

8TH SOUND AND MUSIC COMPUTING CONFERENCE

Creativity rethinks science

2-9 July 2011 – University of Padova
Conservatory «Cesare Pollini»

CONFERENCE GUIDE



PADOVA UNIVERSITY PRESS



8th Sound and Music Computing Conference

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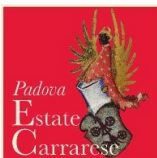
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Edited by Serena Zanolla

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WELCOME

It is my pleasure to welcome you all to the 8th edition of the Sound and Music Computing Conference in Padova.

When two years ago we applied for hosting SMC2011, we were driven by two motivations. First, we wanted to contribute to the growth of our conference, which is still young but has quickly improved its international reputation and scientific quality, thanks to the efforts of previous Organizers. Over the years, SMC has defined its own identity: a compact and selective conference, which aims at representing the whole spectrum of Sound and Music Computing research, looks for participation especially from young and emerging researchers, believes in interdisciplinary exchanges, grants open access to its contents. We believe that all these facets of the “SMC identity” are well represented this year.

A Summer School takes place just before the conference, with about 20 PhD students and young researchers attending lectures and projects around the topic of interaction and embodiment in sound and music. Complementing the Summer School, and marking the beginning of the Conference, the Rencon Workshop takes place for the second time in Europe, and is a special event of this year’s SMC.

The Technical Program comprises 79 contributions selected among 136 submissions. We did our best to set up a rigorous and fair peer-review process: thanks to the work of our TP Committee and of 130 reviewers, each submission received no less than 3 independent reviews. Accepted papers are published under a Creative Commons license and are available on the smcnetwork.org portal. For the Music Program, our concert curators selected 16 works among 77 music submissions. Scientific and music submissions were sent from 37 countries and 5 continents, which shows that our conference is no longer a EU-centered event and is becoming a worldwide reference.

SMC is a discipline where research and art collaborate productively, providing a fertile ground to analyze the relationship between creativity and scientific methodologies. We are very pleased to have philosopher Roberto Casati as our Keynote Speaker. Being an outsider of our community, he will provide the audience with inspiring ideas, addressing from a different angle this years’ theme “Creativity rethinks science”.

An academic conference is successful when participants are able to have fruitful discussions and to establish new collaborations. We hope that the social events that we have organized will serve this purpose, and will be fun for everyone.

I started this welcome address by mentioning two motivations in our candidacy to SMC2011. The second one is that we wanted to celebrate SaMPL, the Sound&Music Processing Lab created by the Conservatory and the University in 2009. Electronic and computer music research in Padova dates back to the 1960s, and the Center of Computational Sonology was founded in 1979. SaMPL aims at becoming part of this history.

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02-05TH JULY: SUMMER SCHOOL

Embodied Sound and Music

The goal of the SMC 2011 Summer School is to give an opportunity to young researchers to learn about some of the core interdisciplinary topics of SMC, and to share their own experiences with other young researchers. This year the focus is on the embodied links between Sound, Music, and Movement. Lectures and hands-on projects will explore also novel sound synthesis techniques, multimodal interaction, music cognition, movement analysis and characterization.

Course 1 - Music and Movement - *Leon van Noorden* (University of Ghent, Belgium)

Recent developments in Systematic Musicology put more emphasis on the link between action and perception in the experience of music. This is in line with the general trend in cognitive and neural sciences. The focus is on Embodied Music Cognition. Important are also the psychological and social aspects.

Hands on projects - *Denis Amelynck* and *Frank Desmet* (University of Ghent, Belgium).

The participants will measure movements related to music listening or music making, analyse it with one of the mathematical models and present a model rendition of the movement in order to get hands on experience with the contents of the more theoretical lectures.

Course 2 - Interactive SMC: The Challenges of Continuous Interaction - *Federico Fontana* (University of Udine, Italy)

Main lectures will survey the diverse questions that need to be answered during a sonic interaction design project, both inside and outside the following music field: Instantaneous Sonic Feedback; interactive musical and everyday sounds; Critical Design and Technological Issues; Case Studies in Musical Sound Synthesis and in Everyday Sound Synthesis.

Hands on projects

- **Natural sonic walking** of *Maurizio Goina* (Conservatorio “Tartini” of Trieste, Italy)

The purpose is the realization of an interactive installation in which the main idea is the exploration of the expressive potential of ecological sounds for gait sonification. The aim is to stimulate the user’s sensitivity to ecological sounds through their embodiment, and, reciprocally, to enhance their proprioception through a continuous and interactive sonic feedback.

- **Effects of sound and vibration in augmented walking tasks** of *Stefano Papetti* (University of Verona, Italy)

By interfacing specific hardware devices with an open-source software for sound synthesis, students will be able to experience both auditory and underfoot tactile feedback simulating different grounds. After exploring this setup, we will start a couple of pilot experiments to investigate the cross-modal effects of sound and vibration in walking scenarios.

RENCON WORKSHOP

WEDNESDAY, JULY 6TH, 2011

13.00 – 16.40h Rencon Workshop

Aula Magna Lepschy and DEI/D lab, Department of Information Engineering,
University of Padova

Rencon (Performance Rendering Contest) is a research project that organizes contests for computer systems generating expressive musical performances. Professional performers estimate the composer's intention behind the work, form their own performance plan, and generate performances with their excellent skill. Even though the capability of computer software to play chess surpasses human professionals, the capability to play musical instruments has not reached the level of human professional performers.

A lot of issues should be solved, including how to deal with intention, affection etc. Subjective evaluation of generated performances is important for research on automatic performance generation systems. Evaluation by contests, where various systems gather and compete against one another, stimulates scientific progress.

Rencon was started in 2002 from this perspective. Nine Rencon workshops have been held since then. Each workshop hosts a competition where systems have to generate performances of newly created musical pieces on site. The aim of such contests is to aid the improvement of performance rendering techniques.

SMC-Rencon has two different evaluation stages. At the first stage, musicality of generated performances and technical quality of systems are evaluated by expert reviewers using a blind evaluation procedure. At the second stage, performances generated on site is openly evaluated by the SMC audience and internet viewers. The SMC-Rencon Award is given to the system having the highest total points (from both stages).

More details about Rencon can be found here: www.renconmusic.org

TECHNICAL PROGRAM

KEYNOTE ADDRESS

12.00h – Friday, July 8th, 2011

Aula Magna Galileo Galilei, Palazzo del Bo, University of Padova

TIME IS OF THE ESSENCE: CREATIVITY, SYMMETRY, AND COUNTERINTUITIVE SOLUTIONS. *Roberto Casati.*

By any measure, biological evolution is astonishingly creative, but can we use its mechanism as a model for understanding cultural creativity? Creative and artistic processes are meant to generate solutions, and the success of these solutions is highly contextually constrained. According to mainstream theories, creative engines have two abstract components: a solution generator and a solution selector. Biological evolution puts all the constraints on the selection mechanism: generation is random, waste is immense, and luckily a vast amount of time provides endless biological money. Cultural evolution cannot afford to be that generous, whereby it must incorporate constraints in the generation itself. I shall discuss a number of cases in which creativity is achieved by exploring parametric solutions that are symmetric to the ones that appear intuitive.

Roberto Casati (Milano, Italy, 1961) is a tenured senior researcher with the French Centre National de la Recherche Scientifique (CNRS). He is based in Paris, France. He studied with Andrea Bonomi and Giovanni Piana in Milano, Italy, where he got his PhD (on Events) in 1992. He also holds a PhD from the University of Genova, Switzerland (on Secondary Qualities, 1991), under the direction of Kevin Mulligan. He has worked on various research projects on philosophy of perception, in particular under the direction of Barry Smith, and has taught at several universities, among which the State University of New York at Buffalo. Most recently he has been visiting professor at the University IUAV, Venezia, and at the University of Torino. He is the recipient of various prizes and of grants from several institutions, including CNRS, MENRT, and the EU Commission. The somewhat nonstandard spread of Casati's publications reflects his interdisciplinary interest as a philosopher of the cognitive sciences, focussed on the psychological status of commonsense notions (such as that of object, event, colors, sounds, and holes and shadows) and the proper methodology for studying these notions. Having received a parallel education as a graphic designer, Casati is also interested in issues in the cognitive study of art.

ORAL SESSIONS

Oral Sessions take place at Aula Magna Galileo Galilei, Palazzo del Bo, University of Padova.

Oral Session 1: COMPUTATIONAL MUSICOLOGY

9.00h – Thursday, July 7th, 2011

Chair: *Maarten Grachten*

9.00h: [OS1-1] THE PLURALITY OF MELODIC SIMILARITY. *Alan Marsden.*

Melodic similarity is a much-researched topic. While there are some common paradigms and methods, there is no single emerging model. The different means by which melodic similarity has been studied are briefly surveyed and contrasts drawn between them, which lead to important differences in the light of the finding that similarity is dependent on context. Models of melodic similarity based on reduction are given particular scrutiny, and the existence of multiple possible reductions proposed as a natural basis for a lack of triangle inequality. It is finally pro-posed that, in some situations at least, similarity is deliberately sought by maximising the similarity of interpretations. Thus melodic similarity is found to be plural on two counts (differing contexts and multiple interpretations) and furthermore to be an essentially *creative* concept. There are therefore grounds for turning research on melodic similarity on its head and using the concept as a means for studying reduction and in musical creative con-texts.

9.20h: [OS1-2] REAL-TIME UNSUPERVISED MUSIC STRUCTURAL SEGMENTATION USING DYNAMIC DESCRIPTORS. *André S. Pires and Marcelo Queiroz.*

This paper presents three approaches for music structural segmentation, i.e. intertwined music segmentation and labelling, using real-time techniques based solely on dynamic sound descriptors, without any training data. The first method is based on tracking peaks of a sequence obtained from a weighted off-diagonal section of a dissimilarity matrix, and uses Gaussian models for labelling sections. The second approach is a multi-pass method using Hidden Markov Models (HMM) with Gaussian Mixture Models (GMM) in each state. The third is a novel approach based on an adaptive HMM that dynamically identifies and labels sections, and also sporadically re-evaluates the segmentation and labelling, allowing redefinition of past sections based on recent and immediate past information. Finally, a method to evaluate results is presented, that allows penalization both of incorrect section boundaries and of incorrect number of detected segments, if so desired. Computational results are presented and analysed both from quantitative and qualitative points-of-view.

9.40h: [OS1-3] MULTIPLE-INSTRUMENT POLYPHONIC MUSIC TRANSCRIPTION USING A CONVOLUTIVE PROBABILISTIC MODEL. *Emmanouil Benetos and Simon Dixon.*

In this paper, a method for automatic transcription of music signals using a convolutive probabilistic model is proposed, by extending the shift-invariant Probabilistic Latent Component Analysis method. Several note templates from multiple orchestral instruments are extracted from monophonic recordings and are used for training the transcription system. By incorporating shift-invariance into the model along with the constant-Q transform as a time frequency representation, tuning changes and frequency modulations such as vibrato can be better supported. For post processing, Hidden Markov Models trained on MIDI data are employed, in order to favour temporal continuity. The system was tested on classical and jazz recordings from the RWC database, on recordings from a Disklavier piano, and a woodwind quintet recording. The proposed method, which can also be used for pitch content visualization, outperforms several state-of-the-art approaches for transcription, using a variety of error metrics.

10.00h: [OS1-4] AUTOMATICALLY DETECTING KEY MODULATIONS IN J.S. BACH CHORALE RECORDINGS. *Lesley Mearns, Emmanouil Benetos, and Simon Dixon.* This paper describes experiments to automatically detect key and modulation in J.S. Bach chorale recordings. Transcribed audio is processed into vertical notegroups, and the groups are automatically assigned chord labels in accordance with Schönberg's definition of diatonic triads and sevenths for the 24 major and minor modes. For comparison, MIDI representations of the chorales are also processed. Hidden Markov Models (HMMs) are used to detect key and key change in the chord sequences, based upon two approaches to chord and key transition representations. Our initial hypothesis is that key and chord values, which are derived from pre-eminent music theory will produce the most accurate models of key and modulation. The music theory models are therefore tested against models embodying Krumhansl's data resulting from perceptual experiments about chords and harmonic relations. We conclude that the music theory models produce better results than the perceptual data. The transcribed audio gives encouraging results, with the key detection outputs ranging from 79% to 97% of the MIDI ground truth results.

Oral Session 2: MUSICAL HERITAGE

12.00h – Thursday, July 7th, 2011

Chair: *Alan Marsden*

12.00h: [OS2-1] A SURVEY OF RAAGA RECOGNITION TECHNIQUES AND IMPROVEMENTS TO THE STATE-OF-THE-ART. *Gopala Krishna Koduri, Sankalp Gulati, and Preeti Rao.*

Raaga is the spine of Indian classical music. It is the single most crucial element of the melodic framework on which the music of the subcontinent thrives. Naturally, automatic raaga recognition is an important step in computational musicology as far as Indian music is considered. It has several applications like indexing Indian music, automatic note transcription, comparing, classifying and recommending tunes, and teaching to mention a few. Simply put, it is the first logical step in the process of creating computational methods for Indian classical music. In this work, we investigate the properties of a raaga and the

natural process by which people identify the raaga. We survey the past raaga recognition techniques correlating them with human techniques, in both north Indian (Hindustani) and south Indian (Carnatic) music systems. We identify the main drawbacks and propose minor, but multiple improvements to the state-of-the-art raaga recognition technique.

12.20h: [OS2-2] VERSION DETECTION FOR HISTORICAL MUSICAL AUTOMATA. *Bernhard Niedermayer, Gerhard Widmer, and Christoph Reuter.*

Musical automata were very popular in European homes in the pre-phonograph era, but have attracted little attention in academic research. Motivated by a specific application need, this paper proposes a first approach to the automatic detection of versions of the same piece of music played by different automata. Due to the characteristics of the instruments as well as the themes played, this task deviates considerably from cover version detection in modern pop and rock music. We therefore introduce an enhanced audio matching and comparison algorithm with two main features: (1) a new alignment cost measure – Off-Diagonal Cost – based on the Hough transform; and (2) a split-and-merge strategy that compensates for major structural differences between different versions. The system was evaluated on a test set comprising 89 recordings of historical musical automata. Results show that the new algorithm performs significantly better than the reference system based on Dynamic Time Warping and chroma features without the above-mentioned new features, and that it may work well enough to be practically useful for the intended application.

12.40h: [OS2-3] DEMETRIO STRATOS RETHINKS VOCAL TECHNIQUES: A HISTORICAL INVESTIGATION AT ISTC IN PADOVA. *Elena Ceolin, Graziano Tisato, and Laura Zattra.*

Demetrio Stratos (1945-1979) was a singer known for his creative use of vocal techniques such as diplophony, bitonality and diphony (overtone singing). His need to know the scientific explanation for such vocal behaviors, drove him to visit the ISTC in Padova (Institute of Cognitive Sciences and Technologies) in the late Seventies. ISTC technical resources and the collaboration with Franco Ferrero and Lucio Croatto (phonetics and phoniatric experts), allowed him to analyze his own phono-articulatory system and the effects he was able to produce. This paper presents the results of a broad historical survey of Stratos' research at the ISTC. The historic investigation is made possible by textual criticism and interpretation based on different sources, digital and audio sources, sketches, various bibliographical references (published or unpublished) and oral communications. Sonograms of Stratos' exercises (made at the time and recently redone) show that various abilities existed side by side in the same performer, which is rare to find. This marks his uniqueness in the avant-gard and popular music scene of the time. The ultimate aim of this study was to produce a digital archive for the preservation and conservation of the sources related to this period.

