

CreateWorld 2014

A Digital Arts Conference

12-13 February 2014

Conference Proceedings

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CreateWorld Program

WEDNESDAY 12 FEBRUARY 2014

Registration		10.30 – 11.00 am	
Welcome and Keynote 1 <i>Chair: Andrew Brown</i>	11.00 – 12.00pm	Building S07, Room 1.23	
		Creative Ecosystems for the 21st Century - Jon McCormack	
Art Exhibition	12.00 – 12:30pm	Building S07, Foyer	
		Tears of the Sun! - Gordon Moyes	
		Generative Jewellery - Daniel Della-Bosca	
		Previs Production in the Digital Art Zone - Louise Harvey	
12.30 – 1:30 pm - Lunch			
Performance1	1.30 – 1.45pm	Building S07, Room 1.23	
	1.45 – 2.00pm	Shifting Nature - Leah Barclay	
Paper Session 1 <i>Chair: Gordon Moyes</i>	2.00 – 2.20pm	Four short cantatas in emotional-sonata-form - Jesus Lopez-Donado	
	2.20 – 2.40pm	Digital Futures: Exploring the role of technology in community empowerment, social activism and cultural change - Leah Barclay	
	2.40 – 3.00pm	Scrum – Industry based methods applied in vocational teaching practice - Justin Carter	
	3.00 – 3.20pm	Technology enhanced one-to-one pedagogy: Bringing the music studio lesson into the 21st century - Rachael Dwyer & Jessica O'Bryan	
	3.20 – 3.40pm	Desktop Video Production for Research and Teaching - Matt Hitchcock and Paul Draper	
Afternoon Tea		3.45 pm - 4.15 pm	
Workshops 1	4.15 – 6:15 pm	Building S02, Room 3.06	Building S02, Room 6.37
		Quartz Composer - Scott Baker	How do I Game Design? - Paris Buttfield-Addison, Jon Manning and Tim Nugent
7.00 pm - Conference Dinner at The Shore Restaurant, South Bank			

THURSDAY 13 FEBRUARY 2014

		Building S07 Room 1.23	
Keynote 2 <i>Chair: Michael Docherty</i>	9.00 – 10.00am	Breaking through the noise - Tim Kitchen and Richard Turner-Jones, Adobe	
	10.00 – 10.15am	Ibis - Josten Myburgh	
Performance 2	10.15 – 10.30am	Intelligent Tracking - Jayashree Panjabi	
	10.30 – 10.45am	Folding Time - Lloyd Barrett and Scott Baker	
10.45 – 11.15am - Morning Tea			
Paper Session 2 <i>Chair: Toby Gifford</i>	11.15 – 11.35am	Building S07, Room 2.16	Building S07, Room 2.17:
		Emotional Discriminant Analysis for Music Composition - Jesus Lopez-Donado	There's An App For That!... Using Mobile Devices to Improve Audience Engagement - Glen Luttrell
Paper Session 3 <i>Chair: Justin Carter</i>	11.35 – 11.55am	From Photo to Photorealistic - Digitising the Planet - Thomas Verbeek	User Experience Design for Hyoomans - Nic Wittison
	11.55 – 12.15pm	Left to Their Own Devices: agency, schizoanalysis, BYO technology and young adolescence - Josh Howard	Trialling Second Life machinima to promote discussion and support learning - Neil Cliffe (paper presented by Joanne Doyle)
12.15 – 1.10pm - Lunch			
Building S07, Room 1.23			
Keynote 3 <i>Chair: Andrew Brown</i>	1.10 – 2.10pm	7bit Hero – Integrating live music, video games and audience interaction - Hans van Vliet	
	2.10 – 2.30pm	An Evolving Collaboration: Performer and Composer Approaches to Creating Visual Music - Carlos Lopez Charles	
Paper Session 4 <i>Chair: Paul Draper</i>	2.30 – 2.50pm	Generative methods for music video composition - Julia Stefan	
	2.50 – 3.10pm	Time in media programming - Andrew Sorensen	
	3.10 – 3.30pm	Around Kallawaya Ronda - Gerado Dirie	
3.30 - 4.00pm Afternoon tea			
Workshops 2	4.00 – 5.00pm	Building S02, Room 6.37	Building S02, Room 6.38
		Sonification: Can bloogle resonators enhance representation of time, space and culture through the Person-Environment-Occupation Model? - Sandra Kirkwood	The Psychology of Embodied Creativity: Preparing the Creative Space before approaching the Digital Space - Simon Thatcher
Closing Panel <i>Chair: Michael Docherty</i>	5.00 – 5.30pm	Building S07, Room 1.23	
		5.30 pm - End of conference formalities	

