2.2.4. User Interface

The User Interface (UI) design is important to appeal to a variety of users. Whereas sound designers, familiar with technical control of audio, may allow for complex control at the expense of the UI, a large proportion of the users (educators) will require a more immediately accessible control interface. Therefore the application will manage workflow and available options depending on the users’ required level of control and proficiency employing a habituation pattern for menu navigation and an incremental construction pattern of the speaker array and sound trajectory design [12].

3. OSC IMPLEMENTATION

OSC messages are sent between the Ensemble system and the mobile device. OSC was developed at CNMAT primarily as a protocol for communication between computers, sound synthesizers, and other multimedia devices optimized for modern networking technology [15].

3.1. Protocol Specification

OSC employs an ‘open-ended URL-style symbolic naming scheme’. The project aims to carry out most of the data processing within the device and to send out as few different messages as possible.

3.1.1. Configuration Messages

At the setup stage, the application sends a request message ‘/getconfig’ to obtain the quantity of speaker outputs and user inputs. The return messages are in the following form. For the speaker outputs: '/config/soundsources i1'. Where i1= the amount of speakers in the design. For the user inputs: '/config/inputs i2'. Where i2= the amount of input sources controlling sound.

3.1.2. Control Messages

During operation, messages are sent when the main volume is changed. The message consists of the speaker number and the master volume in the form: '/speaker/vol n v1'. Where n = the speaker number; v1= master volume (0-1). Messages are sent when the input sources are routed to playing sound trajectories or a changing live mode. Messages are sent in the form: '/speaker/sound n i2 v2'. Where n = the speaker number; i2 = the sound source number; v2 = the percentage scale of the speaker volume (0-1). The percentage scale value is determined by using distance-dependent panning principles utilizing the x and y speaker distances.

Additional OSC messages can be sent which specify the x and y distance between sound source and speaker to allow for easier interfacing with the Ensemble environment.

4. TESTING AND FURTHER WORK

The controller application has been tested successfully with a range of surround sound setups using an emulator designed in Max MSP [3]. Apollo Creative has provided user interface and gesture control feedback. Further user testing is to follow. Further features currently being designed include advanced time manipulation and display; multi-touch control for additional parameters and advanced path manipulation.

5. REFERENCES


MODERN TECHNOLOGY AND CREATIVITY: AN APPROACH TO COMPOSING AT 11-14 YEARS

Al McNichol
Department of Music and Drama,
University of Huddersfield,
Queensgate, Huddersfield,
England, HD1 3DH.
a.mcnichol@hud.ac.uk

ABSTRACT

Modern technology offers creative opportunities to music composers within a sound universe of expanded possibilities. Whilst revolutionising music composition in the wider world this also provides pedagogic opportunities for 11-14 year pupils in the classroom for music composition. However, recent evidence suggests that technology is still not being used to its full creative potential for composing at this level in secondary schools. This paper presents recent developments from investigations into this issue in the context of the National Curriculum for England. It considers a theoretical interrelationship of modern technology, creative thinking and 11-14 composing pedagogy. It presents a view of current resources within secondary school music departments and discusses recent action research into the deployment of modern learning resources, including dedicated software, in 11-14 year music classrooms in the North of England. The oral presentation of this paper will include demonstration of user testing to follow. The software, digital video of it in use in a classroom and audio examples of musical outcomes from 11-14 year old users.

1. CONTEXT

This paper presents recent developments of research first introduced in its early stages at previous ICMC [8]. Since that time modern technology has continued to develop and become increasingly accessible to many secondary school music departments, providing pedagogic opportunities for 11-14 year pupils in music composition. In England, the use of technology in the 11-14 year music curriculum is statutory. It should be used ‘to create, manipulate and refine sounds. Including the use of music technologies to control and structure sound in performing and composing activities [13]’.

To converge technology, composing and music pedagogy statutorily at 11-14 years in this way remains problematic in England. Evidence from the UK Government and elsewhere suggests that the interrelationship is still not fully understood. Whilst there may be increasing provision of modern technology in some 11-14 music classrooms, in others it is often inadequate. Its use is often insufficient, basic and more confined to deployment in upper levels of secondary schools [10;11;14]. To contextualize this evidence it may be useful to consider a theoretical framework that is the basis of this study.