Oral Session 3: AUGMENTED LEARNING

14.30h – Thursday, July 7th, 2011

Chair: *Emery Schubert*

14.30h: [OS3-1] **SOUNDSCAPE: A MUSIC COMPOSITION ENVIRONMENT DESIGNED TO FACILITATE COLLABORATIVE CREATIVITY IN THE CLASSROOM.** *Sylvia Truman.*

A question that has gained widespread interest is ‘how can learning tasks be structured to encourage creative thinking in the classroom?’ This paper adopts the stance of drawing upon theories of learning and creativity to encourage creative thinking in the classroom. A number of scholars have suggested that the processes of ‘learning’ and ‘creativity are inextricably linked. Extending upon this, a generative framework is presented which exists as a design support tool for planning creative learning experiences. A demonstration of how this framework can be applied is made through the design of SoundScape – A music composition program designed for school children. This paper reports upon a study using Sound- Scape within a school with 96 children aged 11. The study focused on two objectives, firstly, identifying any differences in explicitly supporting the creative processes of ‘preparation’ as opposed to not, and secondly, comparing the outcomes of using real-world metaphors to create music compared to the use of abstract visual representation to specify music.

14.50h: [OS3-2] **WHEN SOUND TEACHES.** *Serena Zanolla, Antonio Rodà, Filippo Romano, Francesco Scattolin, Sergio Canazza, and Gian Luca Foresti.*

This paper presents the Stanza Logo-Motoria, a technologically augmented environment for learning and communication, which since last year we have been experimenting in a primary school; this system offers an alternative and/or additional tool to traditional ways of teaching that often do not adapt to the individual learning ability. The didactic use of interactive multimodal systems, such as the Stanza Logo-Motoria, does not replace the teacher; on the contrary this kind of technology is a resource, which offers greater access to knowledge and interaction with others and the environment. This is possible by inventing systems and activities, which bring out inherent values in using technology and in its integration in learning processes. The aim of this paper is to document activities carried out by Resonant Memory, the first application of the Stanza Logo-Motoria, and the relative experimental protocol that we are implementing. In addition, we are going to introduce a new application of the system, the Fiaba Magica, for strengthening gesture intentionality in children with motor-cognitive impairments.

15.10h: [OS3-3] **LJUDSKRAPAN/THE SOUNDSCRAPER: SOUND EXPLORATION FOR CHILDREN WITH COMPLEX NEEDS, ACCOMODATING HEARING AIDS AND COCHLEAR IMPLANTS.** *Kjetil Falkenberg Hansen, Christina Dravins, and Roberto Bresin.*

This paper describes a system for accommodating active listening for persons with hearing aids or cochlear implants, with a special focus on children with complex needs, for instance at an early stage of cognitive development and with additional physical disabilities. The system is called Ljudskrapan (or the Soundscraper in English) and consists of a software part in Pure

data and a hardware part using an Arduino microcontroller with a combination of sensors. For both the software and hardware development, one of the most important aspects was to always ensure that the system was flexible enough to cater for the very different conditions that are characteristic of the intended user group. The Soundscaper has been tested with 25 children with good results. An increased attention span was reported, as well as surprising and positive reactions from children where the caregivers were unsure whether they could hear at all. The sound generating models, the sensors and the parameter mapping were simple, but provided a controllable and complex enough sound environment even with limited interaction.

15.30h: [OS3-4] C. ELEGANS MEETS DATA SONIFICATION: CAN WE HEAR ITS ELEGANT MOVEMENT? *Hiroko Terasawa, Yuta Takahashi, Keiko Hirota, Takayuki Hamano, Takeshi Yamada, Akiyoshi Fukamizu, and Shoji Makino.*

We introduce our video-data sonification of *Caenorhabditis elegans* (*C. elegans*), a small nematode worm that has been extensively used as a model organism in molecular biology. *C. elegans* exhibits various kinds of movements, which may be altered by genetic manipulations. In pursuit of potential applications of data sonification in molecular biology, we converted video data of this worm into sounds, aiming to distinguish the movements by hearing. The video data of *C. elegans* wild type and transgenic types were sonified using a simple motion detection algorithm and granular synthesis. The movement of the worm in the video was transformed into the sound cluster of very-short sine-tone wavelets. In the evaluation test, the group of ten participants (from both molecular biology and audio engineering) were able to distinguish sonifications of the different worm types with an almost 100% correct response rate. In the post experiment interview, the participants reported more detailed and accurate comprehension on the timing of the worm's motion in sonification than in video.

Oral Session 4: SOUND MODELING

16.30h – Thursday, July 7th, 2011

Chair: *Stefania Serafin*

16.30h: [OS4-1] USING PHYSICAL MODELS IS NECESSARY TO GUARANTEE STABLE ANALOG HAPTIC FEEDBACK FOR ANY USER AND HAPTIC DEVICE. *Edgar Berdahl, Jean-Loup Florens, and Claude Cadoz.*

It might be easy to imagine that physical models only represent a small portion of the universe of appropriate force feedback controllers for haptic new media; however, we argue the contrary in this work, in which we apply creative physical model design to re-examine the science of feedback stability. For example, in an idealized analog haptic feedback control system, if the feedback corresponds to a passive physical model, then the haptic control system is guaranteed to be stable, as we show. Furthermore, we argue that it is in fact necessary that the feedback corresponds to a passive physical model. Otherwise, there exists a passive user-haptic device transfer function that can drive the feedback control system unstable. To simplify the mathematics, we make several assumptions, which we discuss throughout the paper and re-examine in an appendix. The work implies that besides all of the known

advantages of physical models, we can argue that we should employ only them for designing haptic force feedback. For example, even though granular synthesis has traditionally been implemented using signal modeling methods, we argue that physical modeling should still be employed when controlling granular synthesis with a haptic force-feedback device.

16.50h: [OS4-2] PHYSICAL MODELING MEETS MACHINE LEARNING: TEACHING BOW CONTROL TO A VIRTUAL VIOLINIST. *Graham Percival, Nicholas Bailey, and George Tzanetakis.*

The control of musical instrument physical models is difficult; it takes many years for professional musicians to learn their craft. We perform intelligent control of a violin physical model by analyzing the audio output and adjusting the physical inputs to the system using trained Support Vector Machines (SVM). Vivi, the virtual violinist is a computer program, which can perform music notation with the same skill as a beginning violin student. After only four hours of interactive training, Vivi can play all of Suzuki violin volume 1 with quality that is comparable to a human student. Although physical constants are used to generate audio with the model, the control loop takes a “black-box” approach to the system. The controller generates the finger position, bow-bridge distance, bow velocity, and bow force without knowing those physical constants. This method can therefore be used with other bowed-string physical models and even musical robots.

17.10h: [OS4-3] PARAMETRIC TROMBONE SYNTHESIS BY COUPLING DYNAMIC LIP VALVE AND INSTRUMENT MODELS. *Tamara Smyth and Frederick Scott.*

In this work, a physics-based model of a trombone coupled to a lip reed is presented, with the parameter space explored for the purpose of real-time sound synthesis. A highly configurable dynamic lip valve model is reviewed and its parameters discussed within the context of a trombone model. The trombone model is represented as two separate parametric transfer functions, corresponding to tapping a waveguide model at both mouthpiece and bell positions, enabling coupling to the reed model as well as providing the instrument’s produced sound. The trombone model comprises a number of waveguide filter elements – propagation loss, reflection at the mouthpiece, and reflection and transmission at the bell – which may be obtained through theory and measurement. As oscillation of a lip reed is strongly coupled to the bore, and playability strongly dependent on the bore and bell resonances, it is expected that a change in the parameters of one will require adapting the other. Synthesis results, emphasizing both interactivity and high-quality sound production, are shown for the trombone in both extended and retracted positions, with several example configurations of the lip reed.

17.30h: [OS4-4] DISTANCE MAPPING FOR CORPUS-BASED CONCATENATIVE SYNTHESIS. *Diemo Schwarz.*

In the most common approach to corpus-based concatenative synthesis, the unit selection takes places as a contentbased similarity match based on a weighted Euclidean distance between the audio descriptors of the database units, and the synthesis target. While the simplicity of this method explains the relative success of CBCS for interactive descriptor-based granular synthesis – especially when combined with a graphical interface – and audio

mosaicing, and still allows to express categorical matches, certain desirable constraints can not be formulated, such as disallowing repetition of units, matching a disjunction of descriptor ranges, or asymmetric distances. We therefore propose a new method of mapping the individual signed descriptor distances by a warping function that can express these criteria, while still being amenable to efficient multidimensional search indices like the kD-tree, for which we define the preconditions and cases of applicability.

Oral Session 5: EMOTIONS AND EXPRESSION IN MUSIC

9.00h – Friday, July 8th, 2011

Chair: *Gualtiero Volpe*

9.00h: [OS5-1] EMOTIONAL RESPONSE TO MAJOR MODE MUSICAL PIECES: SCORE-DEPENDENT PERCEPTUAL AND ACOUSTIC ANALYSIS. *Sergio Canazza, Giovanni De Poli, and Antonio Rodà.*

In the Expressive Information Processing field, some studies investigated the relation between music and emotions, proving that it is possible to correlate the listeners' main appraisal categories and the acoustic parameters, which better characterize expressive intentions, defining score-independent models of expressiveness. Other researches take to account that part of the emotional response to music results from the cognitive processing of musical structures (key, modalities, rhythm), which are known to be expressive in the context of the Western musical system. Almost all these studies investigate emotional responses to music by using verbal labels, that is potentially problematic since it can encourage participants to simplify what they actually experiencing. Recently, some authors proposed an experimental method that makes no use of verbal labels. By means of the multidimensional scaling method (MDS), a two-dimensional space was found to provide a good fit of the data, with arousal and emotional valence as the primary dimensions. In order to emphasize other latent dimensions, a perceptual experiment and a comprehensive acoustic analysis was carried out by using a set of musical pieces all in major mode. Results show that participants tend to organize the stimuli according to three clusters, related to musical tempo and to timbral aspects such as the spectral energy distribution.

9.20h: [OS5-2] EXPLAINING MUSICAL EXPRESSION AS A MIXTURE OF BASIS FUNCTIONS. *Maarten Grachten and Gerhard Widmer.*

The quest for understanding how pianists interpret notated music to turn it into a lively musical experience, has led to numerous models of musical expression. One of the major dimensions of musical expression is loudness. Several models exist that explain loudness variations over the course of a performance, in terms of for example phrase structure, or musical accent. Often however, especially in piano music from the romantic period, performance directives are written explicitly in the score to guide performers. It is to be expected that such directives can explain a large part of the loudness variations. In this paper, we present a method to model the influence of notated loudness directives on loudness in piano performances, based on least squares fitting of a set of basis functions. We demonstrate that the linear basis model approach is general enough to allow for incorporating arbitrary musical features. In particular,

we show that by including notated pitch in addition to loudness directives, the model also accounts for loudness effects in relation to voice-leading.

9.40h: [OS5-3] A COMPARISON OF PERCEPTUAL RATINGS AND COMPUTED AUDIO FEATURES. *Anders Friberg and Anton Hedblad.*

The backbone of most music information retrieval systems is the features extracted from audio. There is an abundance of features suggested in previous studies ranging from low-level spectral properties to high-level semantic descriptions. These features often attempt to model different perceptual aspects. However, few studies have verified if the extracted features correspond to the assumed perceptual concepts. To investigate this we selected a set of features (or musical factors) from previous psychology studies. Subjects rated nine features and two emotion scales using a set of ringtone examples. Related audio features were extracted using existing toolboxes and compared with the perceptual ratings. The results indicate that there was a high agreement among the judges for most of the perceptual scales. The emotion ratings energy and valence could be well estimated by the perceptual features using multiple regression with adj. $R^2 = 0.93$ and 0.87 , respectively. The corresponding audio features could only to a certain degree predict the corresponding perceptual features indicating a need for further development.

10.00h: [OS5-4] INVESTIGATION OF THE RELATIONSHIPS BETWEEN AUDIO FEATURES AND INDUCED EMOTIONS IN CONTEMPORARY WESTERN MUSIC. *Konstantinos Trochidis, Charles Delbé, and Emmanuel Bigand.*

This paper focuses on emotion recognition and understanding in Contemporary Western music. The study seeks to investigate the relationship between perceived emotion and musical features in the fore-mentioned musical genre. A set of 27 Contemporary music excerpts is used as stimuli to gather responses from both musicians and non-musicians, which are then mapped on an emotional plane in terms of arousal and valence dimensions. Audio signal analysis techniques are applied to the corpus and a base feature set is obtained. The feature set contains characteristics ranging from low-level spectral and temporal acoustic features to high-level contextual features. The feature extraction process is discussed with particular emphasis on the interaction between acoustical and structural parameters. Statistical relations between audio features and emotional ratings from psychological experiments are systematically investigated. Finally, a linear model is created using the best features and the mean ratings and its prediction efficiency is evaluated and discussed.

Oral Session 6: CREATIVITY

14.30h – Friday, July 8th, 2011

Chair: *John Dack*

14.30h: [OS6-1] HUMANITIES, ART AND SCIENCE IN THE CONTEXT OF INTERACTIVE SONIC SYSTEMS – SOME CONSIDERATIONS ON A CUMBERSOME RELATIONSHIP. *Pietro Polotti.*

The theme of this conference, “creativity rethinks science” involves a radical epistemological

challenge with respect to a classical view of science and it is an extremely hot topic of speculation within the scientific community, at least for what concerns computer sciences. In this paper, we propose some considerations about the role that artistic research could have within science, where science is meant in the wide sense of knowledge, including, thus, humanities as a one of the partners together with natural sciences. After a more general discussion focused mainly on the field of Information and Communication Technology (ICT), we will restrict the scope to the case of sound art involving new technologies and sound design for Human Computer Interaction (HCI), namely Sonic Interaction Design (SID). In our discussion, the concepts of design have a particular relevance, since they provide a connection between fields traditionally far away one from the other such as natural sciences, art, engineering and humanities. In the last part of the paper, we provide some examples about what we mean by doing artistic research guided by a design practice. We envisage this as one of the possible ways to make a dialogue between artistic research and scientific research more feasible at a methodological level.

14.50h: [OS6-2] EXPLORING THE DESIGN SPACE: PROTOTYPING “THE THROAT V3” FOR THE ELEPHANT MAN OPERA. *Ludvig Elblaus, Kjetil Falkenberg Hansen, and Carl Unander-Scharin.*

Developing new technology for artistic practice requires other methods than classical problem solving. Some of the challenges involved in the development of new musical instruments have affinities to the realm of wicked problems. Wicked problems are hard to define and have many different solutions that are good or bad (not true or false). The body of possible solutions to a wicked problem can be called a design space and exploring that space must be the objective of a design process. In this paper we present effective methods of iterative design and participatory design that we have used in a project developed in collaboration between the Royal Institute of Technology (KTH) and the University College of Opera, both in Stockholm. The methods are outlined, and examples are given of how they have been applied in specific situations. The focus lies on prototyping and evaluation with user participation. By creating and acting out scenarios with the user, and thus asking the questions through a prototype and receiving the answers through practice and exploration, we removed the bottleneck represented by language and allowed communication beyond verbalizing. Doing this, even so-called tacit knowledge could be activated and brought into the development process.

15.10h: [OS6-3] MARCO STROPPA'S COMPOSITIONAL PROCESS AND SCIENTIFIC KNOWLEDGE BETWEEN 1980-1991. *Vincent Tiffon and Noémie Sprenger-Ohana.* The purpose of this paper is to show the creative relationship that can be established between scientific knowledge and musical innovation, through the example of Marco Stroppa's work performed between 1980 and 1991 in three specific places: Padova CSC (and the Conservatory of Venice), Ircam (Paris) and MIT (USA). The following methodological tools allow to understand the links between Stroppa's technico-scientific innovation, and musical invention: an analysis of his training years from 1980 to 1983 and of the main sources of cognitive models; a genetic study of the work *Traiettorie* (1982-1988), that is, the systematic study of traces, sketches, drafts, computer jotters and other genetic documents; written work

published by Stroppa between 1983 and 1991; multiple interviews with the composer and witnesses of the period; a partial reconstitution under Open- Music (OMChroma workspace) of the electronic part initially performed under Music V. In fact, Traiettoria constitutes what can be labelled a laboratory of Marco Stroppa's "workshop of composition".