CreateWorld 2014 - Conference Program

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CreateWorld 2014 - Keynote Presentations

Creative Ecosystems for the 21st Century

Jon McCormack from Monash University.

In just a few decades, technology has radically changed many creative disciplines. Once the domain of experimental artists and researchers working in expensive and often esoteric laboratories, technology is now a fundamental part of almost all creative conceptualisation, production, communication and distribution. But how well do people using these new technologies understand how they work and what effect have they had on individual and collective creativity?

We are now producing more information than any time in human history and much of that information is digital and almost instantly accessible. In this talk I will look at the new creative ecosystems of the 21st century and discuss how recent changes in technology will facilitate new forms of creativity between people, society and machines.

Jon McCormack is a researcher in computing and an internationally acclaimed electronic media artist. He is currently an ARC ARF/QEII fellow in the Faculty of Information Technology at Monash University in Melbourne. With a background in art, mathematics and computer science, his research seeks to discover new kinds of creativity using computers. This research spans visualisation and virtual environments, evolutionary systems, machine intelligence, human-computer interaction, music composition and sound arts. McCormack is the recipient of more than 15 international awards for both art and computing research, most recently the 2012 Eureka Prize for Innovation in Computer Science. His artworks have been widely exhibited at leading galleries, museums and symposia, including the Museum of Modern Art (New York, USA), Tate Gallery (Liverpool, UK), ACM SIGGRAPH (USA), Ars Electronica Museum (Austria) and the Australian Centre for the Moving Image (Australia). His recent book, "Computers and Creativity" (co-edited with Prof. Mark d'Inverno at the University of London) looks at how human creativity is being radically changed by technology and was recently described by the head of Sony research labs in Europe as "required reading for everyone involved in the create arts and interested in the role of technology towards shaping its future."

Breaking through the noise: Digital creativity and education

Tim Kitchen and Richard Turner-Jones from Adobe.

In a world where there is so much digital noise, effective and creative visual communication is more important than ever for educators to do well. Creativity in education is nothing new, what is new is how we are being creative and how effective our messages as educators are breaking through the digital noise that is so prevalent in today's society and constantly distracting our students. This presentation looks at some of the research surrounding the importance of digital creativity in education and provides samples of how Adobe video tools can be used to enhance the teaching and learning process and break through the noise.

Dr Tim Kitchen is the Senior Education Advocate at Adobe for Asia Pacific and the Vice President of DLTV (Digital Learning and Teaching Victoria). He is also the Co-Director of the Building Bridges interfaith dialogue program in Melbourne schools. Tim started his education career in 1991 and has taught in all three sectors (Primary, Secondary and Tertiary). Most recently, he was the Director of Learning Technologies at Strathcona Baptist Girls Grammar School in Melbourne, Australia. Tim is on the sessional teaching staff at Swinburne University of Technology in Melbourne where he teaches ICT in Education and also works casually with Wilkar Productions as a video producer, camera operator and editor. A passionate advocate for creativity in education, Tim is a regular writer and presenter for a wide range of national and international journals and conferences.