2. THEORETICAL RELATIONSHIP

The development of modern technology has revolutionized how music can be composed. This has influenced theoretical and conceptual thought concerning affordances of an expanded sonic universe. A universe through which a composer can exercise creative thinking and explore musical imagination in the structuring of sound [5;7]. However, the composer must develop knowledge and skills of such technology if any use is to be made of any potential possibilities it might offer.

2.1 Modern technology: an expanded sonic universe

Modern technology affords an expanded sonic universe for music composition. The potential sonic space is an open universe of continuous and possibilities ‘where every sound and imaginable process of transformation is available’ [17]. Continuums exist between fundamental sonic properties of pitch, timbre and duration offering the potential for dynamic morphology within sound structures of such a sonic space. Access to such continuums and morphology expand possibilities beyond music based on three-dimensional lattice frameworks of discrete musical distinctions [18]. Such an expanded sonic universe offers alternative possibilities for a composer to explore individual creativity.

2.2 Creativity and composing music

2.2.1 Creativity

Creativity is ‘imaginative activity fashioned so as to produce outcomes that are both original and of value’ [9]. However, creativity can be an intricate concept to define theoretically and practically. Recent definitions draw upon early research that separated creativity into four stages: preparation; incubation; illumination; and verification [4]. Guilford [6] presents a model identifying two productive abilities of convergent and divergent thinking. Such thinking and abilities are applied in a ‘model of creative thinking in music’ proposed by Webster. This model relates thinking processes with an association to creative products [16]. In music contexts, ‘the distinctiveness of creativity is that pupils use sound as the medium for creative
thinking’ [10] and for many music educators, ‘creativity is at its strongest in the act of composition’ [1].

2.2.2 Composing

Composing is a productive process producing actual outcomes. The very process of composing music involves imagining ideas, which at the point of them being imagined may be worth very little musically, but there comes a point when decision-making becomes involved [5]. It is musical imagination, the minds about to think in sound, to internalize music by ‘hearing’ sounds and manipulating ideas towards meaningful intention that is central to composing. After all, it is the positioning and structuring of sounds together and what might be conveyed that is composing [12;15].

Modern technology, creativity and music composition are interrelated as domains when combined in practice. They become interdependent upon each other and ought not to be considered in isolation. The challenge is how might these be integrated practically into an 11-14 year music curriculum to support effective composing pedagogy?

3. TECHNOLOGY SURVEY

Investigation has been undertaken to discover what technology is currently available in regional secondary school 11-14 year music departments. A survey was conducted of 29 secondary schools in two regions in the North of England. The method of survey was by an electronic questionnaire to each Head of Music and by follow up visits to participating music departments. What follows is a summary of the findings felt relevant to this paper.

Table 1. Available hardware resources.
The hardware resources given in Table 1. show a prevalence of electronic MIDI keyboards and PC/computer platforms. Other resources shown are present in the music departments although not necessarily used in 11-14 year age group. Quite often they are used more in upper secondary school levels at 15-18 years.

Table 2. Available software resources.
The software resources shown in Table 2. show a prevalence of Cubase sequencing package and Sibelius notational scoring package. This may be partly due to strong UK market and distribution presence towards education, although other packages do feature in Audacity and Dance EJay. The latter package often being used in 11-14 year composing activities using pre-recorded audio, largely confined to arranging blocks of pre-composed blocks of sounds.

Table 3. Resource (hardware and software) activity usage.
The use of available resources shows an overwhelming dominance towards composing activities. Much of this composing is often through MIDI sequencing using template sessions or pre-existing notation relying on the user’s own ideas. Little use is involved critical listening development. The time given over to such activities varies depending on the school, scheme of work and year group. Predominantly the lesson times are for 1 hour per week although not necessarily occurring every week over a whole term. Quite often lessons are structured in short weekly blocks of time, typically 3 – 6 weeks at 11-14 years. Usage typically increases the higher up the school towards 14-18 years. Quite often use for 11-14 years composing is quite limited if used at all. Resources for listening are rarely accessible outside scheduled class time.