15.30h: [OS6-4] LIMITS OF CONTROL. *Hanns Holger Rutz.*

We are analysing the implications of music composition through programming, in particular the possibilities and limitations of tracing the composition process through computer artefacts. The analysis is attached to the case study of a sound installation. This work was realised using a new programming system, which is briefly introduced. Through these observations we are probing and adjusting a model of the composition process, which draws ideas from systems theory, the experimental system of differential reproduction, and deconstructionism.

Oral Session 7: MUSIC AUTOMATION

16.30h – Friday, July 8th, 2011

Chair: *Haruhiro Katayose*

16.30h: [OS7-1] GENERATING MUSICAL ACCOMPANIMENT THROUGH FUNCTIONAL SCAFFOLDING. *Amy K. Hoover, Paul A. Szerlip, and Kenneth O. Stanley.*

A popular approach to music generation in recent years is to extract rules and statistical relationships by analysing a large corpus of musical data. The aim of this paper is to present an alternative to such data-intensive techniques. The main idea, called functional scaffolding for musical composition (FSMC), exploits a simple yet powerful property of multipart compositions: The pattern of notes and rhythms in different instrumental parts of the same song are functionally related. That is, in principle, one part can be expressed as a function of another. The utility of this insight is validated by an application that assists the user in exploring the space of possible accompaniments to pre-existing parts through a process called interactive evolutionary computation. In effect, without the need for musical expertise, the user explores transforming functions that yield plausible accompaniments derived from pre-existing parts. In fact, a survey of listeners shows that participants cannot distinguish songs with computer-generated parts from those that are entirely human composed. Thus this one simple mathematical relationship yields surprisingly convincing results even without any real musical knowledge programmed into the system. With future refinement, FSMC might lead to practical aids for novices aiming to fulfill incomplete visions.

16.50h: [OS7-2] A RULE-BASED GENERATIVE MUSIC SYSTEM CONTROLLED BY DESIRED VALENCE AND AROUSAL. *Isaac Wallis, Todd Ingalls, Ellen Campana, and Janel Goodman.*

This paper details an emotional music synthesis (EMS) system, which is designed around music theory parameters and previous research on music and emotion. This system uses a rule-based algorithm to generate the music from scratch. Results of a user study on this system show that listener ratings of emotional valence and arousal correlate with intended production of musical valence and arousal.

17.10h: [OS7-3] AUTOMATIC MULTI-TRACK MIXING USING LINEAR DYNAMICAL SYSTEMS. *Jeffrey Scott, Matthew Prockup, Erik M. Schmidt, and Youngmoo E. Kim.*

Over the past several decades music production has evolved from something that was only possible with multi-room, multi-million dollar studios into the province of the average person's living room. New tools for digital production have revolutionized the way we consume and interact with music on a daily basis. We propose a system based on a structured audio framework that can generate a basic mix-down of a set of multi-track audio files using parameters learned through supervised machine learning. Given the new surge of mobile content consumption, we extend this system to operate on a mobile device as an initial measure towards an integrated interactive mixing platform for multi-track music.

17.30h: [OS7-4] DANCEREPRODUCER: AN AUTOMATIC MASHUP MUSIC VIDEO GENERATION SYSTEM BY REUSING DANCE VIDEO CLIPS ON THE WEB. *Tomoyasu Nakano, Sora Murofushi, Masataka Goto, and Shigeo Morishima.*

We propose a dance video authoring system, DanceReProducer that can automatically generate a dance video clip appropriate to a given piece of music by segmenting and concatenating existing dance video clips. In this paper, we focus on the reuse of ever-increasing user-generated dance video clips on a video sharing web service. In a video clip consisting of music (audio signals) and image sequences (video frames), the image sequences are often synchronized with or related to the music. Such relationships are diverse in different video clips, but were not dealt with by previous methods for automatic music video generation. Our system employs machine learning and beat tracking techniques to model these relationships. To generate new music video clips, short image sequences that have been previously extracted from other music clips are stretched and concatenated so that the emerging image sequence matches the rhythmic structure of the target song. Besides automatically generating music videos, DanceReProducer offers a user interface in which a user can interactively change image sequences just by choosing different candidates. This way people with little knowledge or experience in MAD movie generation can interactively create personalized video clips.

Oral Session 8: ENVIRONMENTS FOR SOUND/MUSIC PROCESSING

9.00h – Saturday, July 9th, 2011

Chair: *Dominique Fober*

9.00h: [OS8-1] ON THE CREATIVE USE OF SCORE FOLLOWING AND ITS IMPACT ON RESEARCH. *Arshia Cont.*

Score following research is one of the active disciplines of sound and music computing since almost 30 years that have haunted both algorithmic and computational development in real-time music information retrieval, as well as artistic applications in interactive computer music. This paper explores the creative use of such technologies and brings attention to new scientific paradigms that emerge out of their artistic use. We show how scientific and artistic goals of score following systems might differ and how the second, continuously helps re-think the first. We focus mostly on the musical goals of score following technologies, which brings

us to an underestimated field of research, despite its obviousness in creative applications, which is that of synchronous reactive programming and its realization in Antescofo.

9.20h: [OS8-2] ENSEMBLE: IMPLEMENTING A MUSICAL MULTIAGENT SYSTEM FRAMEWORK. *Leandro Ferrari Thomaz and Marcelo Queiroz.*

Multiagent systems can be used in a myriad of musical applications, including electro-acoustic composition, automatic musical accompaniment and the study of emergent musical societies. Previous works in this field were usually concerned with solving very specific musical problems and focused on symbolic processing, which limited their widespread use, specially when audio exchange and spatial information were needed. To address this shortcoming, Ensemble, a generic framework for building musical multiagent systems was implemented, based on a previously defined taxonomy and architecture. The present paper discusses some implementation details and framework features, including event exchange between agents, agent motion in a virtual world, realistic 3D sound propagation simulation, and interfacing with other systems, such as Pd and audio processing libraries. A musical application based on Steve Reich's Clapping Music was conceived and implemented using the framework as a case study to validate the aforementioned features. Finally, we discuss some performance results and corresponding implementation challenges, and the solutions we adopted to address these issues.

9.40h: [OS8-3] AUDIO PHYSICAL COMPUTING. *Andrea Valle.*

The paper describes an approach to the control of electromechanical devices for musical purposes (mainly, DC motors and solenoids) using audio signals. The proposed approach can be named "audio physical computing", i.e. physical computing oriented towards sound generation by means of audio signals. The approach has its origin in a previous physical computing project dedicated to music generation, the Rumentarium Project that used microcontrollers as the main computing hardware interface. First, some general aspects of physical computing are discussed and the Rumentarium project is introduced. Then, a reconsideration of the technical setup of the Rumentarium is developed, and the audio physical computing approach is considered as a possible replacement for microcontrollers. Finally, a music work is described, in order to provide a real life example of audio physical computing.

10.00h: [OS8-4] THE VOWELWORM: REAL-TIME MAPPING AND VISUALISATION OF SUNG VOWELS IN MUSIC. *Harald Frostel, Andreas Arzt, and Gerhard Widmer.*

This paper presents an approach to predicting vowel quality in vocal music performances, based on common acoustic features (mainly MFCCs). Rather than performing classification, we use linear regression to project spoken or sung vowels into a continuous articulatory space: the IPA Vowel Chart. We introduce a real-time on-line visualisation tool, the Vowel Worm, which builds upon the resulting models and displays the evolution of sung vowels over time in an intuitive manner. The concepts presented in this work can be used for artistic purposes and music teaching.

Oral Session 9: INTERACTION WITH SOUND AND MUSIC

12.00h – Saturday, July 9th, 2011

Chair: *Kjetil Falkenberg Hansen*

12.00h: [OS9-1] SONIC GESTURES AS INPUT IN HUMAN-COMPUTER INTERACTION: TOWARDS A SYSTEMATIC APPROACH. *Antti Jyllhä.*

While the majority of studies in sonic interaction design (SID) focuses on sound as the output modality of an interactive system, the broad scope of SID includes also the use of sound as an input modality. Sonic gestures can be defined as sound-producing actions generated by a human in order to convey information. Their use as input in computational systems has been studied in several isolated contexts, however a systematic approach to their utility is lacking. In this study, the focus is on general sonic gestures, rather than exclusively focusing on musical ones. Exemplary interactive systems applying sonic gestures are reviewed, and based on previous studies on gesture, the first steps towards a systematic framework of sonic gestures are presented. Here, sonic gestures are studied from the perspectives of typology, morphology, interaction affordances, and mapping. The informational richness of the acoustic properties of sonic gestures is highlighted.

12.20h: [OS9-2] IMPROVING PERFORMERS' MUSICALITY THROUGH LIVE INTERACTION WITH HAPTIC FEEDBACK: A CASE STUDY. *Tychonas Michailidis and Jamie Bullock.*

Physical interaction with instruments allows performers to express and realise music based on the nature of the instrument. Through instrumental practice, the performer is able to learn and internalise sensory responses inherent in the mechanical production of sound. However, current electronic musical input devices and interfaces lack the ability to provide a satisfactory haptic feedback to the performer. The lack of feedback information from electronic controllers to the performer introduces aesthetic and practical problems in performances and compositions of live electronic music. In this paper, we present an initial study examining the perception and understanding of artificial haptic feedback in live electronic performances. Two groups of trumpet players participated during the study, in which short musical examples were performed with and without artificial haptic feedback. The results suggest the effectiveness and possible exploitable approaches of haptic feedback, as well as the performers' ease of recalibrating and adapting to new haptic feedback associations. In addition to the methods utilised, technical practicalities and aesthetic issues are discussed.

12.40h: [OS9-3] WHERE DO YOU WANT YOUR EARS? COMPARING PERFORMANCE QUALITY AS A FUNCTION OF LISTENING POSITION IN A VIRTUAL JAZZ BAND. *Adriana Olmos, Paul Rushka, Doyuen Ko, Gordon Foote, Wieslaw Woszczyk, and Jeremy R. Cooperstock.*

This study explores the benefits of providing musicians with alternative audio rendering experiences while they perform with a virtual orchestra. Data collection methods included a field study with a large jazz band and a pilot study in which musicians rehearsed using a prototype that presented two different audio rendering perspectives: one from the musician's

perspective, and a second from the audience perspective. The results showed that the choice of audio perspective makes a significant difference in some musicians' performance. Specifically, for some musicians, e.g., lead trumpet players, an acoustically natural mix results in improved performance, for others, e.g., drummers, it was easier to play along with the artificial "audience" perspective. These results motivate the inclusion of a music mixer capability in such a virtual rehearsal scenario.

13.00h: [OS9-4] THE EYEHARP: AN EYE-TRACKING-BASED MUSICAL INSTRUMENT. *Zacharias Vamvakousis and Rafael Ramirez.*

In this paper we present the EyeHarp, a new musical instrument based on eye tracking. The EyeHarp consists of a self-built low-cost eye-tracking device, which communicates with an intuitive musical interface. The system allows performers and composers to produce music by controlling sound settings and musical events using eye movement. We describe the development of the EyeHarp, in particular the construction of the eye-tracking device and the design and implementation of the musical interface. We conduct a preliminary experiment for evaluating the system and report on the results.

POSTER SESSIONS

Poster Craze presentations take place at Aula Magna Galileo Galilei, Palazzo del Bo, University of Padova.

Poster Sessions take place at Sala delle Colonne-Basilica, Palazzo del Bo, University of Padova.

Poster Session 1

10.30h (Poster Craze); 11.00h (Session) – Thursday, July 7th, 2011.

[PS1-1] IMPROVING TEMPO-SENSITIVE AND TEMPO-ROBUST DESCRIPTORS FOR RHYTHMIC SIMILARITY. *Andre Holzapfel, Arthur Flexer, and Gerhard Widmer.*

For the description of rhythmic content of music signals usually features are preferred that are invariant in presence of tempo changes. In this paper it is shown that the importance of tempo depends on the musical context. For popular music, a tempo-sensitive feature is improved on multiple datasets using analysis of variance, and it is shown that also a tempo-robust description profits from the integration into the resulting processing framework. Important insights are given into optimal parameters for rhythm description, and limitations of current approaches are indicated.

[PS1-2] GESTURAL CONTROL OF REAL-TIME SPEECH SYNTHESIS IN LUNA PARK. *Grégory Beller.*

This paper presented the researches and the developments realized for an artistic project called Luna Park. This work is widely connected, at various levels, in the paradigm of the concatenative synthesis, both to its shape and in the processes, which it employs. Thanks to a real-time programming environment, synthesis engines and prosodic transformations are manipulated, controlled and activated by the gesture, via accelerometers realized for the piece. This paper explains the sensors, the real time audio engines and the mapping that connects these two parts. The world premiere of Luna Park takes place in Paris, in the space of projection of the IRCAM, on June 10th, 2011, during the festival AGORA.

[PS1-3] AN INTERACTIVE SURFACE REALISATION OF HENRI POUSSEUR'S 'SCAMBI'. *Robin Fencott and John Dack.*

We have constructed an interactive touch surface exhibit to re-appropriate a historic electroacoustic composition for the digital age. The electroacoustic work in question is Henri Pousseur's seminal composition 'Scambi', originally created in 1957 at the RAI Studios, Milan. The status of Scambi as a key example of an electroacoustic 'open' form makes it ideal for re-appropriation as an interactive public exhibit, while an existing musicological analysis of Pousseur's compositional instructions for Scambi provide insight for the user interface design and translation of written textual composition process into interactive software. The project is on going, and this paper presents our current work-in progress. We address the musicological, practical and aesthetic implications of this work, discuss informal observation of users engaging with our tabletop system, and comment on the nature of touchscreen interfaces for musical interaction. This work is therefore relevant to the electroacoustic community, fields of human computer interaction, and those developing new interfaces for musical expression. This work contributes to the European Commission 'DREAM' project.

[PS1-4] SPATIO-TEMPORAL UNFOLDING OF SOUND SEQUENCES. *Davide Rocchesso and Stefano Delle Monache.*

Distributing short sequences of sounds in space as well as in time is important for many applications, including the signaling of hot spots. In a first experiment, we show that the accuracy in the localization of one such spot is not improved by the apparent motion induced by spatial sequencing. In a second experiment, we show that increasing the number of emission points does improve the smoothness of spatio-temporal trajectories, even for those rapidly-repeating pulses that may induce an auditory-saltation illusion. Other indications for auditory-display designers can also be drawn from the experiments.

[PS1-5] AN EXPLORATION ON THE INFLUENCE OF VIBROTACTILE CUES DURING DIGITAL PIANO PLAYING. *Federico Fontana, Marco Civolani, Stefano Papetti, Valentina del Bello, and Balázs Bank.*

An exploratory experiment was carried out in which subjects with different musical skills were asked to play a digital piano keyboard, first by following a specific key sequence and style of execution, and then performing freely. Judgments of perceived sound quality were recorded in three different settings, including standard use of the digital piano with its own internal

loudspeakers, and conversely use of the same keyboard for controlling a physics-based piano sound synthesis model running on a laptop in real time. Through its audio card, the laptop drove a couple of external loudspeakers, and occasionally a couple of shakers screwed to the bottom of the keyboard. The experiment showed that subjects prefer the combination of sonic and vibrotactile feedback provided by the synthesis model when playing the key sequences, whereas they promote the quality of the original instrument when performing free. Even if springing out of a preliminary evaluation, these results were in good accordance with the development stage of the synthesis software at the time of the experiment. They suggest that vibrotactile feedback modifies, and potentially improves the performer's experience when playing on a digital piano keyboard.