Richard Turner-Jones utilises his extensive knowledge of Adobe's tools & services as a Solutions Consultant for ANZ, expanding on his role in promoting Adobe products and services to the community, including managing the Brisbane Adobe User Groups. With more than 18 years in the multimedia and web application development field, as both an Adobe Certified Developer and Instructor, he has been involved in the development of many high profile projects for the Australian Army, Airservices Australia, Suncorp and Caterpillar, to name but a few.

Integrating live music, video games and audience interaction

Hans van Vliet from 7bit Hero

7Bit Hero (<http://7bithero.com/>) - We are an indie bitpop band that make video games you play at our shows! They are experimenting with new ways of combining video games, concert visuals and audience interaction. At our show, your smartphone will be your joystick that allows you to control a character in the multi-player game that is projected behind the band. Your opponents or friends are somewhere in the crowd around you, and the band is playing the soundtrack. 7bit Hero recently played at the incredible PAX AUS which saw 40,000 people attend, Festival of Voices in Tasmania and QUT's robot festival, Robotronica. Their song Come on. Stand out was nominated at the Q Music awards for best pop song.

Hans van Vliet is a musician and multimedia creative. As well as being a member of the bands 7Bit Hero and Hunz he is a creative director at the the Brisbane-based motion graphics company IV Motion.

Peer Reviewed Full Papers

Scrum – Industry Based Methodology Applied in Vocational Teaching Practice	Justin T. Carter
Emotional Discriminant Analysis for Music Composition	Jesus Lopez-Donado, Andrew Brown, Gerardo Dirié & Toby Gifford
Technology Enhanced One-to-One Pedagogy: Bringing the Music Studio Lesson into the 21st Century	Rachel Dwyer & Jessica O'Bryan
An Evolving Collaboration: Performer and Composer Approaches to Creating Visual Music	Nicole Canham & Carlos Lopez Charles
Left to Their Own Devices: agency, schizoanalysis, BYO technology and young adolescence	Josh Howard

Scrum – Industry Based Methodology Applied in Vocational Teaching Practice

Justin T Carter
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Abstract

Contemporary game production studios apply a variety of agile software development methodologies. The most common of these is the Scrum framework. Through our campus based game production studio we have developed a strategy for teaching that incorporates the Scrum framework into the learning environment. This paper reports on the strategy in its current form including the teaching methods, software technology and established systems that allow the application of Scrum software development framework into a vocational teaching environment.

Keywords

agile development, scrum, constructivist, games.

Introduction

During regular consultation with the game development industry in Brisbane Australia, the teaching team at Southbank Institute of Technology (SBIT) realised the need to incorporate an agile production methodology into the course curriculum. The SBIT Diploma of Games is a nationally accredited vocational qualification that has been delivered by SBIT since 2003. Learners participating in the course produce a wide range of game titles in a studio based teaching environment. This paper reports on our teaching practices and experience of implementing Schwaber and Sutherland's^[1] Scrum framework for agile software development into the course curriculum over the last five years.

Methods

This study was conducted through a process of what Schön^[10] defines as reflective practice in which the generation of new knowledge is created by researching through “action”, and “reflecting in and on action”^[10]. According to Merriam and Caffarella^[8] reflective practice provides researchers with a framework to “make judgements in complex and murky situations.”

As a teacher working in a nationally accredited vocational institute teachers are required to regularly meet with industry and other teaching professionals to document and moderate teaching practices. This process has provided a rich source of data for which a cycle of critical reflection could be applied both in and on action. The importance of reflection throughout this process is highlighted by Larrivee^[7], who states “when teachers become reflective practitioners, they move beyond a knowledge base of discrete skills to a stage where they integrate and modify skills to fit specific contexts, and

eventually, to a point where the skills are internalised enabling them to invent new strategies”.

Agile Software Development

Although incremental approaches to software development have been utilised for some time, the agile approach was defined by a group of seventeen software engineers who gathered in 2001 to discuss a particular group of software development methodologies. The results of this meeting were a set of principles for agile development, later published in the *Manifesto for Agile Software Development*^[1]. Agile methodologies work on the assumption that change is part of the development cycle and therefore are structured to support rapid and flexible responses to change. This is achieved through placing emphasis on the product rather than the product plan, and on communication amongst the development teams and the customer instead of development contracts.

