the piece revolves around illusory and immaterial processes in imagined space, inspired by Italo Calvino's well-known text *Le città invisibili*. The placement of the acoustic soprano voice in a number of different spaces with virtual (artificial) acoustics made for a play with absence and presence of recognizable elements in the music, and consequently both the timbral and musical expectations of the audience.

The musical prelude to the workshop banquet consisted of two works, both employing live electronics and acoustic instruments. *Xtrapolución* from 1988, written and performed by Joan Sanmarti, was a carefully crafted piece for electric guitar and computer. The piece was clearly jazz-oriented and was kept strictly within bounds, although the tonal language leaned toward an art-music approach. The performance was excellent, and the piece was enthusiastically received.

The second piece of that program was *El doble (No. 1)* by Argentinian Jorge Sad, for the *bandoneon* (an Argentinian accordion) and electronics. Enrique Martín Entenza played the accordion, filling the quiet and sparingly composed work with a music that was often unstated, but still heard. As a composer, Mr. Sad knows his material, and exactly up to which point he can take it before the lift becomes too small; this piece balanced daringly on the narrowest edge.