[PS1 - 6] ON COMPUTING MORPHOLOGICAL SIMILARITY OF AUDIO SIGNALS. *Martin Gasser, Arthur Flexer, and Thomas Grill.*

Most methods to compute content-based similarity between audio samples are based on descriptors representing the spectral envelope or the texture of the audio signal only. This paper describes an approach based on (i) the extraction of spectro-temporal profiles from audio and (ii) non-linear alignment of the profiles to calculate a distance measure.

[PS1-7] SOUND SPATIALIZATION CONTROL BY MEANS OF ACOUSTIC SOURCE LOCALIZATION SYSTEM. *Daniele Salvati, Sergio Canazza, and Antonio Rodà.*

This paper presents a system for controlling the sound spatialisation of a live performance by means of the acoustic localization of the performer. Our proposal is to allow a performer to directly control the position of a sound played back through a spatialization system, by moving the sound produced by its own musical instrument. The proposed system is able to locate and track the position of a sounding object (e.g., voice, instrument, sounding mobile device) in a two-dimensional space with accuracy, by means of a microphone array. We consider an approach based on Generalized Cross-Correlation (GCC) and Phase Transform (PHAT) weighting for the Time Difference Of Arrival (TDOA) estimation between the microphones. Besides, a Kalman filter is applied to smooth the time series of observed TDOAs, in order to obtain a more robust and accurate estimate of the position. To test the system control in real-world and to validate its usability, we developed a hardware/software prototype, composed by an array of three microphones and a Max/MSP external object for the sound localization task. We have got some preliminary successfully results with a human voice in real moderately reverberant and noisy environment and a binaural spatialisation system for headphone listening.

[PS1-8] AN ANALOG I/O INTERFACE BOARD FOR AUDIO ARDUINO OPEN SOUND CARD SYSTEM. *Smilen Dimitrov and Stefania Serafin.*

AUDIOARDUINO is a system consisting of an ALSA (Advanced Linux Sound Architecture) audio driver and corresponding microcontroller code; that can demonstrate full duplex, mono, 8-bit, 44.1 kHz soundcard behavior on an FTDI based Arduino. While the basic operation as a soundcard can be demonstrated with nothing more than a pair of headphones and a couple of capacitors – modern PC soundcards typically make use of multiple signal standards; and correspondingly, multiple connectors. The usual distinction that typical off-

the-shelf stereo soundcards make is between line-level signals (line-in/line-out) - and those not conforming to this standard (such as microphone input/speaker output). To provide a physical illustration of these issues in soundcard design, this project outlines an open design for a simple single-sided PCB, intended for experimentation (via interconnection of basic circuits on board). The contribution of this project is in providing a basic introductory overview of some of the problems (PWM output in particular) in analog I/O design and implementation for soundcards through a real world example, which - while incapable of delivering professional grade quality - could still be useful, primarily in an educational scope.

[PS1-9] DESIGNING AN EXPRESSIVE VIRTUAL PERCUSSION INSTRUMENT. *Brian Dolhansky, Andrew McPherson, and Youngmoo E. Kim.*

One advantage of modern smart phones is their ability to run complex applications such as instrument simulators. Most available percussion applications use a trigger-type implementation to detect when a user has made a gesture corresponding to a drum hit, which limits the expressiveness of the instrument. This paper presents an alternative method for detecting drum gestures and producing a latency-reduced output sound. Multiple features related to the shape of the percussive stroke are also extracted. These features are used in a variety of physically-inspired and novel sound mappings. The combination of these components provides an expressive percussion experience for the user.

[PS1-10] ACTIVE PRESERVATION OF ELECTROPHONE MUSICAL INSTRUMENTS. THE CASE OF THE “LIETTIZZATORE” OF “STUDIO DI FONOLOGIA MUSICALE” (RAI, MILANO). *Sergio Canazza, Federico Avanzini, Maria Maddalena Novati, and Antonio Rodà.*

This paper presents first results of an on-going project devoted to the analysis and virtualization of the analog electronic devices of the “Studio di Fonologia Musicale”, one of the European centres of reference for the production of electroacoustic music in the 1950’s and 1960’s. After a brief summary of the history of the Studio, the paper discusses a particularly representative musical work produced at the Studio, *Scambi* by Henri Pousseur, and it presents initial results on the analysis and simulation of the electronic device used by Pousseur in this composition, and the on-going work finalized at developing an installation that re-creates such electronic lutherie.

[PS1-11] DESIGN AND APPLICATIONS OF A MULTI-TOUCH MUSICAL KEYBOARD. *Andrew McPherson and Youngmoo Kim.*

This paper presents a hardware and software system for adding multiple touch sensitivity to the piano-style keyboard. The traditional keyboard is a discrete interface, defining notes by onset and release. By contrast, our system allows continuous gestural control over multiple dimensions of each note by sensing the position and contact area of up to three touches per key. Each key consists of a circuit board with a capacitive sensing controller, laminated with thin plastic sheets to provide a traditional feel to the performer. The sensors, which are less than 3mm thick, mount atop existing acoustic or electronic piano keyboards. The hardware connects via USB, and software on a host computer generates OSC messages reflecting a broad array of low- and high-level gestures, including motion of single points, two- and

three-finger pinch and slide gestures, and continuous glissandos tracking across multiple keys. This paper describes the system design and presents selected musical applications.

[PS1-12] IMPROVED FREQUENCY ESTIMATION IN SINUSOIDAL MODELS THROUGH ITERATIVE LINEAR PROGRAMMING SCHEMES. *Vighnesh Leonardo Shiv.*

Sinusoidal modeling systems are commonly employed in sound and music processing systems for their ability to decompose a signal to its fundamental spectral information. Sinusoidal modeling is a two-phase process: sinusoidal parameters are estimated in each analysis frame in the first phase, and these parameters are chained into sinusoidal trajectories in the second phase. This paper focuses on the frequency estimation aspect of the first phase. Current methods for estimating parameters rely heavily on the resolution of the Fourier transform and are thus hindered by the Heisenberg uncertainty principle. A novel approach is proposed that can super-resolve frequencies and attain more accurate estimates of sinusoidal parameters than current methods. The proposed algorithm formulates parameter estimation as a linear programming problem, in which the L1 norm of the residual component of the sinusoidal decomposition is minimized. It achieves 3.5 times the frequency resolution of Fourier-based approaches.

[PS1-13] PERSONALITY AND COMPUTER MUSIC. *Sandra Garrido, Emery Schubert, Gunter Kreutz, and Andrea Halpern.*

Research has suggested that music preferences and an attraction to computers and technology are related to specific personality traits. This paper will argue that so-called ‘music-systemizing’ may be predictive of a preference for electronica, techno and computer-generated music. We report a preliminary study in which listeners who enjoy computer music based genres demonstrated a trend towards a higher mean score on the music-systemizing scale than those who enjoy love songs.

[PS1-14] AUDITORY FEEDBACK IN A MULTIMODAL BALANCING TASK: WALKING ON A VIRTUAL PLANK. *Stefania Serafin, Luca Turchet, and Rolf Nordahl.*

We describe a multimodal system, which exploits the use of footwear-based interaction in virtual environments. We developed a pair of shoes enhanced with pressure sensors, actuators, and markers. Such shoes control a multichannel surround sound system and drive a physically based sound synthesis engine, which simulates the act of walking on different surfaces. We present the system in all its components, and explain its ability to simulate natural interactive walking in virtual environments. The system was used in an experiment whose goal was to assess the ability of subjects to walk blindfolded on a virtual plank. Results show that subjects perform the task slightly better when they are exposed to haptic feedback as opposed to auditory feedback, although no significant differences are measured. The combination of auditory and haptic feedback does not significantly enhance the task performance.

[PS1-15] ANALYSIS OF SOCIAL INTERACTION IN MUSIC PERFORMANCE WITH SCORE-INDEPENDENT AUDIO FEATURES. *Gualtiero Volpe, Giovanna Varni, Barbara Mazzarino, Silvia Pisano, and Antonio Camurri.*

Research on analysis of expressive music performance is recently moving its focus from a single player to small music ensembles, extending the analysis to the social interaction among the members of the ensemble. A step in this direction is the definition and the validation of a set of score-independent audio features that enable to characterize the social interaction in the ensemble, based on the analysis of the music performance. This paper focuses on the analysis of four different performances of a same music piece performed by a string quartet. The performances differ with respect to factors affecting the social interaction within the ensemble. The analysis aims at evaluating whether and to what extent a set of consolidated score-independent audio features, already employed for analysis of expressive music content and particularly suitable for string instruments, enable to distinguish among such different performances.

Poster Session 2

10.30h (Poster Craze); 11.00h (Session) – Friday, July 8th, 2011.

[PS2-1] APPLICATIONS OF SYNCHRONIZATION IN SOUND SYNTHESIS. *Martin Neukom.*

The synchronization of natural and technical periodic processes can be simulated with self-sustained oscillators. Under certain conditions, these oscillators adjust their frequency and their phase to a master oscillator or to other self-sustained oscillators. These processes can be used in sound synthesis for the tuning of non-linear oscillators, for the adjustment of the pitches of other oscillators, for the synchronization of periodic changes of any sound parameters and for the synchronization of rhythms. This paper gives a short introduction to the theory of synchronization, shows how to implement the differential equations, which describe the self-sustained oscillators and gives some examples of musical applications. The examples are programmed as mxj- externals for MaxMSP. The Java code samples are taken from the perform routine of these externals. The externals and Max patches can be downloaded from <http://www.icst.net/downloads>.

[PS2-2] MELODY HARMONIZATION IN EVOLUTIONARY MUSIC USING MULTIOBJECTIVE GENETIC ALGORITHMS. *Alan Freitas and Frederico Guimarães.*

This paper describes a multiobjective approach for melody harmonization in evolutionary music. There are numerous methods and a myriad of results to a process of harmonization of a given melody. Some implicit rules can be extracted from musical theory, but some harmonic aspects can only be defined by preferences of a composer. Thus, a multiobjective approach may be useful to allow an evolutionary process to find a set of solutions that represent a trade-off between the rules in different objective functions. In this paper, a multiobjective evolutionary algorithm defines chord changes with differing degrees of simplicity and dissonance. While presenting such an algorithm, we discuss how to embed musical cognizance in Genetic Algorithms in a meta-level. Experiments were held and compared to human judgment of the results. The findings suggest that it is possible to devise a fitness function, which reflects human intentions for harmonies.

[PS2-3] AN ADAPTIVE CLASSIFICATION ALGORITHM FOR SEMIOTIC MUSICAL GESTURES. *Nicholas Gillian, R. Benjamin Knapp, and Sile O'Modhrain.*

This paper presents a novel machine learning algorithm that has been specifically developed for the classification of semiotic musical gestures. We demonstrate how our algorithm, called the Adaptive Naïve Bayes Classifier, can be quickly trained with a small number of training examples and then classify a set of musical gestures in a continuous stream of data that also contains non-gestural data. The algorithm also features an adaptive function that enables a trained model to slowly adapt itself as a performer refines and modifies their own gestures over, for example, the course of a rehearsal period. The paper is concluded with a study that shows a significant overall improvement in the classification abilities of the algorithm when the adaptive function is used.

[PS2-4] AN INTERACTIVE MUSIC COMPOSITION SYSTEM BASED ON AUTONOMOUS MAINTENANCE OF MUSICAL CONSISTENCY. *Tetsuro Kitahara, Satoru Fukayama, Shigeki Sagayama, Haruhiro Katayose, and Noriko Nagata.*

Various attempts at automatic music composition systems have been made, but they have not addressed the issue of how the user can edit a composed piece. In this paper, we propose a human-in-the-loop music composition system, in which the manual editing stage is integrated into the composition process. This system first generates a musical piece based on the lyric input by the user. Then, the user can edit the melody and/or chord progression. The advantage of this system is that once the user edits the melody or chord progression of the generated piece, the system can regenerate the remaining part so that this part musically matches the edited part. With this feature, users can create various melodies and arrangements and avoid the musical inconsistency between the melody and the chord progression. We confirmed that this feature facilitates the trial and error process of users who edit music.

[PS2-5] A LEARNING INTERFACE FOR NOVICE GUITAR PLAYERS USING VIBROTACTILE STIMULATION. *Marcello Giordano and Marcelo M. Wanderley.*

This paper presents a full-body vibrotactile display that can be used as a tool to help learning music performance. The system is composed of 10 vibrotactile actuators placed on different positions of the body as well as an extended and modified version of a software tool for generating tactile events, the Fast Afferent/Slow Afferent (FA/SA) application. We carried out initial tests of the system in the context of enhancing the learning process of novice guitar players. In these tests we asked the performers to play the guitar part over a drum and bass-line base track, either heard or felt by the performers through headphones and the tactile display they were wearing. Results show that it is possible to accurately render the representation of the audio track in the tactile channel only, therefore reducing the cognitive load in the auditory channel.

[PS2-6] FUNCTIONAL SIGNAL PROCESSING WITH PURE AND FAUST USING THE LLVM TOOLKIT. *Albert Gräf.*

Pure and Faust are two functional programming languages useful for programming computer music and other multimedia applications. Faust is a domain-specific language specifically designed for synchronous signal processing, while Pure is a general-purpose language,

which aims to facilitate symbolic processing of complicated data structures in a variety of application areas. Pure is based on the LLVM compiler framework, which supports both static and dynamic compilation and linking. This paper discusses a new LLVM bitcode interface between Faust and Pure which allows direct linkage of Pure code with Faust programs, as well as inlining of Faust code in Pure scripts. The interface makes it much easier to integrate signal processing components written in Faust with the symbolic processing and metaprogramming capabilities provided by the Pure language. It also opens new possibilities to leverage Pure and its JIT (just-in-time) compiler as an interactive frontend for Faust programming.

[PS2-7] RAPSCOM – A FRAMEWORK FOR RAPID PROTOTYPING OF SEMANTICALLY ENHANCED SCORE MUSIC. *Julian Rubisch, Jakob Doppler, and Hannes Raf-faseder.*

In film and video production, the selection or production of suitable music often turns out to be an expensive and time-consuming task. Directors or video producers frequently do not possess enough expert musical knowledge to express their musical ideas to a composer, which is why the usage of temp tracks is a widely accepted practice. To improve this situation, we aim at devising a generative music prototyping tool capable of supporting media producers by exposing a set of high-level parameters tailored to the vocabulary of films (such as mood descriptors, semantic parameters, film and music genre etc.). The tool is meant to semi-automate the process of producing and/or selecting temp tracks by using algorithmic composition strategies to either generate new musical material, or process exemplary material, such as audio or MIDI files. Eventually, the tool will be able to provide suitable raw material for composers to start their work. We will also publish parts of the prototype as an open source framework (the RaPScoM framework) to foster further development in this area.

[PS2-8] FOLEY SOUNDS VS. REAL SOUNDS. *Stefano Trento and Amalia de Götzen.*

This paper is an initial attempt to study the world of sound effects for motion pictures, also known as Foley sounds. Throughout several audio and audio-video tests we have compared both Foley and real sounds originated by an identical action. The main purpose was to evaluate if sound effects are always better than real sounds. We found a similarity in subjects' preferences between real sounds and Foley sounds, with a limited discrimination ability between them.

[PS2-9] ROBOTIC PIANO PLAYER MAKING PIANOS TALK. *Winfried Ritsch.*

The overall vision of a piano, which can talk, a piano that produces understandable speech playing notes with a robotic piano player has been developed as artwork over the last decade. After successfully transcribing recorded ambient sound for piano and ensembles, the outcome of this mapping was applied by the composer Peter Ablinger in his artwork, which explores the auditory perception in the tradition of artistic phenomenologists. For this vision a robotic piano player has been developed to play the result from the mapping of voice recordings, by reconstructing the key features of the analyzed spectrum stream, so that a voice can be imagined and roughly recognized. This paper is a report on the artistic research, mentioning different solutions. The output as artworks will be referenced.