According to Keith [2], the incremental and iterative nature of agile methods is beneficial to game developers aiming to develop more efficient game production processes. Keith [5] argues that the rising cost of development due to growing team sizes, changes in technology and market demand all influence the need for game developers to adopt agile approaches to development. In particular he suggests the use of the Scrum framework as a viable solution for game production.

Scrum Framework

The Scrum software development framework is a popular agile approach used within the game development community. The focus of the Scrum framework is on strategies for managing collaborative work when developing applications. Scrum offers advantages for game developers in the way in which it addresses issues that arise when large development teams work on complex software projects. Scrum uses simple strategies to enhance communication and teamwork. This is achieved through the core principle that small teams of people are able to produce better results than larger teams. Larger teams require more coordination and therefore generate too much complexity for an empirical process such as Scrum to manage^[5]. Implementing SCRUM in a large Game studio may involve dividing larger teams down into smaller development teams who work in parallel to a list of prioritised tasks. Known as the product backlog, these tasks are the responsibility of the product owner and considered to never be complete while the product exists.

The incremental and iterative nature of agile development is achieved in Scrum through “Time-boxed” Scrum events. Sprints are periods of up to a month in which a product in-

crement is created. Daily Scrum events consist of a 15-minute “time-boxed” event in which the development team plans out the activities for the next 24 hours.

Ken Schwaber and Jeff Sutherland who also co-authored the definitive Scrum Guide initially formulated Scrum [6] in an attempt to ensure accurate application of the framework. We have utilised the Scrum guide to apply team roles within the teaching environment.

Team Roles

Scrum involves participation from three core roles consisting of the *Product Owner*, the *Development Team* and the *Scrum Master*. These three roles make up the Scrum team and consist of the following functions:

Product Owner – The product owner’s role is the voice of the customer and drives the customer expectations through adding and prioritising tasks in the product backlog. There should only be one product owner that may also be part of the development team but should never act as the Scrum Master. In many game studios this may be the project manager.

Development Team – Development teams are self-organising small groups who are responsible for delivering product increments at the end of each Sprint (milestone). Members of the development team should possess cross functional technical skills involved in the design and development of the product.

Scrum Master – Although not the team leader the Scrum master facilitates the Scrum by ensuring the Scrum process is being adhered to and that barriers that arise do not detract from the task at hand. The Scrum master will often drive key meetings and challenge the team to improve through enforcing the rules of the Scrum framework.

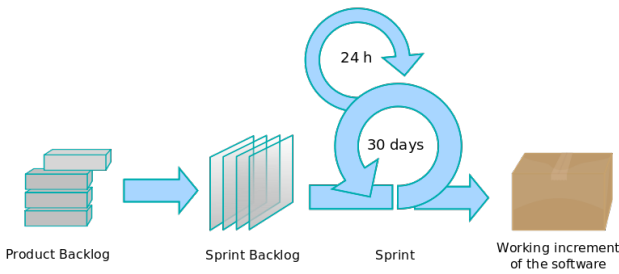


Figure 1. Scrum project management method [6]

Studio Kaboom – Southbank Institute Constructivists teaching paradigm

The application of agile game production methodologies in the learning environment creates challenges for traditional models of teaching and learning.

Traditional methods based on behavioural theory typically encompass fixed curriculum in which students work independently. In contrast, constructivism and constructivist based approaches such as problem based learning, places emphasis on the learner and their ability to solve real-life, practical problems. Students typically work in cooperative groups that focus on projects, which require solutions to problems [3]. The role of the teacher in constructivist models is to facilitate the learning experience in order to allow the acquisition of knowledge [9].

