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Auditory Display

6th International Symposium, CMMR/ICAD 2009
Copenhagen, Denmark, May 18-22, 2009
Revised Papers

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Preface

Computer Music Modeling and Retrieval 2009 was the sixth event of this international conference series that was initiated in 2003. Since the start, this conference has been co-organized by the University of Aalborg, Esbjerg, Denmark (<http://www.aau.dk>) and the Laboratoire de Mécanique et d'Acoustique in Marseille, France (<http://www.lma.cnrs-mrs.fr>) and has taken place in France, Italy and Denmark. The five previous editions of CMMR offered a varied overview of recent years' music information retrieval and sound modeling activities in addition to alternative fields related to human interaction, perception and cognition, as well as philosophical aspects linked to the field. We believe that the strength and the originality of this international conference both lie in its multidisciplinary concept and its ability to permanently evolve and open for new trends and directions within the related fields of interest. This year's CMMR took place in Copenhagen, Denmark, May 18–22, 2009 and was associated with the International Conference on Auditory Display (<http://www.icad.org>), hereby introducing new topics related to sound design, sonification and augmented reality to the computer music modeling and retrieval community.

Research areas covered by ICAD include:

- Auditory exploration of data via sonification (data-controlled sound) and audification (audible playback of data samples)
- Real-time monitoring of multivariate data
- Sound in immersive interfaces (virtual environments) and teleoperation
- Perceptual issues in auditory display
- Sound in generalized computer interfaces
- Technologies supporting auditory display creation
- Data handling for auditory display systems
- Applications of auditory display

As Derek Brock describes in the short foreword that follows this preface, the auditory display community is a very active one that opens for a large number of applications. Even though musical sounds have not traditionally been part of auditory display topics, the joint CMMR-ICAD conference revealed mutual interests and uncovered new perspectives of applications and fundamental research in both areas.

The proceedings of the previous CMMR conferences were published in the *Lecture Notes in Computer Science* series (LNCS 2771, LNCS 3310, LNCS 3902, LNCS 4969 and LNCS 5493), and the present edition follows the lineage of previous ones, including a collection of 25 papers of which a majority are directly related to auditory display topics. These articles were specially reviewed and corrected for proceedings volume.

The current book is divided into two main parts, one that concerns auditory display which deals with new CMMR topics such as sound design, sonification

and audio-augmented reality and another entitled Modeling and Retrieval, which concerns more traditional CMMR topics linked to sound events, perception and cognition as well as music analysis and MIR.

We would like to thank the Program Committee members for their valuable paper reports and thank all the participants who made CMMR - Auditory Display an exciting and original event. Finally, we would like to thank Springer for accepting to publish the CMMR/ICAD 2009 proceedings in their LNCS series.

January 2010

Sølvi Ystad
Mitsuko Aramaki
Richard Kronland-Martinet
Kristoffer Jensen

Foreword

In May 2008, the International Community for Auditory Display (ICAD) was invited to hold its 15th conference in partnership with the 6th International Computer Music Modeling and Retrieval (CMMR) Symposium and the annual Danish re-new digital arts festival. The result of this joint meeting, which convened in Copenhagen one year later, was an exciting mix of research, presentations, and performances and a stimulating cross-fertilization of practice and ideas from three communities with many interests in common. This was the first collaboration between these organizations, so my purpose in this foreword to the latest volume in the CMMR series of selected proceedings papers is to briefly introduce the reader to a bit of the history, scope, and ambitions of the ICAD community.

ICAD's interests and goals have evolved and expanded over the course of 15 plus conferences and meetings, but it continues to be a research community whose primary focus—to paraphrase its founder, Gregory Kramer—is the study and technical application of sound, as it is used or occurs in familiar settings, to convey meaningful information. When ICAD was formed in the early 1990s, this was hardly an undiscovered domain, but it was nevertheless an area of inquiry that was just beginning to achieve a critical body of applied and theoretical work. Thus, the first conference, which took place at the Santa Fe Institute in October 1992, was attended by a comparatively modest, international group of researchers. These individuals hailed from a wide variety of backgrounds and, in many cases, were motivated by very different objectives. However, most were already deeply invested in the enterprise of displaying information with sound, and the range of topics that emerged from this initial gathering have gone on to shape the core interests of the community. These include the sonification of data, the psychology, semiotics, and design of aural information, virtual and spatialized sound, auditory interfaces (both pure and mixed) for human/machine interaction, and the nature of technologies and tools needed for auditory displays. A quick glance at the range of material presented at ICAD 2009 and papers selected for this volume will confirm the ongoing relevance of each of these areas of work in the ICAD community.

By the end of the 1990s, ICAD had grown well beyond its origins and, in the new century, its meetings began to be hosted annually by research groups and institutions in Europe, the Pacific rim, and elsewhere in North America. Through the activities of the community, a wider recognition of how techniques for aurally exploring and transforming data can make meaningful contributions in both scientific and applied settings was achieved, and ICAD was asked to develop a formal research agenda and executive overview of sonification for the U.S. National Science Foundation. There are numerous other developments in the past decade that can be cited, too. ICAD has, for instance, enjoyed an

important growth in work and colleagues addressing aural information design research for blind and sight-impaired individuals. It has also worked to broaden the community's distinct take on the study and use of sound as information, both internally and by reaching out to other entities and groups involved in the sound-based arts and sciences. Notable examples of this include ICAD's seminal concert of sonifications of brain activity, "Listening to the Mind Listening," presented at the Sydney Opera House in 2004, and, more recently, of course, its joint/concurrent conference with the CMMR community and re-new digital arts festival leading to the present volume.

Finally, and perhaps most vitally, ICAD has recently launched an online presence for both the ICAD community and all who have an interest in topics, news, and events related to auditory display. Membership in ICAD continues to be free, and, at this new website, one can find an extensive bibliography, read about and hear examples of auditory displays, learn about relevant auditory tools and design techniques, and find and interact with others who are working in the field and/or related areas, as well as much more. If any of the work in the following pages—or the notion of an auditory display—sounds interesting, you are encouraged to go to www.icad.org where you will find yourself welcomed and invited to listen, explore, and join the conversation.

January 2010

Derek Brock
Secretary, ICAD

Organization

The 6th International Symposium on Computer Music Modeling and Retrieval (CMMR2009) was co-organized with the 15th International Conference on Auditory Display (ICAD 2009) by Aalborg University (Esbjerg, Denmark), LMA/INCM-CNRS (Marseille, France) and Re:New - Forum for digital arts.

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