Accademia Musicale Studio Musica
Michele Della Ventura, *editor*

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Preface

This volume of proceedings from the conference provides an opportunity for readers to engage with a selection of refereed papers that were presented during the International Conference on New Music Concepts and Inspired Education. The reader will sample here reports of research on topics ranging from mathematical models in music to pattern recognition in music; symbolic music processing; music synthesis and transformation; learning and conceptual change; teaching strategies; e-learning and innovative learning. This book is meant to be a *textbook* that is suitable for courses at the advanced undergraduate and beginning master level. By mixing theory and practice, the book provides both profound technological knowledge as well as a comprehensive treatment of music processing applications.

The goals of the Conference are to foster international research collaborations in the fields of Music Studies and Education as well as to provide a forum to present current research results in the forms of technical sessions, round table discussions during the conference period in a relax and enjoyable atmosphere.

36 papers from 16 countries were received. All the submissions were reviewed on the basis of their significance, novelty, technical quality, and practical impact. After careful reviews by at least three experts in the relevant areas for each paper, 12 papers from 10 countries were accepted for presentation or poster display at the conference.

I want to take this opportunity to thank all participants who have worked hard to make this conference a success. Thanks are also due to the staff of "Studio Musica" for their help with producing the proceedings. I am also grateful to all members of Organizing Committee, Local Arrangement Committee and Program Committee as well as all participants who have worked hard to make this conference a success.

Finally I want to appreciate all authors for their excellent papers to this conference.

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Contents

Kinetic Sound Art and the Sound Canvas

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Abstract. This paper proposes a mixed-media format for the exhibition of spatial music and kinetic sound art in galleries. A sound canvas is a term suggested by the author to describe both its hybrid nature and that it is composed of the spatialisation of sound within a defined surface. The audience is positioned in front of the sound field to experience the artwork. These pieces are mostly comprised of an array of loudspeakers, a compact multichannel system, lights and sensors. This approach offers a range of possibilities to the field of composition and sound art, as it can be representative (e.g. soundscapes), performative, interactive or conceptual. Commentary on the techniques employed for designing compact multichannel systems is exposed and examples of results are given.

Keywords. mixed-media, kinetic art, sound art, sound spatialisation.

1 Introduction

This paper will initially present a brief historical introduction to the development of sound and electro-mechanical devices in galleries. This will contextualise the idea of 'sound canvas' and its technology as a medium that connects perspectives from both visual and auditory art scenarios. Finally, the research progress of an on-going artistic project conducted by the author will be presented.

In the 1960s, sound performance transmuted from black to white cubes. Silent galleries began to permit more than thoughts and comments to be heard, as concrete sound works required new spaces — Cage with Fluxus projects, Leitner with aural architecture, Bertoia with sound sculptures and other works by artists inspired by the legacy of Schaeffer's Musique Concrète [1]–[4].

Along with the gallery's adoption of loudspeakers and other transducers, electronic sculptures were manifested by the engineering and geometric ideas of kinetic artists [5]. If we take Eusebio Sempere's work to illustrate we will find spinning sculptures, illuminated wood sheets — *Relieve luminoso móvil*, 1959 — and the use of sequential incandescent lamps to create luminous geometric shapes — *Ley de la buena forma*, 1968 [6]–[8]. The Brazilian artist Abraham Palatnik, whose work has been referred to as 'kine-

chromatic', has shared aesthetic similarities, by exploring light bulbs and the use of electric motors [9].

Although both the auditory and the visual aspects of technology in galleries have developed concurrently, it seems they did not coalesce to a point where both arts fused or interchanged ideas. As described above, we have paradigms of artists such as Leitner working specifically with sound, whereas Sempere or Palatnik focused essentially in light and mechanical movement. When we examine Leitner's work and other similar spatial sound installations, a strong connection with kinetic art can be seen. As sound moves from one plane to another it vibrates not only acoustic waves, but it vibrates space *per se*; the spatial frequency created by panning rate or speed. The essence of kinetic art is 'perceived motion', therefore Leitner's work and the like are beyond a mere generalisation of sound art, but closely related to kinetic art, or expanding the terminology and restricting further the concept: 'kinetic sound art'.