Honebein[3] summarizes what he describes as the seven pedagogical goals of a constructivists learning environments:

- Provide experience with the knowledge construction process (students determine how they will learn).
- Provide experience in and appreciation for multiple perspectives (evaluation of alternative solutions).
- Embed learning in realistic contexts (authentic tasks).
- Encourage ownership and a voice in the learning process (student centred learning).
- Embed learning in social experience (collaboration).
- Encourage the use of multiple modes of representation, (video, audio text, etc.).
- Encourage awareness of the knowledge construction process (reflection, metacognition).

When considering pedagogical approach, similarity can be drawn between constructivist based teaching practice and the Scrum framework. Although we had already been using constructivists teaching models, such as problem based learning, we found the Scrum framework more applicable to the learning environment than those we had already attempted such as the “waterfall” production model. This is because in comparison to the iterative nature of Scrum, the waterfall model is a more linear and sequential process [5].

Applying the Framework

Students are broken into small development teams that operate under the scrum framework. The teams are expected to work as a unit to reach a development goal. Team members are co-located, self-organising and utilise a high level of verbal communication across the team irrespective of specific development team roles.

The Scrum framework provides an environment that challenges the student to engage, communicate and collaborate. Learners meet frequently due to the daily Scrum and Sprint cycles. Development teams use a variety of tools to document the collaboration process. These include team-meeting minutes, timelines, spreadsheets, notes and tracking software. Implementing Scrum has also provided a framework for the teacher to guide and facilitate the learning process. If adhered to, learners are active in the environment, frequently identifying issues and tasks across the team, setting goals and tracking progress.

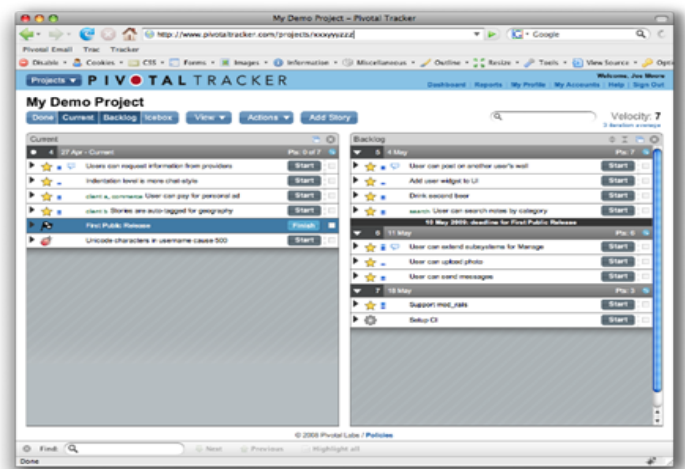


Figure 2. Pivotal Tracker

Reflecting upon early integration of Scrum into the classroom revealed several challenges for tracking production tasks and progress toward production goals. This included issues with communication, version control of documents and task allocation. To address these issues we adopted web based agile project management software: *Pivotal Tracker*.

The project development software functioned well as a teaching tool as it provided a record of students actively participating in the production process. This provides opportunity for the teacher to identify areas of the project and team communication that require guidance.

Establishing Student Development teams

The production of interactive games offers a unique creative opportunity for students wishing to explore disciplines within the creative industries:

- Animation
- 3D modelling
- 3D digital environments
- Concept and environment art
- Interaction and useability design
- Production management
- Sound design

Students working in the development teams share responsibility for managing the projects. A system of “lead” positions allows students to explore specific studio roles. This creates provisions for specialisation, as students are able to coordinate specific creative roles within the production. Students respond to job advertisements and must attend a formal interview by a panel that includes teaching staff and industry representatives. Students receive feedback from the panel on how they performed in the interview and are asked to reflect on potential areas for improvement.

Studio Design

In line with Honebein’s^[3] view on embedding learning within realistic contexts, we have attempted to provide an environment that simulates a game production studio. The physical layout of the studio is not a conventional classroom (Fig 3, Fig 4). The teacher does not sit at the front of the room in a position of authority as in traditional teaching environments. The studio also has a kitchen facility, meeting rooms and a reception desk, creating a professional environment that encourages communication and collaboration.