Regional education research reported at National level and from other large-scale surveys [10;11;14]. In response to such findings, intervention was planned in the form of action research with the intention of trying to develop the use of technology in 11-14 year composing activities.

4. ACTION RESEARCH

Action research is broadly considered as research undertaken by practitioners into their own practice, in order to improve it. The process is described as a recurring spiral of planning, acting, observing or evaluating and reflecting [2].

Action research has been implemented since 2009 in collaboration with four secondary school music departments in the North of England. Early materials and results from two of these were published at a previous ICMC [8]. Since that time three further cycles of action research have been implemented in two other secondary schools. These schools wished to integrate practical composing into their music departments and increase the use of technology in music pedagogy at 11-14 years particularly for composing music. Suitable hardware resources were available in the form of a networked PC lab, although this was mainly used for IT studies and not utilized for music teaching at the time.

Other available technology was used in performance, using keyboards and drum performance pads. General IT technical support was available to assist in the deployment of resources across the available hardware systems.

Part of the action research involved developing learning resources to support the teaching of a composing project using modern technology consisting of three distinct stages: digital sampling of natural sound; appraising and manipulating digital sound and; structuring digital sound. Learning resources included schemes of work, lesson plans, teaching materials, video tutorials and dedicated sound processing software. The dedicated software presented in this paper intended to encourage and facilitate composing in stage two of the project; sound manipulation. Each section is progressive and incorporates modern practice in the use of music technology for music composition. There are ‘x’ stages within these sections were pupils are able to progress at differing paces achieving a range of outcomes as they do so. Data has been collected during and after each stage through a variety of methods including digital video, digital soundfiles, still photographs, observations, verbal discussion, aural audition and feedback questionnaires. A selection of this material will be available as part of any oral presentation of this paper.

4.1 Revising software for audio manipulation

Software for manipulating digital sound has been developed to support this action research. The software has been renamed ‘Soundtools Manipulator’ and is a collection of sound processing tools processing in real-time, presented as a standalone application. Each tool implements a time or frequency domain processing technique designed to be simple to operate yet effective in scope. The processing techniques employed in each tool are real-time and include independent pitch-shifting and time compression/expansion. Also included are effects of delay, filtering, reverberation and ring modulation. These particular techniques have been selected for this project to allow exploration of sonic space, whilst introducing the user to typical sound manipulation techniques. The tools are intended to be easily deployed in a classroom environment to encourage creative-thinking for the imaginative exploration and manipulation of sound. The tools are programmed using Max/MSP by Cycling’74 and are compiled as a standalone application for both Windows or Apple computer platforms.

Since v2.0 of the software was demonstrated at ICMC revision has taken place. This has been informed by reflective practice and results from the action research above. The revisions have been such that graphical user interfaces are more intuitively presented and user access is facilitated via a central server.

The Gui also presents recording space and storage controls. A horizontal graph gives the available storage capacity of four minutes in the form of a ‘fuel tank gauge’. Whilst over the sound level is above a minimal noise floor level the DSP output is automatically recorded to the computer RAM. This is to allow the user to concentrate on sonic manipulation and not worry about saving what sound is produced, whether intentional or accidental. If the user wishes to save what sound has occurred they may save a resampled soundfile to storage. If not, the storage space can be erased and the full four minutes is available once more and the process can be repeated. This automatic storage process may be overridden to manual mode to capture decay of time-based effects such as delay and reverberation should these be in use.

4.2 Recent use of ‘Soundtools Manipulator’

Soundtools Manipulator has recently been used by three separate groups of 11-14 students in two different secondary schools. The pupils are of mixed gender and abilities. It has been used for stage two of the project whilst Cubase S2 and Audacity 1.3 where used for stage three on WindowsXP and Macintosh desktop computers. All computers were networked and the application ran from a central server.

The action research projects have all begun with sound capture using portable digital recorders. Pupils are encouraged to explore the sound environment around their school, both indoor and outdoor. A strong emphasis is placed on the quality of sound recording, aural skills development and use of imagination.