Working through the principles of kinetic art, new sound explorations can be learned. Kinetic *visual* art can work as a paradigm for further sound explorations, by substituting its objects of motion — i.e. light bulbs — with sound material, or by synchronising these objects in the same spatial frequency as a sound object. Evidently, there are technological challenges when creating spatial networks, but digital technology and the use of microcontrollers have been facilitating this practice and thus allowing new mixed-media formats to emerge.

2   Sound Canvas

Since 2014 I have been experimenting with mobile sound spatialisation, framing multi-channel compositions on a compact surface that sits on the wall at eye level, with the purpose of reaching the same exhibition design as in a traditional painting display. I have coined different terms for this type of mixed-media and 'sound canvas' seems to strongly reflect this point of transition, from canvas as a surface material for paint and canvas as a material for sound. The first series of media of this kind was designed to be a 'painting' series, they were framed with wooden stretcher bars, whereas loudspeakers, wires and electronics were covered by a canvas-like material, mainly polyester fabric, which allowed sound to effectively pass through. Switches, volume buttons and USB connectors were adapted to the wooden frame, offering accessible control. This first series of works I called 'musical paintings', they were produced between 2014–2018 and exhibited in galleries and conferences[29]. The first of this series was *Collage #1: Frozen Night* [fig. 1], an eight channels soundscape comprised mainly of recordings of insects. Compact loudspeakers were hidden behind a black painted canvas and a battery-powered circuit allowed the sound to be processed and amplified.

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[29] Unpublished papers are available at: http://artlyra.com/iancostabile/art/musical-paintings/
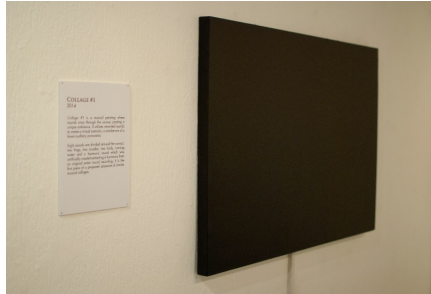
Fig. 1. *Collage #1: Frozen Night* (2014)

A challenge in this project was to find the best techniques for designing multichannel systems that would be compact, battery-powered and affordable. Four techniques have been explored:

1. Single-board computer and eight-channel USB soundcard running Pure Data or Max MSP.
2. Asynchronous pairs of stereo audio decoder modules and microcontroller unit (MCU).
3. Eight-channel audio decoder module and MCU.
4. Digital potentiometer (six-channel or multiple integrated circuits running in parallel), one audio decoder module and MCU.

The first technique, consisting of using single-board computers — i.e. Raspberry PI and Windows PC-stick — was abandoned for a series of reasons. Having an operating system has complications such as system crashes, slow boot loader, driver issues and high power consumption. Certainly, using software such as Max MSP presents advantages in terms of creating complex interactive systems or employing more sophisticated spatial techniques such as VBAP or Ambisonics. In *Bi-dimensional* [fig. 2], a six-channel composition for flute, light and electronics, Max MSP was used for triggering different speakers and LED lights according to the flute's pitch, and in some sections, users could interact with the artwork — clapping hands triggered sounds in different places. However, due to all other circumstances this technique has not been much employed throughout projects and controlling the circuitry through microcontroller units (MCUs) such as the Arduino platform was preferred.

Fig. 2. *Bi-dimensional* (2017)