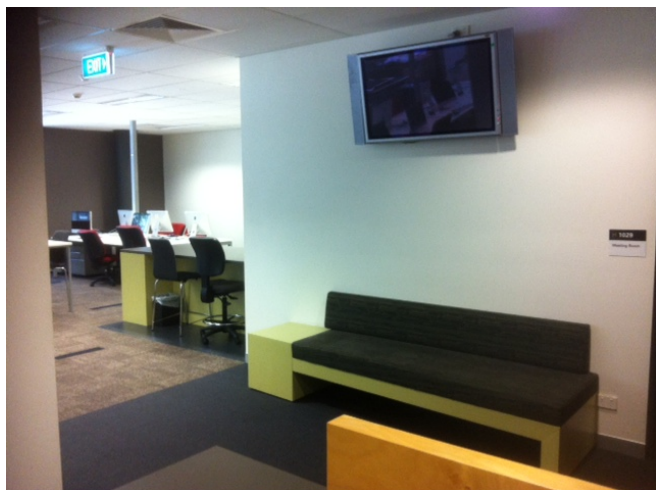


Figure 3. Studio Environment



Figure 4. Studio Foyer.

Role of the teacher

Teaching Scrum methodology in a constructivist’s environment has implications on teaching practice in particular the role the teacher plays in the production. During initial stages of the studio model, teachers assumed the role of product owner/production manager and enlisted a Scrum Master from the student cohort. However after a few iterations of this model we found that the development team would start to relax the methodology in the later stages of the production. This led to sprints and scrums becoming almost non-existent at the end of the project life cycle/semester.

An analysis of this phenomenon revealed a link to students and inexperienced developers acting in the Scrum Master role. In these cases the Scrum Master was inadequately equipped with an understanding of the role that the Scrum frameworks plays in applying the agile principles. We also found that students acting in the role of Scrum Master lost focus due to increasing demands of the Sprint backlog during crunch time (end of semester).

Reflecting on the activity we realised that while the teacher’s role in the production is primarily that of facilitator and product owner/production manager it is also important for the teacher to mentor the student. Acting alongside the Scrum master and helping to coordinate their task allocation ensured the Scrums continued through to completion. Facilitating this activity can be a difficult balancing act for teachers who are required to have an in depth understanding of both the role of product owner and the activities of the Scrum Master. Successful teaching in the studio environment requires an in-depth knowledge of agile principles, the Scrum framework and the role of a teacher in a constructivist’s environment.

Role of the learner

While working and learning in the studio model students are allocated “lead roles” based on their performance in a formal interview and their previous learning outcomes. Lead areas are driven by the project scope and decided by the teaching staff.

These may include disciplines such as:

- Programming
- 3D modelling

- Design
- Concept/technical artist

Learners acting in a lead position are not solely responsible for that particular aspect of the development and it is expected that the learner develop and apply skills and knowledge across a range of development tasks. Timetabling is structured in a way to allow fulltime participation in studio activity and students are not timetabled into “stand alone” classes. This provides the opportunity for students to immerse themselves in the production methodology. Previous versions of the studio model included subjects that operate independent from the requirements of the studio. We found this created a distraction from the production and the role the learner plays in the studio.

The scrum framework tasks the learner with working in self-directed teams to incrementally accomplish each sprint goal. The product owner/teacher or external client creates a prioritised list of product goals for the development teams to accomplish. Students must embrace the Scrum framework when completing the sprint backlog. It is therefore important that the teacher empowers the development teams to identify the amount that can be achieved in one sprint. This process further emphasises the collaborative self-directed nature Scrum has in common with constructivist teaching practice.

Production Activity

The year 2014 signifies a decade of teaching and learning in Southbank’s Studio Kaboom. The following is a small sample of production and industry related activity.

Game Development Competitions

Students participate in conferences and game development competitions.