[PS2-10] SOUND SPHERES: A DESIGN STUDY OF THE ARTICULACY OF A NON-CONTACT FINGER TRACKING VIRTUAL MUSICAL INSTRUMENT. *Craig Hughes, Michel Wermelinger, and Simon Holland.*

A key challenge in the design of Virtual Musical instruments (VMIs) is finding expressive, playable, learnable mappings from gesture to sound that progressively reward practice by performers. Designing such mappings can be particularly demanding in the case of non-contact musical instruments, where physical cues can be scarce. Unaided intuition works well for many instrument designers, but others may find design and evaluation heuristics useful when creating new VMIs. In this paper we gather existing criteria from the literature to assemble a simple set of design and evaluation heuristics that we dub articulatory. This paper presents a design case study in which an expressive non-contact finger-tracking VMI, Sound Spheres, is designed and evaluated with the support of the articulatory heuristics. The case study explores the extent to which articulatory usefully informs the design of a non-contact VMI, and we reflect on the usefulness or otherwise of heuristic approaches in this context.

[PS2-11] PRIORITIZED CONTIG COMBINING TO SEGREGATE VOICES IN POLYPHONIC MUSIC. *Asako Ishigaki, Masaki Matsubara, and Hiroaki Saito.*

Polyphonic music is comprised of independent voices sounding synchronously. The task of voice segregation is to assign notes from symbolic representation of a musical score to monophonic voices. Human auditory sense can distinguish these voices. Hence, many previous works utilize perceptual principles. Voice segregation can be applied to music information retrieval and automatic music transcription of polyphonic music. In this paper, we propose to modify the voice segregation algorithm of contig mapping approach by Chew and Wu. This approach consists of 3 steps; segmentation, separation, and combining. We present a modification of “combining” step on the assumption that the accuracy of voice segregation depends on whether the segregation manages to correctly identify which voice is resting. Our algorithm prioritizes voice combining at segmentation boundaries with increasing voice counts. We tested our voice segregation algorithm on 78 pieces of polyphonic music by J.S.Bach. The results show that our algorithm attained 92.21% of average voice consistency.

[PS2-12] RENCON WORKSHOP 2011 (SMC-RENCON): PERFORMANCE RENDERING CONTEST FOR COMPUTER SYSTEMS. *Mitsuyo Hashida, Keiji Hirata, and Haruhiro Katayose.*

The Performance Rendering Contest (Rencon) is an annual international competition in which entrants present computer systems they have developed for generating expressive musical performances, which audience members and organizers judge. Recent advances in performance-rendering technology have brought with them the need for a means for researchers in this area to obtain feedback about the abilities of their systems in comparison to those of other researchers. The Rencon contest at SMC2011 (SMC-Rencon) is going to have two different stages of evaluation. In the first stage, the musicality of generated performances and technical quality of systems will be evaluated by expert reviewers using a blind procedure for evaluation. In the second stage, performances generated on site will be openly evaluated by the SMC audience and Internet viewers. The SMCRencon Awards will be bestowed on the systems exhibiting excellent performances at both stages.

[PS2-13] COMPARING INERTIAL AND OPTICAL MOCAP TECHNOLOGIES FOR SYNTHESIS CONTROL. *Ståle A. Skogstad, Kristian Nymoen, and Mats Høvin.*

This paper compares the use of two different technologies for controlling sound synthesis in real time: the infrared marker-based motion capture system OptiTrack and Xsens MVN, an inertial sensor-based motion capture suit. We present various quantitative comparisons between the data from the two systems and results from an experiment where a musician performed simple musical tasks with the two systems. Both systems are found to have their strengths and weaknesses, which we will present and discuss.

[PS2-14] A TOOLBOX FOR STORING AND STREAMING MUSIC-RELATED DATA. *Kristian Nymoen and Alexander Refsum Jensenius.*

Simultaneous handling and synchronisation of data related to music, such as score annotations, MIDI, video, motion descriptors, sensor data, etc. requires special tools due to the diversity of the data. We present a toolbox for recording and playback of complex music-related data. Using the Sound Description Interchange Format as a storage format and the Open Sound Control protocol as a streaming protocol simplifies exchange of data between composers and researchers.

[PS2-15] AUTOMATIC CREATION OF MOOD PLAYLISTS IN THE THAYER PLANE: A METHODOLOGY AND A COMPARATIVE STUDY. *Renato Panda and Rui Pedro Paiva.*

We propose an approach for the automatic creation of mood playlists in the Thayer plane (TP). Music emotion recognition is tackled as a regression and classification problem, aiming to predict the arousal and valence (AV) values of each song in the TP, based on Yang's dataset. To this end, a high number of audio features are extracted using three frameworks: PsySound, MIR Toolbox and Marsyas. The extracted features and Yang's annotated AV values are used to train several Support Vector Regressors, each employing different feature sets. The best performance, in terms of R^2 statistics, was attained after feature selection, reaching 63% for arousal and 35.6% for valence. Based on the predicted location of each song in the TP, mood playlists can be created by specifying a point in the plane, from which the closest songs are retrieved. Using one seed song, the accuracy of the created playlists was 62.3% for 20-song playlists, 24.8% for 5-song playlists and 6.2% for the top song.

Poster Session 3

10.30h (Poster Craze); 11.00h (Session) – Saturday, July 9th, 2011.

[PS3-1] TOWARDS A PERSONALIZED TECHNICAL EAR TRAINING PROGRAM: AN INVESTIGATION OF THE EFFECT OF ADAPTIVE FEEDBACK. *Teruaki Kaniwa, Sungyoung Kim, Hiroko Terasawa, Masahiro Ikeda, Takeshi Yamada, and Shoji Makino.*

Technical ear training aims to improve the listening of sound engineers so that they can skillfully modify and edit the structure of sound. To provide non-professionals such as amateur sound engineers and students with this technical ear training, we have developed a simple yet personalized ear training program. The most distinct feature of this system is that

it adaptively controls the training task based on the trainee's previous performance. In detail, this system estimates a trainee's weakness, and generates a training routine that provides drills focusing on the weakness, so that the trainee can effectively receive technical ear training without an instructor. We subsequently investigated the effect of the new training program with a one-month training experiment involving eight subjects. The result showed that the score of the group assigned to the proposed training system improved more than that of the group assigned to conventional training.

[PS3-2] EXTRACTION OF SOUND LOCALIZATION CUE UTILIZING PITCH CUE FOR MODELLING AUDITORY SYSTEM. *Takatoshi Okuno, Thomas M. McGinnity, and Liam P. Maguire.*

This paper presents a simple model for the extraction of a sound localization cue utilizing pitch cues in the auditory system. In particular, the extraction of the interaural time difference (ITD) as the azimuth localization cue, rather than the interaural intensity difference (IID), is constructed using a conventional signal processing scheme. The new configuration in this model is motivated by psychoacoustical and physiological findings, suggesting that the ITD can be controlled by the pitch cue in the simultaneous grouping of auditory cues. The localization cues are extracted at the superior olivary complex (SOC) while the pitch cue may be extracted at a higher stage of the auditory pathway. To explore this idea in the extraction of ITD, a system is introduced to feed back information on the pitch cue to control and/or modify the ITD for each frequency channel.

[PS3-3] SUPPORT FOR LEARNING SYNTHESISER PROGRAMMING. *Mateusz Dykiert and Nicolas Gold.*

When learning an instrument, students often like to emulate the sound and style of their favourite performers. The learning process takes many years of study and practice. In the case of synthesisers the vast parameter space involved can be daunting and unintuitive to the novice making it hard to define their desired sound and difficult to understand how it was achieved. Previous research has produced methods for automatically determining an appropriate parameter set to produce a desired sound but this can still require many parameters and does not explain or demonstrate the effect of particular parameters on the resulting sound. As a first step to solving this problem, this paper presents a new approach to searching the synthesiser parameter space to find a sound, reformulating it as a multi-objective optimisation problem (MOOP) where two competing objectives (closeness of perceived sonic match and number of parameters) are considered. As a proof-of-concept a pareto-optimal search algorithm (NSGA-II) is applied to CSound patches of varying complexity to generate a pareto front of non-dominating (i.e. "equally good") solutions. The results offer insight into the extent to which the size and nature of parameter sets can be reduced whilst still retaining an acceptable degree of perceived sonic match between target and candidate sound.

[PS3-4] LEECH: BITTORRENT AND MUSIC PIRACY SONIFICATION. *Curtis McKinney and Alain Renaud.*

This paper provides an overview of a multi-media composition, Leech, which aurally

and visually renders BitTorrent traffic. The nature and usage of BitTorrent networking is discussed, including the implications of wide-spread music piracy. The traditional usage of borrowed musical material as a compositional resource is discussed and expanded upon by including the actual procurement of the musical material as part of the performance of the piece. The technology and tools required to produce this work, and the roles that they serve, are presented. Eight distinct streams of data are targeted for visualization and sonification: Torrent progress, download/ upload rate, file name/size, number of peers, peer download progress, peer location, packet transfer detection, and the music being pirated. An overview of the methods used for sonifying and visualizing this data in an artistic manner is presented.

[PS3-5] SONIK SPRING. *Tomás Henriques.*

This paper presents a new digital musical instrument that focuses on the issue of feedback in interface design as a condition to achieve a highly responsive and highly expressive performance tool. The Sonik Spring emphasizes the relationship between kinesthetic feedback and sound production while linking visual and gestural motion to the auditory experience and musical outcome. The interface consists of a 15-inch spring that is held and controlled using both hands. The spring exhibits unique stiffness and flexibility characteristics that allow many degrees of variation of its shape and length. The design of the instrument is described and its unique features discussed. Three distinct performance modes are also detailed highlighting the instrument's expressive potential and wide range functionality.

[PS3-6] ISOMORPHIC TESSELLATIONS FOR MUSICAL KEYBOARDS. *Steven Maupin, David Gerhard, and Brett Park.*

Many traditional and new musical instruments make use of an isomorphic note layout across a uniform planar tessellation. Recently, a number of hexagonal isomorphic keyboards have become available commercially. Each such keyboard or interface uses a single specific layout for notes, with specific justifications as to why this or that layout is better. This paper is an exploration of all possible note layouts on isomorphic tessellations. We begin with an investigation and proof of isomorphism in the two regular planar tessellations (Square and hexagonal), we describe the history and current practice of isomorphic note layouts from traditional stringed instruments to commercial hex keyboards and virtual keyboards available on tablet computers, and we investigate the complete space of such layouts, evaluating the existing popular layouts and proposing a set of new layouts which are optimized for specific musical tasks.

[PS3-7] IMPROVING THE EFFICIENCY OF OPEN SOUND CONTROL WITH COMPRESSED ADDRESS STRINGS. *Jari Kleimola and Patrick J. McGlynn.*

This paper introduces a technique that improves the efficiency of the Open Sound Control (OSC) communication protocol. The improvement is achieved by decoupling the user interface and the transmission layers of the protocol, thereby reducing the size of the transmitted data while simultaneously simplifying the receiving end parsing algorithm. The proposed method is fully compatible with the current OSC v1.1 specification. Three widely used OSC toolkits are modified so that existing applications are able to benefit from the improvement with minimal reimplementations, and the practical applicability of the

method is demonstrated using a multitouch-controlled audiovisual application. It was found that the required adjustments for the existing OSC toolkits and applications are minor, and that the intuitiveness of the OSC user interface layer is retained while communicating in a more efficient manner.

[PS3-8] DYNAMIC INTERMEDIATE MODELS FOR AUDIOGRAPHIC SYNTHESIS.

Vincent Goudard, Hugues Genevois, Émilien Ghomi, and Boris Doval.

Mapping is one of the most important aspects of software instruments design. We call “mapping” the relation defined between the parameters from hardware interaction devices, and those of the process to be controlled. For software instruments, this relation between the user’s gestures and synthesis engine parameters has a decisive role in resulting ergonomics, playability and expressive possibilities of the system. The authors propose an approach based on a modular software design inspired by a multidisciplinary study of musical instruments and their playing. In this paper, the concept of “Dynamic Intermediate Models” (DIM) is introduced as the centre of the proposed architecture. In such a scheme, DIM modules are inserted between the gestural interfaces and the audio-graphic synthesis and rendering engines. The concept of DIM is presented and explored as an extension of usual mapping functions, leading to an improvement of the interaction between the musician and his/her instrument. Then, design and programming guidelines are presented, together with some concrete examples of DIMs that have been created and tested. Finally, the authors propose some directions to evaluate such DIMs in the architecture.

[PS3-9] FROM SNOW [TO SPACE TO MOVEMENT] TO SOUND. *Alexandros*

Kontogeorgakopoulos, Olivia Kotsifa, and Matthias Erichsen.

The current paper concerns a ‘work in progress’ research and design project regarding a forthcoming mixed media interactive performance, which integrates ‘space design’, sound, visuals and snowboarding. The aim is to create a playful and even provocative experience to the users-/performers and to the spectators of the final event by mixing and blending music, sound design, architecture, visual projections and freestyle snowboarding. It is a collaborative effort between a French freestyle snowpark development, a snowboarding events company named H05, and three researchers and practitioners in computer music, architectural design and electronic engineering. Computer motion tracking techniques, a variety of spatial and body sensors and sonic transformations of pre-composed material have been and are currently explored for the realization of the musical part of the piece. The fundamental and key concept is to map sound features and interactively composed sound objects to snowboarding full body gestures. Architectural design plays a critical role in the project, since the composed space shapes the snowboarding movements, which then form the corresponding musical and visual elements that will be introduced to our work in the future. The current paper describes our initial designs and working prototypes used during a test period in the H05 snowparks in the Alps.

[PS3-10] A BAYESIAN APPROACH TO DRUM TRACKING. *Andrew N. Robertson.*

This paper describes a real-time Bayesian formulation of the problem of drum tracking. We describe how drum events can be interpreted to update distributions for both tempo and

phase, and how these distributions can be combined together in a real-time drum tracking system. Our algorithm is intended for the purposes of synchronisation of pre-recorded audio or video with live drums. We evaluate the algorithm of a new set of drum files from real recordings and compare it to other state-of-the-art algorithms. Our proposed method performs very well, often improving on the results of other real-time beat trackers. The algorithm is implemented in C++ and runs in real-time.

[PS3-11] TOWARDS A GENERATIVE ELECTRONICA: HUMAN-INFORMED MACHINE TRANSCRIPTION AND ANALYSIS IN MAXMSP. *Arne Eigenfeldt and Philippe Pasquier.*

We present the initial research into a generative electronica system based upon analysis of a corpus, describing the combination of expert human analysis and machine analysis that provides parameter data for generative algorithms. Algorithms in MaxMSP and Jitter for the transcription of beat patterns and section labels are presented, and compared with human analysis. Initial beat generation using a genetic algorithm utilizing a neural net trained on the machine analysis data is discussed, and compared with the use of a probabilistic model.

[PS3-12] THE CLOSURE-BASED CUEING MODEL: COGNITIVELY INSPIRED LEARNING AND GENERATION OF MUSICAL SEQUENCES. *James Maxwell, Philippe Pasquier, and Arne Eigenfeldt.*

In this paper we outline the Closure-based Cueing Model (CbCM), an algorithm for learning hierarchical musical structure from symbolic inputs. Inspired by perceptual and cognitive notions of *grouping*, *cueing*, and *chunking*, the model represents the *schematic* and *invariant* properties of musical patterns, in addition to learning explicit musical representations. Because the learned structure encodes the formal relationships between hierarchically related musical segments, as well as the within-segment transitions, it can be used for the generation of new musical material following principles of *recombinance*. The model is applied to learning melodic sequences, and is shown to generalize perceptual contour and invariance. We outline a few methods for generation from the CbCM, and demonstrate a particular method for generating ranked lists of plausible continuations from a given musical context.