The resulting digital samples are used for sound manipulation using Soundtools Manipulator.
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3.1 Resources: hardware, software and usage

<table>
<thead>
<tr>
<th>Resource type</th>
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</tr>
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<tbody>
<tr>
<td>Electronic MIDI Keyboard</td>
<td>100</td>
</tr>
<tr>
<td>PC (Windows) Computer</td>
<td>86</td>
</tr>
<tr>
<td>Apple Computer</td>
<td>29</td>
</tr>
<tr>
<td>Synthesizer (hardware or software)</td>
<td>86</td>
</tr>
<tr>
<td>Sampler (hardware or software)</td>
<td>57</td>
</tr>
<tr>
<td>Effects Processor</td>
<td>57</td>
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<tr>
<td>Microphones</td>
<td>100</td>
</tr>
<tr>
<td>Portable Digital Audio Recorder</td>
<td>71</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
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<tr>
<td>None of the above</td>
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<tr>
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<td>43</td>
</tr>
<tr>
<td>Music theory</td>
<td>43</td>
</tr>
<tr>
<td>Sound sampling</td>
<td>43</td>
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<tr>
<td>Sample editing</td>
<td>43</td>
</tr>
<tr>
<td>Audio manipulation</td>
<td>71</td>
</tr>
<tr>
<td>Audio sequencing</td>
<td>57</td>
</tr>
<tr>
<td>Performance development</td>
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</tr>
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<td>Critical listening development</td>
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Since v2.0 of the software was demonstrated at ICMC revision has taken place. This has been informed by reflective practice and results from the action research above.

The revisions have largely been prompted by reflective practice and evaluating and reflecting [2].

Several areas of concern were highlighted. The processing techniques are graphically presented and implement automatic configuration with minimal input from the user. Such decisions were made in response to user feedback and observations. Audio DSP and routing is now configured automatically although can be overridden and set to ‘Rewire’ or an advanced routing matrix if required. Digital sounds can now be loaded by drag/drop into a central area, giving a graphical waveform for viewing. Minimal transport controls allow playback and looping of the whole, or selection within a soundfile. The primary parameters for initial manipulation are pitch (0-100.) and playback speed (-100.-100.). These are independent of each other and any changes made are applied in real-time.

The GUI also presents recording space and storage controls. A horizontal graph gives the available storage capacity of four minutes in the form of a ‘fuel tank gauge’. Whilst ever the sound level is above a minimal noise floor level the DSP output is the recorded sound. The level is electronically controlled to allow the user to concentrate on sonic manipulation and not worry about saving what sound is produced, whether intentional or accidental. If the user wishes to save what sound has occurred they may save a resampled soundfile to storage. If not, the storage space can be erased and the full four minutes is available once more and the process can proceed. This automatic storage process may be overridden to manual mode to capture decay of time-based effects such as delay and reverberation should these be in use.

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The action research projects have all begun with sound capture using portable digital recorders. Pupils are encouraged to explore the sound environment around their school, both indoor and outdoors. A strong emphasis is placed on the quality of sound recording, aural skills development and use of imagination.

The resulting digital samples are used for sound manipulation using ‘Soundtools Manipulator’.
Demonstration and discussion are used to emphasize the close evaluation of sonic characteristics within the captured sound(s). Musical elements are discussed in terms of pitch, duration, dynamics, timbre and texture. Further demonstration is used to show how sound might be manipulated by beginning to focus on specific aspects within the sound(s) and manipulating sonic properties. The stimulation of musical imagination is emphasized to generate ideas towards composing in preparation for the structuring of sound.

4.2.1 Pedagogically Speaking
From a pedagogic perspective the data collected shows that the technology could support effective music pedagogy. Pupils became quickly engaged by the technology in exploring sonic material. They enjoy exploring sonic parameters and learnt what effect manipulating these has upon sound. This musical learning can become increasingly based on their own imagination, intentions and thematic ideas. However, beyond play familiarity being able to imagine, manipulate and select sounds towards intentional composing most pupils found much more difficult. Yet some of their work and short compositions do show learning development, musical imagination and real intention in the way they try to structure sounds towards musical intention.