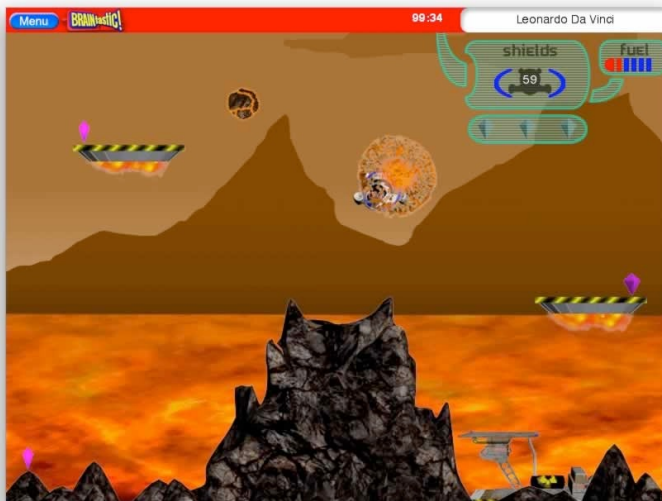


Figure 5. Frequency 2006 - Games Connect Asia Pacific

Studio Published Work

Southbank Studio Kaboom has published titles for a variety of platforms.



Figure 6. Galactic Retrieval Squad - EdAlive 2005.

Industry engagement

Students frequently participate in quality assurance and focus testing with a variety of local Brisbane studios.



Figure 7. Invasion, Quality Assurance Testing - ScrewTape Studios 2012.



Figure 8. London Olympics, Focus testing - Sega Australia 2012.

Future Research

When reflecting upon student feedback there was evidence to support that students may not fully understand the benefits of working in a simulated studio. This indicates to us that

perhaps there is a need for further investigation into the role metacognition plays within the studio environment and how we may introduce the student to this concept. Metacognition refers to how the student thinks about their own thinking and the understanding of how they process information^[4]. Students entering the studio production model demonstrate varying levels of metacognition, in some instances learners display traits typically associated with “Novice Learners”. Novice learners do not think about how they think, they fail to engage in the “self- planning, self-monitoring, self-regulating, self-questioning, self-reflecting, self- reviewing” that is necessary to critical thinking and learning^[4]. In contrast to this others demonstrate “expert learning” traits in which they have a greater understanding and awareness of how to learn and identify strategies that allow them to learn. Students who display these traits tend to adapt to the studio model quickly and achieve higher level of success.

Conclusion

Our research to date indicates that applying the Scrum framework within the studio context has proven to be beneficial for students in the game production phase of the course. A majority of students have reported having an enjoyable and positive learning experience. Feedback from industry indicates that our learners are well equipped to understand contemporary game production. Teachers working in this environment have also reported that while there are many challenges and implications on practice, the chosen methodologies work well together. In particular feedback indicates very positive links between the application of the Scrum framework and its ability to facilitate constructivist-teaching methods. These links include the ability of the framework to promote self-directed learning, communication and collaboration. The methods discussed in this paper offer strategies for teaching and learning Scrum in a constructivist studio environment.

Overall we have found the Scrum framework to be an effective approach that helps to facilitate a collaborative environment. This paper offers a brief insight into our current activity and highlights the need for further inquiry into the application of Scrum into constructivist learning environments.

Acknowledgements

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Emotional Discriminant Analysis for Music Composition

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Abstract

A compositional workflow is proposed to assist composing via ‘emotional form’ - where the structure of a composition is specified as a sequence of desired emotional content. The workflow guides composers’ selection (or construction) of musical features contingent upon their prior emotional responses to a training set of musical fragments. This workflow combines Plutchik’s emotional classification framework with the statistical formalism of Fisher Discriminants to correlate emotional content with combinations of musical features. These correlations are used to compose by populating sections of a predefined musical form – in our case an electro acoustic adaptation of the sonata form termed ‘emotional sonata form’.

