‘BODYCODER’: A SENSOR SUIT AND VOCAL PERFORMANCE MECHANISM FOR REAL-TIME PERFORMANCE.

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Abstract

The aim of the project was to create a new performance mechanism using the movements and vocalisations of a performer to affect and control all aspects of the audio and video compositional material, in effect to become a new musical instrument. The brief was to design an integrated system which would interface with the kinetic qualities of dance and dynamics of vocal expression. The requirement was to free the dancer/performer of any physical attachment to the computer systems and to free the performer within the performance space from the constraints of having to interact with fixed sensor elements.

1 Background

The Bodycoder project is a continuation of the authors research into emersive and interactive performance environments and reactive sound installations. Developments of work undertaken by the authors over the past five years has resulted in a number of sensitised theatrical performance spaces as part of work with the company - ‘Electronic Dance Theatre’ (1), three Virtual Instrument designs for the London Science Museum / Sea France Interactives (2), ‘Passage To India’ - an interactive sound sculpture commissioned and now in the permanent collection of Wakfield City Art Gallery (3), a number of interactive sensory mechanisms for instrumentalist including the ‘Metabone’ for trombonist Barry Webb (4). The first piece to employ radio technology was bench tested during a 3 weeks residency at the STEIM institute in Amsterdam during Easter 1997. The first performance of a work which utilised the Bodycoder system was entitled ‘Bodycoder’, this took place at The Lawrence Batley Theatre, Huddersfield on 17th September 1997.

2 Sensor Mechanics

Various sensor elements were investigated and it was decided to integrate both switched and proportional elements into the ‘suit’. Small bore conductive rubber tubing was a cheap and readily available material from which to construct sensors for transmitting joint ‘bend’ information. Unfortunately the material exhibited a large hysteresis and was also unable to stand the stresses of continued use. Strain gauges proved to be extremely accurate but were found to be unreliable for extended use, being unable to withstand the continued rigours of physical performance. Small conductive plastic linear potentiometers were reliable but were found to be unwieldy in use. Eventually small resistive elements were sourced which gave a range of 15K to 30K (flat to 90 degrees bend), these were extremely cheap at 5 dollars each and were sourced from a US games and virtual reality electronics company. The sensors were backed with thin pieces of clear acetate sheet and enclosed with heat shrink sleeving to aid with durability, the connecting wires being soldered and further fixed to the sleeving with cyanoacrylate adhesive. Each sensor connecting cable was terminated with screw ‘lockable’ phono connectors. Four resistive elements were employed, 1 on each knee joint and 1 on each elbow joint - the sensors were held in position by inserting each element into small pockets sewn into the
fabric of the suit material. Switch elements were used which allowed the performer to move between visual / vocal & audio patches. The switches used were miniature keypad types designed into a pair of thin gloves, a multicore cable was then attached directly to the switch contacts terminating in a 9 pin ‘D’ type lockable connector (fig 1). A Shure micro instrument microphone was used to transmit vocal signals via a separate radio link to the SE70 effect processor, a custom microphone housing was fabricated from extruded polypropylene which was held in place inside the vocal cavity with a modified dental tooth brace.