4.2.2 Technologically Speaking
From a technical programming perspective the revisions of Soundtools Manipulator were successful. The software application ran over the school network with no inherent issues within the software, although individual PCs did cause some minor issues with corrupt audio driver issues early in the project. The software has been used without any issues on Apple OSX iMac machines in undergraduate and postgraduate student seminars with teacher trainers. The application requires little storage space (12MB WindowsXP: 30MB OSX 10.5.8) and low CPU usage (8-10%) depending on the specification of the computer. The GUI is reported to be easy to use, functional, less cluttered and more intuitive. There are however more revisions under consideration. These will be implemented and tested in further cycles of action research already being planned for September 2012 and beyond.

5. WIDER CONTEXT
This paper is intended to illuminate a theoretical interrelationship between modern technology, creative thinking and composing pedagogy at 11-14 years. It discloses investigation into this issue within Regional secondary school music departments in the North of England. It presents a view of current resources within these music departments and discusses recent results from action research. This research is primarily concerned with developing pedagogic resources for 11-14 year music classrooms. Such discussion and information may prove constructive to other music educators around the world engaged in developing the use of modern technology for composing pedagogy at 11-14 years. Educators who are interested in fostering links and collaborating in such action research are encouraged to contact the author for discussion.

6. REFERENCES


GEORGIA STATE UNIVERSITY
MUSIC TECHNOLOGY STUDIO REPORT

Tae Hong Park, Robert Scott Thompson, Alex Marse, Johannah Turner
School of Music
Georgia State University
Atlanta, GA, USA
park, rsthompson@gsu.edu
amarse1, jturner30@student.gsu.edu
http://musictech.gsu.edu

ABSTRACT

This studio report describes Georgia State University’s (GSU) recent activities in the area of computer music and music technology. A summary of on-going and recent research will be provided as well as an overview of the School of Music, the Music Technology programs, its facilities, key personnel, and future plans in developing the graduate and undergraduate music technology curricula.

1. INTRODUCTION

GSU School of Music enrolls approximately 450 students representing 6 countries and 21 states. Approximately 360 of the students are in bachelor’s degree programs, 70 in master’s degrees, and the remainder in other programs, including a Ph.D. in music education. 40 full-time and 30 part-time faculty serve students in concentrations including performance, music education, music management, music recording and technology, composition, and jazz studies. The music technology program currently includes faculty members Robert Scott Thompson and Tae Hong Park and approximately 30 full-time students.

The music technology program is comprised of an undergraduate concentration in music technology (B.Mus.) and a master’s program in composition with an emphasis in music technology (M.Mus.). Opportunities also exist for student-designed programs focusing on music technology within the Bachelor of Interdisciplinary Studies (B.I.S) degree track. Various courses are offered for graduate and undergraduate students including digital signal processing, computer music I/II, recording techniques I/II/III, music production, electroacoustic music composition, audio post-production and a comprehensive industry-based internship experience.

2. FACILITIES AND CENTERS

The music technology facilities at GSU consist of three recording studios, one computer music composition studio, and a PreTools-based post-production suite designed by Walters-Storky Design Group (WSDG) in 1995. The studios are housed in the historic Standard and Haas-Howell buildings in the heart of downtown Atlanta, Georgia.

All three of the recording studios are interconnected via patch bays, allowing users to record from any tracking room into any control room. Each control room contains both digital and analog hardware including Eventide harmonizers and various signal processing modules; Avalon, Universal Audio, and Grace Designs preamps; standard DAWs, a plethora of software plug-ins, and interactive computer music applications for all of the studio workstations; and Tannoy, Genelec, Adams, and JBL studio monitors. Studios are maintained with the assistance of advanced undergraduate and graduate students. This model serves as a pedagogical mechanism to help students learn the complexities of studio maintenance while fostering a sense of community.

Figure 1. Studio A control room

Other related facilities include the Music Technology Lab and the School of Music Media Center, the latter housing numerous studio workstations, a music technology seminar room, a 18-station multimedia teaching lab with a dedicated teaching station, together with a large collection of recordings and reading material. The School of Music also possesses several performance venues including the 400-seat Florence Kopple Recital Hall, with a built-in recording booth and