The second technique, 'stereo-pairs', is the simplest to implement. By combining stereo audio decoder modules more channels could be achieved, although with different clock systems there is no accurate synchronisation. However, not all artworks demanded complete synchronization and this technique was sufficient to conceptualise aesthetic ideas. *Collage #2* [fig. 3a–3b] combined four pairs of speakers in which sounds are panned in a circular fashion. *The Seashore* combined two pairs of speakers to simulate the sea waves breaking on the seashore. *Battistero, Voci della Terra e del Cielo*, a composition for soprano and tenor recorded at the Pisa Baptistery uses only one pair, split into recordings from two architectural levels to represent the full vertical panorama of the baptistery.
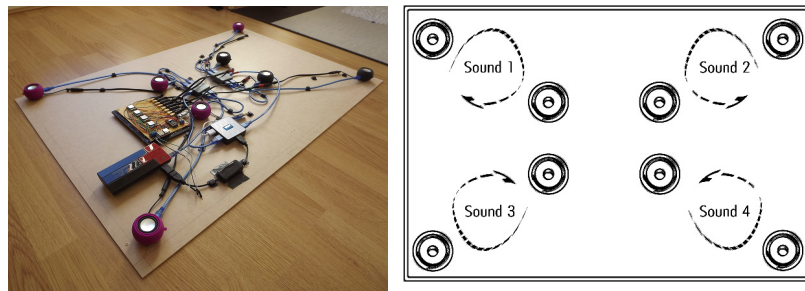

Fig. 3a–3b. *Collage #2* (2017)

The third technique consisted of using an eight-channel audio decoder module controlled by an MCU. This has been explored in a few sound canvasses and is the most effective for synchronous multichannel compositions. The module implemented was the Tsunami Super WAV Trigger designed by Robertsonics. The last technique explored consisted of the use of digital potentiometers for creating panning effects through MCUs. This offered an efficient way of synchronising the panning motion of sound with LED lights. It was employed in *Sound Lines #2* (2017), a four-channel interactive electronic musical composition accompanied by light sensors, which allowed users to move the position of sounds by hovering their hands in front of the canvas.

In 2018 I began to develop a second series of sound canvasses, a series I called 'sound scrolls'. Although the aesthetics of musical paintings were satisfying, I noticed the curiosity of audiences to see the internal circuitry of the paintings. An answer to this was found in East Asian scrolls, used in painting and calligraphy, which inspired a new design for displaying kinetic sound. A scroll presents the advantages of portability and storage which seemed convenient to these mobile projects. The first development, *Lotus Sound* [fig.4], consists of six 3W compact loudspeakers, seven LED lights and a proximity sensor. Its production began at an artist residency organised by the Visual Research Network (VRN) in September 2018. The sound material was made of water recordings at the canals of Brighouse, West Yorkshire. The physical material employs a magnetic sheet, wooden frame and copper tapes for electrical connections, which allows all circuitry to be rolled for storage and results in an authentic visual configuration. Concerning its interactive feature, when users approach their hands a 'water splash' sound is triggered and the panning rate changes — the closer the hand is to the canvas, the faster the spatial rotation of sound and light. The technique used for spatialisation was the fourth presented above, a combination of a six-channel digital potentiometer and an MCU, which sets the panning law and synchronises the lights and sensor.

Currently further explorations of kinetic sound art using this media continue to progress and by looking back to what has been produced by kinetic visual art, it seems that there is still much to be explored through the kinetics of sound.
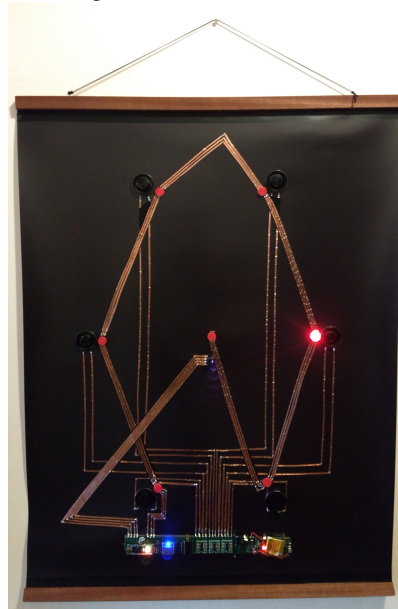

Fig. 4. *Lotus Sound* (2018)

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This book presents a collection of selected papers that present the current variety of all aspect of music research, development and education, at a high level. The respective chapters address a diverse range of theoretical, empirical and practical aspects underpinning the music science and teaching and learning, as well as their pedagogical implications. The book meets the growing demand of practitioners, researchers, scientists, educators and students for a comprehensive introduction to key topics in these fields. The volume focuses on easy-to-understand examples and a guide to additional literature.

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New Music Concepts and Inspired Education

Revised Selected Papers