[PS3-13] EVALUATION OF SENSOR TECHNOLOGIES FOR THE RULERS, A KALIMBA-LIKE DIGITAL MUSICAL INSTRUMENT. *Carolina Brum Medeiros and Marcelo M. Wanderley.*

Selecting a sensor technology for a Digital Musical Instrument (DMI) is not obvious specially because it involves a performance context. For this reason, when designing a new DMI, one should be aware of the advantages and drawback of each sensor technology and methodology. In this article, we present a discussion about the Rulers, a DMI based on seven cantilever beams fixed at one end which can be bent, vibrated, or plucked. The instrument has already two sensing versions: one based on IR sensor, another on Hall sensor. We introduce strain gages as a third option for the Rulers, sensors that are widely used in industry for measuring loads and vibration. Our goal was to compare the three sensor technologies according to their measurement function, linearity, resolution, sensitivity and hysteresis and also according to real-time application indicators as: mechanical robustness, stage light sensitivity and

temperature sensitivity. Results indicate that while strain gages offer more robust and medium sensitivity solution, the requirements for their use can be an obstacle for novice designers.

[PS3-14] BEATLED – THE SOCIAL GAMING PARTYSHIRT. *Tom De Nies, Thomas Vervust, Michiel Demey, Rik Van de Walle, Jan Vanfleteren, and Marc Leman.*

This paper describes the development of a social game, BeatLED, using music, movement and luminescent textile. The game is based on a tool used in research on synchronization of movement and music, and social entrainment at the Institute of Psychoacoustics and Electronic Music (IPEM) at Ghent University. Players, divided into several teams, synchronize to music and receive a score in realtime, depending on how well they synchronize with the music and each other. While this paper concentrates on the game design and dynamics, an appropriate and original means of providing output to the end users was needed. To accommodate this output, a flexible, stretchable LED-display was developed at CMST (Ghent University), and embedded into textile. In this paper we analyze the characteristics a musical social game should have, as well as the overall merit of such a game. We discuss the various technologies involved, the game design and dynamics, a proof-of-concept implementation and the most prominent test results. We conclude that a real-world implementation of this game not only is feasible, but would also have several applications in multiple sectors, such as musicology research, team-building and health care.

MUSIC PROGRAM

WEDNESDAY, JULY 6TH, 2011

19.00 – Opening Concert

Concert Hall of the Conservatory “Cesare Pollini” of Padova

Performers

Daniele Ruggieri, flute

Daniele Spano, tuba

Mario Paladin, viola

Carlo Teodoro, cello

Aldo Orvieto, harpsichord

Amalia de Götzen, live electronics and motion capture

Alvise Vidolin, sound director

Program

Luigi Nono (1924-1990) *Post-prae ludium per Donau* (1987) for tuba and live electronics [13’]

Luca Francesconi (1956) *Animus II* (2007) for viola and live electronics [14’]

Aldo Clementi (1925-2011) *Passacaglia* (1988) for flute and fixed media [13’]

New fixed media rendering by SaMPL

Adriano Guarnieri (1947) *Abitata dal grido* (2010-11), for cello and live electronics [15’]

World Premiere of the new version with motion capture system

Nicola Sani (1961) *Un souffle le soulève, folie* (2011) for alto flute, harpsicord, fixed media and live electronics [8’] **World premiere**

Tonight’s concert is offered by the conference organizers to give a broad perspective of the Italian musical production involving electroacoustic means over a span of three generations. Overcoming a considerable amount of environmental limitations, contemporary music has blossomed in Italy to a world-renowned status since the end of the Second World War - and the attention to analog and later on digital electroacoustic tools has been a distinctive feature of Italian music production. Thus, this concert presents two works by unexcelled masters, which may now be considered “classics”, *Post-Prae Ludium per Donau* by Luigi Nono and *Passacaglia* by Aldo Clementi. *Passacaglia* (1997, commissioned by the Centro Tempo Reale, Florence) is premiered in this SMC2011 concert with a newly generated 8-track fixed media (diffusing the 48 recorded voices) prepared by Nicola Bernardini and by Alvise Vidolin (who

had already assisted Clementi during the preparation of the initial version in 1997) from new sound materials recorded by flutist Daniele Ruggieri. The works by Luca Francesconi, Adriano Guarnieri and Nicola Sani offer an overview on electroacoustic productions by some of the most important Italian composers of the “middle generation”. With *Abitata dal Grido*, world première of a new version of a work by the same name (2010, SaMPL/Ex Novo Musica Venice commission), Guarnieri introduces in this concert a new live-electronics score of increased complexity integrated with the Phasespace MoCap technology. *Un souffle le soulève, folie* by Nicola Sani (another work written expressly for SMC 2011 and premiered in this occasion) offers a sophisticated estrangement of instrumental writing (entrusted here to the flute and to the harpsichord, two instruments with a rich Italian baroque and classical tradition) compared with new technological horizons. *Animus II* (2007, IRCAM Paris commission) by Luca Francesconi investigates the contaminations of “light particles” with the worn and saturated sound matter of the soloist string instrument. While all compositions deal with in-depth inspections of sound - explored with a masterly instrumental writing combined with innovative electroacoustic thinking, the immediately apparent feature is that each piece sports a totally different musical universe and vision. Enjoy.

Post-prae ludium per Donau (Luigi Nono). “The compositional path is determined in all its details; however, its performance is to be considered as a sketchpad for the performer. The new performance techniques possibilities offered by the six-cylinder tubas present the interpreter with the continuous freedom to take over these notes and to create random sonic events. The electronic processing of sound is weaved into the composition in to varying degrees. The tuba must capture, process and reply to the sound expansion events. The specific notation, the new performance techniques and the live electronics substitute all together the effect of my own interpretation” (written by Luigi Nono for the premiere of *Post-prae-ludium per Donau* on October 17th, 1987 in Donaueschingen).

Animus II (Luca Francesconi) is the second chapter of a series of sound explorations by means of digital instruments. Each piece sees a different soloist at grips with the computer: in *Animus I* it was the trombone; here it is the viola. Both works were commissioned by IRCAM in Paris. So now we are once again in search of particles of light within a worn-out, saturated, post-digital material. With the aid of computers we explore first of all these sparks, then the musical and life-giving connections between rhythms and colours. But perhaps this ‘techne’ is no longer a friend and it breaks down the boundaries of our intimacy, invading us.

Passacaglia (Aldo Clementi) is based on an original grid of scales that attempts to create an illusionary sound effect, similar to that of Escher’s famous lithograph *Ascending and Descending*. Within this grid Clementi has arranged patterns that horizontally move upwards, and diagonally downwards. Twelve different fragments have been taken from three masterpieces of flute repertoire: four from the first movement of Bach’s *Sonata in B minor BWV 1030*, four from the first movement of Mozart’s *Concerto in D major K 314*, and the other four from Schubert’s *Introduction and Variations op. 160* (on the theme of the Lied “Trockne Blumen”, from *Die Schöne Müllerin*).

Abitata dal grido (Adriano Guarnieri) The title is derived from the “verses of genius of Massimo Cacciari”. The idea of the scream (*grido*), which proliferated from a new research on cello sounds processed by the “theatrical sound” of live electronics, describes the interior world of the contemporary man, inhabited by cynicism, indifference and deformation. Guarnieri pours the interior world of sentiments into art at the concrete risk of distort and to exasperate it. These distortions, which are left to the very gestures of the cello player captured by the *Phasespace* motion capture cameras at the SaMPL labs in Padova, give back a materic singing devoid of “artifacts” but rather fully “human” in constant dialectics between light and shadow, density and rarefaction, silence and sound.

Un souffle le soulève, folie (Nicola Sani). In this new composition, the harpsichord joins the flute, live electronics and fixed media. Thus, two instruments coming from the great baroque and classical tradition are faced with new technological horizons, where the human and poetic dimension is merged with experimentation. Their voices are blended with convolution algorithms that re-synthesize their timbral components. The complex, distorted and metallic spectrum of the harpsichord is combined with the rough and aerial dimension of sound tubes. The title of the composition is freely adapted from a poem of Giacinto Scelsi combined with a word, “folie” (madness), which unveils the arcane ancient origin of the harmonic scheme of the work.

THURSDAY, JULY 7TH, 2011

19.00 – Interaction and Live Processing

Concert Hall of the Conservatory “Cesare Pollini” of Padova

Curator: *Claudio Ambrosini*

Performers

Daniele Ruggieri, flute

Davide Teodoro, clarinet and bass clarinet

Carlo Lazari, violin

Victoria Johnson, electric violin

Carlo Teodoro, cello

Aldo Orvieto, piano

Ellen Røed, video

Amalia de Götzen, *Marco Marinoni*, *Daniel Mayer*, *Luca Richelli*, *Luigi Sammarchi*, *Stefano Trevisi*, *Alvise Vidolin*, live electronics and sound direction

Program

Marco Marinoni (1974) *Dalla Sua Orbita* (2007-11) for iperviolin [7' 12"]

Daniel Mayer (1967) *Lokale Orbits / Solo 6* (2010) for piano and fixed media [11'40"]

Luca Richelli (1963) *No Direction* (2011) for clarinet and live electronics [7' 30"]

World premiere

Knut Vaage (1961) *Electra 3* (2003) for electric violin and computer generated tape [13'40"]

Stefano Trevisi (1974) *Tagli mobili d'ombra* (2006-07) for cello and live electronics [11'40"]

Luigi Sammarchi (1962) *Imago Aedica* (2011) for flute, violin, piano and live electronics [6']

World premiere

Claudio Ambrosini (1948) *Ogni emozione dell'aria* (2011) for bass clarinet and live electronics [10'] **World premiere**

This evening's concert gathers together musical works that place one or more traditional instruments next to live-generated or controlled electronic sounds. These compositions offer a broad overview on the different possibilities of processing and integration between different worlds, which constantly discover new forms of dialogue. They are even able to perform "counterpoints", referring literally to the etymological sense of the word: for each note (punctum) in a voice - or in an instrument that can be traditional or digital - other ones will be created (contra punctum)... Why can't we read that "contra" as a welcome stimulus rather than in terms of opposition: the notes of one instrument with and between the ones of another? In this way very old instruments such as piano, clarinet and violin will be bump into sound production and processing methods as granular synthesis, instrument augmentation (e.g. the hyper violin), motion capture, etc. producing thus very surprising *mélanges*. A particular praise should be expressed to the composers of the program because they have carried out a very deep research into virtuosity (which is demanding for the performers as well), without ever forgetting the architectural requirements of the pieces and the needed equilibrium between all the digital components: from those that have to be written with numbers to those that have to become alive with... fingers.

Dalla Sua Orbita (Marco Marinoni) was written in 2007. The purpose was to integrate in the compositional structure external parameters of control setting a continuous feedback between the actions on the instrument and the electronic treatment of generated sound materials. The musician, working together with the live-electronics performer, isn't anymore responsible only for the performance of the instrumental part but with his movements and through his interpretational choices is directly involved in the building of the timbre modifications and spatialization paths of sound materials. This new version was accomplished in March 2011 expressly for the "8th Sound and Music Computing Conference".

Lokale Orbits (Daniel Mayer) started as a sequence of pieces for solo instrument and tape, whereby sounds, played by the musicians concerned, were recorded for further processing. Buffer granulation allows a huge bandwidth of results and a gradual transition from real sounds into electronic space, which makes it especially interesting for mixed instrumentations. *Solo 6* is framed by the slow pulsation of a piano sound alienated by granulation, spatialisation and reverb with accompanying artefacts. Two minimal motifs in the piano part are derived from

this and a more rapid pulsation; as a compound structure they are finally operating against a cluster granulation shifted by a quartertone.

No Direction (Luca Richelli). A web-cam device grabs the movements of the instrument and successively the software transforms them into control-parameters, so the clarinetist controls the amount of the electronic transformations. There are 11 control-parameters in the electroacoustic transformations algorithm, the clarinetist controls only two at a time. The aim of the composition is to realize a hyper instrument: the boundary between the natural sound of the clarinet and the sound of the electronics transformation must be blurred as much as possible.

Electra 3 (Knut Vaage) was commissioned by Victoria Johnson and premiered by her at the Autunnale festival (2003). The computer programming is by Thorolf Thuestad. All the sounds in the piece are coming directly from the violinist's action on stage, even the very low sub-frequencies. The programming of Max/MSP, in combination with the pure musical ideas, and the frequent use of a "low teck" fuzz box make this possible. The work is a dramatic dialogue between the computer and the violin, with the former stealing energy in real time from the violinist, who has to fight back in order to maintain the focus of the musical dramaturgy.

Tagli mobili d'ombra (Stefano Trevisi) is seen both as a compositional and a performative space to be electro-acoustically explored. This approach has been implemented through a selective near-field miking of a prepared cello, consistent with the idea that a very close listening point decontextualizes the sound material from its causal source. The research is based on the concept of fragment, which has been considered both as a morphological element (sound gestures) and as a structural framework: the form unfolds as a set of disjointed snapshots, resulting from a splitting process of a linear and directional development.

Imago Aedica (Luigi Sammarchi)

Aedico Canto, art of memory...reminiscence...aporia of meaning.

Perceive traces of an archaic "way back"...

vision of the "paradoxical":

listening to images - see music.

Remember...act of Soul who lose the time, date, time in the "timeless moment".

Melodic flows, as shards of light,

projected from the dimension of the space frequency in a spherical, volumetric space,

new harmonic dimension synthesis of the "Symbolic".

Toute émotion de l'air (Claudio Ambrosini) is the statement that J.J. Rousseau chose in order to define noise in his *Dictionnaire de Musique* (1782). But actually everything in music is emotion and air motion and now perhaps even *e-motion* (as in *e-mail*). This is even clearer when the instrument is the bass clarinet, a true goldmine of wonders which get progressively revealed as in a sonic matrioskas game: very deep sounds produce unimaginable high sounds, arousing electronic sounds that move the air around the performer and hopefully *move* the

audience. This piece has been written in 2011 for Davide Teodoro and Alvis Vidolin and dedicated to Padova where the author found many sounds, thoughts and friends.

FRIDAY, JULY 8TH, 2011

19.00 – Digital vs Analog

Concert Hall of the Conservatory “Cesare Pollini” of Padova

Curator: *Ron Kuivila*

Program and Performers

Curtis and Chad McKinney (1983) *Leech: The Sound of Piracy* (2010-11), installation [10'] (during the entrance of the public)

Chikashi Miyama (1979) *Black Vox* (2010) for self designed instrument Peacock [10'] (author's performance)

Juan Parra Cancino (1979) *KVSwalk_II* (2010) solo live electronics [10'] (author's performance)

Seiichiro Matsumura, (1970) *Past to the Light* (2011) [10'] (author's performance)

World premiere

Fernando Lopez-Lezcano (1956) *A Very Fractal Cat, Somewhat T[r]illed* (2008-11) for piano controller and computer [10'] (author's performance)

Dario Sanfilippo (1983) *LIES – Live Interaction with Emergent Sound* (2009-11) [10'] (author's performance)

Ron Kuivila (1955) *States variable* (2011) [10'] (author's performance) **World premiere**

In *The Glazed Soundscape*, R. Murray Schafer critiques the disconnection of visual and aural experience as arising from the use of glass windows as a prototypical example of the “schizophonia” that defines one's relation to sound in a media saturated world. Each piece on tonight's program touches on this disconnection in its own way. Two deploy video imagery that directly but inscrutably shapes the sounding music, explicitly enacting the separation of sound and sight. However, in both the causal disconnection serves to force us to confront the leeching away of empathy that seems to be an inescapable side effect of “connecting” through media. The physical immediacy of performance is central to the other pieces on this concert. But the connection between physical action and resultant sound is itself composed for each of these pieces. One uses infrared detectors to transduce hand gestures, recalling chironomy as musical notation. Another uses a conventional keyboard controller but kaleidoscopes the

piano as an objet sonore. The remaining three focus on modeling physical phenomena that shape both individual sounds and their continuity as they unfold over time. The “carrier” and the “content” are fused and performers play a role akin to park ranger – or lion tamer – to either lead us on a walk through the parametric spaces they have composed or influence its behavior. So, we can say that these pieces fill Schafer’s glazing with liquid crystals that allow new patterns – and alternative connections and ways of connecting – to form.