3 Implementation

The radio circuitry was based on a commercial 35Mhz design normally sold for model aircraft use. The Transmitter coder was modified to accept either switched inputs or proportional resistive elements, a hardware link was used to select the required input configuration. The 8 channel PPM receiver and coder circuitry was interfaced to a custom pulse width to voltage converter and scaling circuit to give the 0 to 5V analogue voltages required to drive the PC 1600. A Peavey PC1600 Midi Controller was customised to accept 8 external control voltages, in effect replacing the internal fader control voltages and also modified to accept 8 switch inputs, hardware switches were wired to switch between internal and external voltage control. A 25 way ‘D’ type connector was used to connect the receiver decoder to the PC1600. 8 vertical LED arrays were employed within the receiver housing to assist with calibration and performance monitoring without the need for external metering (fig.2). The PC1600 held several patches of midi controller and system exclusive information which were recalled by program change information held in small sequences in Opcode’s StudioVision Pro integrated sequencing / soundfile program. Each patch also held set-up strings which ensured that note off information was sent to the E4x sampler at the start of each subsequence, the set-up strings also initialised the various controller data required for the SE70 effects processor (fig.3).
Pre composed samples were triggered by the performer and extensively changed by utilising the real time filter morphing facilities and ‘cord’ system of modulation routings of the E4x sampler. Soundfiles of processed Tuuvan throat singing held within the subsequences were triggered and output via an Audiomedia II card to one input of the SE70 processor used as carrier information for various vocoder patches used in the piece. The throat microphone provided the modulator signal for the vocoder patches. Various effect parameters were modified by mapping the performers movement information to a maximum of 4 modulation parameters at any one time, these included vocoder levels, delay levels, chorus rates and EQ filtering. Ring modulator patches were also used with various joint sensors effecting frequency modulation rates and pitch change parameters. The sound palettes used in the piece comprised a variety of Electro-acoustic samples of throat and overtone singing which were then re-authored using various computer based processes including Sound Designer II, Alchemy and Hyperprism.

A second computer was used running Steinberg’s X<>Pose visual sampling program. The X<>Pose software held several patches of stored Picts and Quicktime movies to be recalled and effected by the performer in real time. Switch and proportional information was routed via the PC1600 to the software on a dedicated midi channel, the video output being projected on to a large screen via a high definition LCD projector. Images were photographed and then manipulated via Photoshop while movies were constructed in Premiere. The visual information (stills and QuickTime movies) held in X<pose> allowed a number of visual effects / filters such as image pan, fragmentation, and a number of chromakeys to be mapped to midi information giving the performer the ability to both access the various visual palettes and to perform effects on visuals in real-time.

3.1 Computer System

Macintosh Quadra 650 c/w 24Mb ram, 500Mb HD and Digidesign Audiomedia 2 with Opcode’s StudioVision Pro v.3.1 software. Macintosh Power PC 7100 A/V c/w 32Mb ram, 1Gb HD with Steinberg’s X<>Pose v.1.0 software.
3.2 Audio System

EMu E4x sampler c/w 64Mb ram and 540Mb HD. Roland SE70 digital multi effect modules. Shure LX1 / LX3 radio microphone. Mackie CR1604 mixing console.

3.3 Midi System

2 Opcode Studio 3 interface. Peavey PC1600 Midi Controller

4 Summary

The idea for the suit grew out of a desire to provide a dancer with enhanced authority over the various performance parameters involved in a dance theatre experience and to find an interface mechanism which would allow an organic integration of electronic mediums into a conventional dance theatre setting. This was partly a political move, partly a natural course of development which grew out of a long term collaboration between a performer and a composer / electronics designer (the two authors of this paper) which began in 1991. The development of the Bodycoder System is an expression of a particular contemporary approach to theatre based performance which is concerned with developing integrated systems and the evolution of a more holistic, specifically synaesthesic, electronic theatre aesthetic as an appropriate medium which is capable of expressing contemporary issues. The development of this type of performance control mechanism goes hand-in-hand with the electronic control revolution in areas of lifestyle and market economies. Above and beyond the idea of control, the Bodycoder System is an expression of a return to a more sensual, specifically whole-body orientated approach to the electronic medium. This is a notion which was promoted, and in some ways instigated, by the idea of the VR interface or the possibility of submersive electronic environments. What sets the Bodycoder System apart from VR systems, in which the actual human form is lost or reduced to avatar status, is the sophisticated level of physical control and the subsequent demand for an enhanced or hypersensitive awareness of the body, linked to a type of 3D Spacial/anatomical kinesthetic discipline which dancers have developed to a very high degree. Bodycoder also places an actual human body at the centre of an electronic environment. As Drew Hemment observed in his recent article about the work of the company, Bodycoder “opens a domain of cyborg art that exceeds the human without simply rejecting it.”

References


Bromwich, Mark. “An Interactive sound sculpture for the visually impaired”. In proceedings of The Ensemble research group conference, York University 1996.