Leech: The Sound of Piracy (Curtis McKinney and Chad McKinney) is a musical composition based on the real-time sonification and visualization of a BitTorrent download. During the course of the piece an album’s worth of MP3’s are downloaded using a BitTorrent client. Furthermore, a packet sniffing system captures packets transmitted to and from each of the peers that the BitTorrent client is downloading from. This data is sonified and visualized in artistically meaningful ways. The audio data for each individual MP3 being pirated is itself used as a sound source for processing in the piece. A list of the individual MP3’s being downloaded and the download progress for each one is displayed on the screen. The piece is finished when the download is complete.

Black Vox (Chikashi Miyama) is a quasi-improvisational performance for Peacock (a self-designed box-shaped sensor-based interface). This interface detects the movements of a performer’s hands employing thirty-five infrared sensors whose output is mapped to more than three hundred parameters of a synthesizer. The synthesizer generates electronic sound employing the phase-bash synthesis technique based on six seconds of pre-recorded spoken voice. The performer controls a maximum of five voices simultaneously and creates polyphonic textures. A number of chaos attractors, developed as external objects in Pd-extended by the composer, are utilized for randomizing parameters of the synthesizer.

KVSwalk_II (Juan Parra Cancino) aims to research the possibilities and limitations of physicality and embodied musicality in computer music performance. The musical structure is centered around the metaphoric imaginary, as well as sonic derivatives of the Karman Vortex Street phenomena. This particular version features a mixed setup consisting of an analog/digital sound-generation engine and a custom controller that demands from its performer to use physical gestures derived from a variety of ‘traditional’ instrumental actions. The dedicated controller is a collaboration project of the composer with Lex van der Broek, head of the Technical department of the Royal Conservatory of The Hague, Netherlands.

Past to the Light (Seiichiro Matsumura) describes the disaster of earthquakes and subsequent TSUNAMI, which hit East Japan on 11th March 2011. The original patch of Max/MSP reads in JPEG files of this TSUNAMI and its damage. Photos are horizontally scanned line-by-line, directly converted values of RGB pixels into sound. Through the process of scanning tragic scenes again and again, textures of sound represent roughness of nature. This time, we are convinced and learn that we have no power against the nature. However, we certainly feel the power to face up to this trial and keep on seeing the light of hope.

A Very Fractal Cat, Somewhat T[r]illed (Fernando Lopez-Lezcano). The performer connects through a keyboard controller, four pedals and two modulation wheels to four virtual sampled pianos both directly and through algorithms. Through the piece different note and phrase generation algorithms are triggered by the performer's actions, including markov chains that the virtual cat uses to learn from the performer, fractal melodies, plain scales and trills and other even simpler algorithms. The sound of the pianos is heard directly, and is also processed using spectral, granular and other synthesis techniques at different points in the performance, creating spaces through which the performer moves.

LIES - Live Interaction with Emergent Sound (Dario Sanfilippo) is a project of improvised Human-Computer Interaction performance. The sound system was implemented by means of audio feedback networks of non-stochastic DSP processes. Every effect (output) from each element in the network is, directly or indirectly, also cause (input) for all other elements. This distributed circular causality makes the processes iterated and the system strictly non-linear. The result is a complex autonomous dynamical system with chaotic behaviours and emergent properties. The performer, changing the parameters of the DSP processes and the amount of signal flowing within the feedback loops, drives the system towards different behaviours and, in turn, is affected by the output sound. The two entities are interdependent and recursively coupled and make a global meta-system.

States variable (Ron Kuivila, 2011) is based on a set of identical sound processing chains for 36 distinct tunings or "states". The performer's task in realizing the piece is to move continuously through the musical terrain these states define. This process of navigation is controlled with a graphics tablet and a keyboard. Key presses assign different attributes of the tablet to different aspects of the configuration, allowing the performer to select a state as the sonic 'target' and define the path taken in approaching that state. These states appear either as timbral tendencies throughout the work rather than fixed "presets".

SATURDAY, JULY 9TH, 2011

18.00 – Laptop Orchestra Music

Concert Hall of Conservatory "Benedetto Marcello" of Venezia.

Curator: *Marek Chotoniowski*

Performers

Carlo Lazari, violin

Arazzi Laptop Ensemble (Stefano Alessandretti, Nicola Buso, Ongakuaw, Luca Richelli, Julian Scordato, Giovanni Sparano, Davide Tiso, Alvise Vidolin, Paolo Zavagna)

Program

Julian Scordato (1985) *Studio per un'orbita* (2010) for violin and laptop ensemble [12']

Paula Matthusen (1978) *Lathyrus* (2007) for laptop ensemble [11']

John Gibson (1960) *Wind Farm* (2009) for laptop ensemble [12']

Marek Chołoniowski (1953) *All real ...* (2011) [10'] (author's performance)

World premiere

Laptop ensemble: quite nice but also controversial concept. The main purpose of using many portable machines linked on stage is the multiplication the power of a single machine. But the question is whether we need to extend the potential of single computer. And the first answer is: no, because a single computer can perform the Symphony of "ThouSounds", or even much more than that. It's sonic potential is unlimited, because it can mix, control, project and perform many audiovisual actions simultaneously. So why the concept of laptop ensemble, or even laptop orchestra (!) is so interesting. The interaction between laptop performers is a significant element of live network performance, so the new concept are a new 'tool' for the composer Laptop as a modern equivalent of traditional instrument is an physical object, with it's versatile and mobile form, with tangible controllers, with small speakers filtering sound with the loudness and frequency range, which can be a very useful and nice limitations, when we use laptops stand alone, like traditional instrument without amplification ...

Studio per un'orbita (Julian Scordato) is a homage to the composer Bruno Maderna and consists in the dislocation of a "sound matter" in the listening space describing an orbit around a center represented by the figure of the violinist, who generates the initial state of this "matter" and determines its shape. The indetermination of the resulting "material", obtained by the action of the laptop performers, involves the dynamical-timbrical parameter, while the relation with the amplitude spectrum of the acoustic instrument ensures a close correspondence between violinist gesture and electronic sound.

Lathyrus (Paula Matthusen) is a structured, improvisatory, game-like piece modelled much like the choose-your-adventure books. The ensemble travels down various 'musical paths' in search of a suitable ending. Multiple endings are possible. Some may be expected others sudden, and still others may be at times undesirable if not dangerous. The performers self-organize, interrupting the navigation of the score, until agreeing upon a path. Each musical choice is negotiated, a balance between coherence and surprise. *Lathyrus* was commissioned by the Berlin Laptop Orchestra and is dedicated to them.

Wind Farm (John Gibson) is a piece that touches metaphorically on the promise and problems of wind energy. Wind turbines could be an important source of renewable energy, but the turbines kill birds, disrupt habitats, confuse airplane and weather radar, and spoil natural views. How should we live with them? The laptops produce two different types of sound: spinning, pitched clicks and synthetic wind noises. A conductor laptop guides the individual

players over a wireless network, sending them pitches to play, performance instructions, and sound characteristics. Wind Farm was written for the Electric Monster Laptop Ensemble at Montana State University, under the direction of Hsiao-Lan Wang.

All real ... (Marek Chołoniewsky, 2011) describes the superposition between different forms of realities around confirming video and audio illusions as a immanent part of the performance reality where physical objects and their illusionary equivalents are blended together in a linear and continuous way.

Co-produced by



Conservatorio "B. Marcello"
di Venezia

BIOGRAPHIES

Curators

Claudio Ambrosini (1948) studied at the Venice Conservatory and graduated in Linguistics and in History of Music. Important encounters: Bruno Maderna and Luigi Nono. He has composed vocal, instrumental, electronic works, oratorios, operas and ballets conducted by R. Muti, D. Masson, S. A. Reck, Ed Spanjaard and performed at La Scala, La Fenice, IRCAM, Gulbenkian and Gaudeamus Foundations, Mozarteum, Akademie der Künste etc. In 1979 he founded the Ex Novo Ensemble. In 1985 he was the first Italian composer to receive the Prix de Rome from France. Recent awards: Ass. Beaumarchais, Music Theatre Now, Golden Lion (Venice Biennale), Rotary, Abbiati.

Marek Chołowiec (1953) is a composer, sound artist and performer. Head of the Electroacoustic Music Studios at the Academy of Music in Krakow; founder and President of the Muzyka Centrum Art Society and the Polish Society for Electroacoustic Music. Since 2008 He is Secretary of the International Confederation of Electroacoustic Music, director of Audio Art Festival in Krakow and founder of many groups and ensembles. He received Honorable Award of the Polish Composers Union, Award of the Ministry of Culture and National Heritage, as well as the Independent Project grant of the CEC ArtsLink in New York.

Ron Kuivila (1955) is University Professor of Music at Wesleyan University. He has been a guest professor at Brown University and the Technische Universität of Berlin. He has been an artist in residence under the sponsorship of the DAAD, the Rockefeller Foundation, the Getty Research Institute, the Institute for Studies in the Arts at Arizona State University, California Institute of the Arts, Mills College, the Banff Centre for the Arts, Tempo Reale, and Stichting STEIM. Kuivila has performed and exhibited installations in the U.S., Canada, Europe, and China.

Composers

Aldo Clementi (1925-2011) began his piano studies at the age of thirteen, and received his diploma in 1946 with Giovanna Ferro, a student of Alfredo Casella. In 1947, he attended Pietro Scarpini's piano master class in Siena. At the age of sixteen he started studying composition in Catania, where he later became a pupil of Alfredo Sangiorgi (a Schoenberg's student) who introduced him to the technique of twelve-tone composition. From 1952 to 1954 he studied and graduated in Roma with Goffredo Petrassi. He attended the courses at Darmstadt from 1955 to 1962. In 1956 he met Bruno Maderna marking a decisive turning point in his musical thought. He attended the Studio of Phonology in Milano from 1956 to 1962. From 1971 to 1992 he taught music theory at the University of Bologna (DAMS).

Luca Francesconi (1956) studied piano at the Conservatory of Milano and composition with Azio Corghi, Karlheinz Stockhausen, Luciano Berio and jazz in Boston. He worked as assistant of Berio (1981-1984). In 1990 he founded Agon Acustica Informatica Musica based in Milano, which he led until 2006. He has so far written over 70 works for very different forces (ranging from soloist, large orchestra and opera to multimedia). He has been teaching for 25 years both in Italian Conservatory and in master classes all over the world. At present he is professor and head of the Department of Composition at the Musikhögskolan of Malmö in Sweden. He is the Artistic Director of Biennale of Venezia.

John Gibson (1960) is Assistant Professor of Composition at the Indiana University Jacobs School of Music. His instrumental and electroacoustic music has been performed worldwide and is available on the Centaur, Everglade, and SEAMUS labels. He writes sound processing and synthesis software and has taught composition and computer music at the University of Virginia, Duke University, and the University of Louisville. He holds a Ph.D. in music from Princeton University, where he studied with Milton Babbitt, Paul Lansky, and Steven Mackey. For more information, please visit <http://john-gibson.com>.

Adriano Guarneri (1947) completed his musical education at Bologna Conservatory, obtaining a diploma in composition with Giacomo Manzoni and in choral music with Tito Gotti. He also started to conduct, founding the Nuovo Ensemble Bruno Maderna in Firenze; subsequently he has devoted himself entirely to composition. He takes composition at Milan, Firenze and Pesaro Conservatories. In *Nafshi*, *Recit* and other compositions greater attention is directed to form as the synthesis of an episodic multiplicity in a state of becoming. The Guarneri's mature works have an internal tension deriving from the consistency of the sound invention centrality; their formal construction can also be traced back to this, following courses which are not charted in advance but are closely connected with the nature of the sound-situations, with the logic of passing from one to the other.

Fernando Lopez-Lezcano (1956) is a composer, performer, lecturer and computer systems administrator at CCRMA, Stanford University. He has been teaching, making music and taking care of computing resources since 1993, and created and maintains since 2001 the Planet CCRMA collection of open source sound and music packages for Linux. He has been involved in the field of electronic music since 1976 as a composer, instrument builder and performer, blurring the lines of his dual background in music (piano and composition) and electronic engineering.

Marco Marinoni (1974) studied Composition with Mario Garuti and Corrado Pasquotti and Electronic Music with Alvis Vidolin. He was finalist for the International Gaudeamus Composers Competition (2002-03), Prix du Trivium at the 29° Concours International de Musique et d'Art Sonore Electroacoustiques (Bourges 2002), selected for the project *What's Next* by Nuova Consonanza (Roma 2003), winner at the second call for electroacoustic music by Federazione CEMAT and included the CD *Punti di Ascolto* 2005, 1° Prize at the I Concorso Internazionale di Composizione per Iperviolino (Genova 2007), 1° Prize at the VIII Concorso Internazionale di Composizione Città di Udine (2010). ArsPublica, Taukay,

Auditorium and Mnemosyne publish his music. He is member of SIMC (Società Italiana Musica Contemporanea).

Seiichiro Matsumura (1970) is a composer, sound and interactive designer. He is Associate Professor of School of Design at Tokyo University of Technology. He also bridges media art and experimental music field. He finished his PhD at Tokyo University (2006) with the research of Sound Installation focusing on Rhythm generated by concrete sounds. He studied at Institute of Sonology course of Royal Conservatory The Hague (2003-2005) supported by grants of Agency for Cultural Affairs Japan and Pola Art Foundation.

Paula Matthusen (1978) is a composer who writes both electro-acoustic and acoustic music and realizes sound installations. For three years, she served as Assistant Professor and Director of Music Technology at Florida International University where she founded the FLEA (FIU Laptop & Electronic Arts) Ensemble. Most recently, she was appointed Assistant Professor at the Wesleyan University Music Department. She has written for diverse instrumentations, such as 'run-on sentence of the pavement' for piano, Ping-Pong balls, and electronics, which Alex Ross of The New Yorker noted as being 'entrancing'. Her work often considers discrepancies in musical space real, imagined, and remembered.

Daniel Mayer (1967) studied pure mathematics and philosophy at University Graz (MSc, MPhil) and music composition (MA) with Gerd Kühr at University for Music and Performing Arts Graz (Austria). In 2001/02 he had postgraduate study at the electronic studio of the Music Academy of Basel (CH) with Hanspeter Kyburz. Guest composer at the Centre for Art and Media Karlsruhe (2003/04) and at IEM Graz (2005). Working with generative computer algorithms in electronic and instrumental music (www.daniel-mayer.at).

Chad McKinney (1983) is an experimental musician living in the S. Francisco bay area. He has recently completed his MFA in Electronic Music & Recording Media at Mills College where he studied with Chris Brown, John Bischoff, and Roscoe Mitchell. He received his Bachelor of Music degree in 2007 from the University of Oklahoma, studying with Christian Asplund, John Haek, and Michael Lee. McKinney has recently been focused on writing for and performing with the transcontinental network laptop quartet Lag.

Curtis McKinney (1983) recently graduated from Mills College in Oakland, CA with an MFA in Electronic Music and Recording Media. There he studied with John Bischoff, Chris Brown, and Roscoe Mitchell. Currently he is pursuing a PhD in Network Computer Music and Audio Interactions at Bournemouth University in England, where he is studying with Alain Renaud.

Chikashi Miyama (1979) is a composer, video artist, interface designer. He received a Nachdiplom from the Musik-Akademie der Stadt Basel, Switzerland and a Ph.D. from the University at Buffalo, USA. His works and papers have been accepted by ICMC twelve times, by NIME four times, and selected by numerous international festivals in seventeen countries. His compositions have received a second prize in SEAMUS competition, a special prize in

Destellos competition, and an honourable mention in Bourges competition. He also received SUNY chancellor's award and Pillars of leadership award recently. He is currently working a visiting researcher of ZKM, Karlsruhe, Germany.

Luigi Nono (1924-1990) began his musical studies in 1941 at the Conservatory of Venezia. He then studied law at the University of Padova, receiving a PhD there, while at the same time he was studying with the prominent avant-garde composer Bruno Maderna and the noted conductor Hermann Scherchen. He came to public attention in 1950 with his work *Variazioni Canoniche*, orchestral variations on a 12-tone theme of Arnold Schoenberg. An avowed communist, Nono also produced works of political substance, many of which sparked controversy and reaction. He employed aleatory techniques and serialism, sometimes fragmenting language and using electronically manipulated sounds. His best-known work is the opera *Intolleranza* (1961).

Juan Parra Cancino (1979) studied Composition at the Catholic University of Chile and Sonology at The Royal Conservatory of The Hague (NL). As a guitarist he was part of several ensembles related to Guitar Craft, a school founded by Robert Fripp. He collaborates with Frances Marie Uitti, Richard Craig, KLANG and Insomnio Ensembles. He is founder and active member of The Electronic Hammer, a Computer and Percussion Music Ensemble and Wiregriot, a voice and electronics duo. He is currently a PhD candidate of the Leiden University (NL) and the Orpheus Institute (BE). Since October 2008, he is associate researcher for the Orpheus Research Center in Music (ORCiM).

Luca Richelli (1963) took the Piano, Composition, Electronics Music, Composition and New Technologies and Live Electronics degree at the Trento, Verona and Venezia Conservatories. He attended to many workshops and master classes about the new technologies in music. He is teaching Music Information and Music Theory at Accademia Musicale "S. Martinelli" (Verona, Italy).

Luigi Sammarchi (1962) started his musical studies at the Conservatory of Bologna, where he obtained the degrees in piano performance and in composition under the guidance of Lidia Proietti and Adriano Guarnieri. In 2008 he obtained the master degree in Composition and New Technologies at the Conservatory of Venezia, under the guidance of Alvisé Vidolin. He has attended several advanced classes in composition.

Dario Sanfilippo (1983) got his degree in Music and New Technologies from the Conservatory of Trapani (2011). His interest on non-linearity and unpredictability led him to the use of improvisation for the realization of his works and performances. He develops real-time processing non-stochastic systems with emergent properties based on feedback networks, exhibiting nonlinear dynamics, self-dis/organization and chaotic behaviours. His performances are the result of the interaction between the aesthetics of the human and the aesthetics of the machine, where these two entities are interdependent and recursively influenced by each other.

Nicola Sani (1961) studied composition with Domenico Guaccero and Karlheinz Stockhausen, author of a large number of instrumental and electroacoustic compositions, stage operas, dance operas, video art and multimedia installations. He was curator of the music section of the Festival Arte Elettronica (Camerino) and of the electronic art section of RomaEuropa Festival, artistic director of the Contemporary Chamber Music series Emergenze (Roma) and of the Sonora Project. Since 2006 to 2009 he has been member of the board and then artistic director of the Teatro dell'Opera of Roma. He is currently artistic advisor of the Teatro Comunale of Bologna and of the IUC-Istituzione Universitaria dei Concerti (Roma). Since 2004 he is President of the "Isabella Scelsi" Foundation (Roma).

Julian Scordato (1985) studied Composition and New Technologies with Corrado Pasquotti and Alvis Vidolin at the Conservatory of Music in Venezia. His chamber and electroacoustic music works have been performed during important festivals and they have been selected in international competitions. As a composer and performer he participated in events like the recent Arts National Prize 2011. He composes music for video, theatre and installations. Ars Publica and Taukay Edizioni Musicali publish his compositions.

Stefano Trevisi (1974) studied Composition with Mario Garuti and Electronic Music with Francesco Giomi. His music has been presented at festivals such as RaiNuovaMusica (Torino), Synthèse (Bourges), Venice Biennale, Traiettorie (Parma), International summer courses of Darmstadt, and selected in several competitions, like Gaudeamus Music Prize (Amsterdam), Concours International de Musique Electroacoustique (Bourges), Franco Evangelisti (Roma). He was composer-in-residence at Tempo Reale (Firenze, 2006-07). RaiTrade publishes his compositions. With the visual artist Paolo Cavinato he formed the project SpazioVisivo, creating installations exposed in several countries and produced by Galerie Mazzoli (Berlin). He took a degree in Environmental Science and he is working as a teacher of mathematics.

Knut Vaage (1961) graduated as pianist and composer from Griegakademiet in Bergen. From the Norwegian Academy of Music he has received a professional certificate as a lecturer in composition. He has worked in different styles of music, though concentrating on improvised and contemporary music. Many of Vaage's projects have investigated the boundaries between improvisation and composed music. His music has been regularly performed on concerts and at festivals in Norway and abroad.

Performers

Amalia de Götzen is the SaMPL coordinator (Sound and Music Processing Laboratory) at the Conservatorio C. Pollini of Padova from 2010. She studied piano with Daniele Dazzan (diploma 1996) and electronic music with Nicola Bernardini (2003). She got a master degree in Electronic Engineering at the University of Padova in 2002 with Giovanni De Poli and a PhD in Computer Science in 2007 with Davide Rocchesso at the University of Verona. Her research has been devoted to computer music, with particular attention to Human Computer Interaction through sounds and to performing arts, writing many scientific papers on these

topics. She works as live-electronics performer, collaborating with the Ex Novo ensemble and Alvise Vidolin.

Victoria Johnson works with electric violin, live electronics, improvisation and musical technological issues in her artistic work. Trained as a classical violinist in Oslo, Vienna and London, she made her debut recital in Oslo 1995. She has established herself internationally as a soloist, chamber musician and improviser in the field of contemporary, improvised and experimental, cross-disciplinary music and art. She crosses borders and challenges traditions, collaborating with leading forces in her field. Spring 2011 she finishes her artistic PhD project on electric violin, live electronics at the Norwegian Academy of Music, supported by Norwegian Research Fellowship for the arts. She teaches electric violin at the Norwegian Academy of Music.

Carlo Lazari began studying the violin with Emilio Cristinelli; after a scientific bachelor he took his violin diploma (1984) at the Venice Conservatory with Renato Zanettovich and postgraduate courses with Salvatore Accardo at the Stauffer Academy of Cremona, Stefan Gheorghiu at Fiesole music school, Franco Gulli at the Accademia Musicale Chigiana of Siena and Nathan Milstein at Muraltegut in Zürich. Since 1981 he is member of the Ex Novo Ensemble for contemporary music (Venezia). On the philological side he is involved in a project by L'Arte dell'arco, ensemble of ancient music. He is member of the string orchestra "I Solisti Filarmonici Italiani" and violin teacher at Adria Conservatory.

Aldo Orvieto studied at the Conservatory of Venezia. He owes much of his musical development to Aldo Ciccolini. He has recorded more than forty CDs dedicated to composers of the classical era of the Twentieth Century, always to the unanimous praise of the critics. He has played as soloist with many orchestras and worked intensively in concerts and recording with the violinists Luigi Alberto Bianchi, Felix Ayo, Dora Bratchkova and Rodolfo Bonucci, with the cellist Arturo Bonucci, with the pianists John Tilbury and Marco Rapetti and with the singers Monica Bacelli, Gemma Bertagnoli, Luisa Castellani, Sara Mingardo, Christa Meyer and Sonia Visentin. In 1979 he was one of the founders of the Ex Novo Ensemble.

Mario Paladin has performed as soloist and in collaboration with renowned musicians in many of the major concert halls of the world. He is a permanent member of the group Ex Novo Ensemble, specialized in contemporary music. He has been first viola with various opera, symphonic and chamber orchestras. He is founding member of the group L'Arte dell'Arco with whom he has undertaken an in-depth study of the philological performance of baroque music on original instrument. He is Professor of viola at the Conservatory of Music in Piacenza.

Ellen Røed is educated at the Academy of Visual Arts, NTNU in Trondheim, Norway (2001). Before that she was part of the Norwegian art collectives Motherboard and Verdensteatret, who make projects that mix elements from both theatre and visual arts with electronic art. She soon developed devotion towards unstable and temporary forms, projections, and performativity. Having completed her formal education, she immediately started working at

Bergen Center for Electronic Art, and from 2004 she was working at the National Academy of the Arts in Bergen, first as Assistant Professor in Electronic Art and Digital Media, and currently as a Research fellow in Fine art.

Daniele Ruggieri completed his studies in Venezia where he graduated with the highest marks and subsequently in Genova where he was awarded the first “Prix de Flute” in the class of Maxence Larrieu. He has been intensely active on the concert circuit for several years taking part in major European festivals. Moreover he recently premiered Salvatore Sciarrino’s Adagio accompanied by the La Fenice Orchestra and made his Japanese debut at the Denki Bunka Kaikan in Nagoya accompanied by the Central Symphony Orchestra. He actively collaborates with the Ex Novo Ensemble of Venezia of which he is a founding member.

Daniele Spano studied with Ercole Laffranchini, principal tuba of Teatro Verdi in Trieste and he specializes with Mario Barsotti, principal tuba of Maggio Fiorentino, with international soloists as Alessandro Fossi and James Gourlay, with Rex Martin, tuba professor of music at Northwestern University in the USA and Gene Pokorny tuba of the Chicago Symphony Orchestra. He works with various orchestras and chamber ensembles: Udine Philharmonic Orchestra, the Orchestra Filarmonica of Teatro Lirico G. Verdi in Trieste, the San Marco orchestra of Pordenone and the Symphony Orchestra of Savona, the Virtuosi Italiani and Ex Novo ensemble. As a soloist he performed on several occasions including the season 2010 whit Ex Novo Ensemble in Teatro La Fenice in Venezia.

Carlo Teodoro studied cello with Adriano Vendramelli at Conservatory of Music in Venezia, graduating “cum laude”. He perfected with Michael Flaksman at Hochschule in Stuttgart getting the Higher Degree in cello and later at Hochschule in Mannheim getting the Konzertexamen. He also graduated at the Chamber Music International School of the Trio di Trieste (Duino) getting the Higher Degree. He is one of the founders of Ex Novo Ensemble (Venezia) performing widely on the main festivals and concerts seasons throughout the world. At present he teaches chamber music and cello at Specialized two-years-course (cello interpretation) at Conservatory of Music in Udine.

Davide Teodoro graduated at the Conservatory of Music in Venezia (Giovanni Bacchi class); further training for chamber music with Trio di Trieste; prize-winner in numerous chamber music competitions such as those of Trapani, Caltanissetta and Stresa. At present he is professor of clarinet at the Conservatory of Music in Udine. He is one of the founders of Ex Novo Ensemble, the chamber group he has worked with since 1979, performing in the main European Festivals.

Alvise Vidolin is sound director, computer music researcher, live electronics interpreter and carried out scientific and musical studies. He gave his services to several important Italian and foreign institution and he worked for several composers. He is co-founder and staff member of Centro di Sonologia Computazionale (CSC - University of Padova) where he is conducting a research in the field of computer assisted composition and performance. Co-founder of the Italian Computer Music Association (AIMI), since 1977 he is working for La

Biennale di Venezia. He is member of the scientific committee of Luigi Nono Archive and he was chair of the Electronic Music School at Conservatory of Music in Venezia (1976-2009).

Musical Ensembles

Ex Novo Ensemble was founded in Venice in 1979 by the composer Claudio Ambrosini and seven young musicians, who have remained with the Ensemble ever since. The Ex Novo Ensemble now represents a point of reference on the international panorama of new music. The continuity obtained by working together, its artistic and professional coherence, has bequeathed a certain character, a “sound”, which both public and critics of the major European festivals have recognised to be unique of this Ensemble. Many celebrated composers have dedicated new important pieces to the Ensemble. The Ensemble’s commitment to exploring the language of contemporary music later became the basis for re-interpreting classical repertory, particularly those scores composed for rare instrumental sets that, although very beautiful, remain little known. Many world premieres and works dedicated to the Ex Novo Ensemble have also been recorded and transmitted by the major European broadcasting corporations. Of particular significance in the Ensemble’s work is its contribution to the promotion of Italian chamber music of the early 1900s, as demonstrated by its long association with recording companies such as Arts, ASV, Black Box, Dynamic, Stradivarius, Ricordi, Naxos, and others, is significant.

Arazzi Laptop Ensemble was established in Venice in 2009 within the ‘laboratorioarazzi’, a series of workshops/seminars organized by the Music Institute of the Fondazione Giorgio Cini. It brings together a group of performers/composers in electroacoustic music experiences of interaction between musicians, between technologies and between musicians and technologies. Particularly interested in the exchange of information – both audio and control – between the components during the performance, the Arazzi Laptop Ensemble aims – through improvisation, execution, collective or individual composition – at measuring with the sound events during their manifestation. Most recent performances include the one of June 18th, 2011 at the Archaeological Museum of Venice; a participation, with a soundscape composition entitled Variations on a Venetian Soundscape, in a side event of the 12th Venice Architecture Biennale Beyond Entropy: When Energy Becomes Form, organized by the Architectural Association School of London (2010); a concert session for the Institute for Living Voice workshops (Venezia, 2010) using processed speech materials produced by participants the workshops. Current members of the ensemble are Stefano Alessandretti, Nicola Buso, Ongakuaw, Luca Richelli, Julian Scordato, Giovanni Sparano, Davide Tiso, Alvise Vidolin and Paolo Zavagna.

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From	To	WED, JULY 6 th	THU, JULY 7 th	FRI, JULY 8 th	SAT, JULY 9 th
		Dept. of Information Engineering	Palazzo Bo	Palazzo Bo	Palazzo Bo
	09.00		Registration	Registration	Registration
09.00	10.30		OS1 Computational Musicology	OS5 Emotion and expression in music	OS8 Environments for sound/music processing PC3
10.30	11.00		PC1	PC2	
11.00	12.00	Registration	PS1/Coffee break	PS2/Coffee break	PS3/Coffee break
12.00	13.00	Welcome lunch and Rencon set piece publishing	OS2 Musical Heritage	Keynote Time is of the essence: creativity, symmetry, and counterintuitive solutions Roberto Casati	OS9 Interaction with sound and music
13.00	13.30				
13.30	14.30	Visit to Rencon rendering room	PS1/Lunch	PS2/Lunch	PS3/Lunch
14.30	15.00		OS3 Augmented learning	OS6 Creativity	
15.00	16.00	Rencon Workshop			Trip to Venice
16.00	16.30		Coffee break	Coffee break	
16.30	18.00		OS4 Sound modeling	OS7 Music Automation	
18.00	19.00	Transfer to Conservatory	Transfer to Conservatory	Transfer to Conservatory	Concert 3
19.00	20.00	Opening Concert	Concert 1	Concert 2	
20.00	20.30			Transfer to restaurant	Free time
20.30	22.00	Free time	Free time	Conference dinner	
22.00	23.00				Return to Padova
23.00	24.00			Free Time	

Legend:

- OS: Oral Session
- PC: Poster Craze
- PS: Poster Session