Keywords

music composition, Fisher discriminant scores, computer assisted composition, emotional sonata form, cantata.

Introduction

This paper describes a computer-assisted methodology for music composition. In particular, electro acoustic composition is explored, but the methodology could be applied to other musical genres. The method aims to aid composers in discovering musical features that correlate with the composer’s emotional perceptions - or musical impressions (MIs) from a pre-composed set of musical/audio fragments. We suggest analyzing audio/music fragments by calculating a set of deterministic musical descriptors. Then by using formal statistical discrimination analysis we elucidate a ranking of musical descriptors as they correlate with previously perceived emotions. Further, two electro acoustic compositions are reported as case studies so as to analyze the methodology using reflective practice as a research approach. The aim is to investigate our compositional methodology and how it could further and motivate creativity whilst exploring how certain deterministic musical features can be used as emotional drivers during the composition process. Certain challenges are encountered and discussed, as well as the musicality we experienced with this approach.

The paper follows with a methodology section that expands on how to discover emotional musical descriptors. To achieve this a well-known statistical discriminant is described as it assists on music feature selection and their correlations with specific emotions from a reported system of human emotions classification [1]. The paper then follows with two case studies comprising musical outcomes and pertinent reflective practice insights.

Methods: Emotional Classification

Robert Plutchik offers a three-dimensional model of emotions as a hierarchy of both general and specific emotions [1, 2]. It arranges emotions in concentric circles where inner circles are basic and outer circles complex. Blending the inner circle emotions also forms outer circles. Plutchik’s model utilizes a circumplex representation, where emotional words are plotted based on similarity [1]. As applied to this study, Plutchik’s framework is chosen in a semi-arbitrary basis. Nevertheless, as with other models, its geometric symmetry allows for the identification of antagonistic emotions. It also provides a concentric hierarchical classifications which could be exploited by exploring step-wise based methodologies in future developments of this research [2].

Plutchick’s approach to emotions’ classification is based on evolutionary principles. Evolution is a theory, not a law, and although evolution has served as a theoretical paradigm for constructing emotional, computational and biological heuristics it remains unproven. Plutchik establishes that his classification is based on evolution as a way to make it a universal system for living creatures – this forms a conceptual fault. Further, neither Plutchick nor, more recently, Cambria [2] construct a formal theoretical correlate between survival mechanisms and emotions.

Ultimately however, notwithstanding any shortcomings in Plutchik and Cambria’s claims, the Plutchik wheel is a useful device for this research as we are simply leveraging the classification to enhance the creative process of music composition. Ian Whalley has used Plutchik’s classification scheme for emotional structuring of network distributed music, where the associated colours form part of a graphical scores that are “visually interesting enough to be projected as part of performances, to allow audience greater understanding of distributed works” [19].

Methods: Feature extraction

The proposed workflow starts with labeling a set of musical fragments using a vector of 19 music descriptors namely:

1. Amplitude Modulation [3],
2. Classic Auto Correlation [4],
3. Complex Domain Onset Detection [5],
4. Energy [4],
5. Envelope [4],
6. Envelope Shape Statistics [6],
7. LPC: by computing the Linear Predictor Coefficients (LPC) of a signal frame. It uses autocorrelation and Levinson-Durbin algorithm [7],

8. Loudness [8],
9. Mel-frequencies cepstrum coefficients [9],
10. Spectrum, Perceptual Sharpness [10],
11. Perceptual Spread [10],
12. Spectral Decrease [10],
13. Spectral Flatness [4],
14. Spectral, Flux [4],
15. Spectral Roll-off [11],
16. Spectral Shape Statistics [6],
17. Spectral Slope [10],
18. Spectral Variation [10],
19. Variation and Temporal Shape Statistics [10].

Scripts for measuring these descriptors for an arbitrary audio file are available to the research community within the YAFEE suite of UNIX scripts [4] Describing each musical descriptor in detail is beyond the scope of this document; nevertheless the reader is encouraged to consult the main YAFEE's paper.

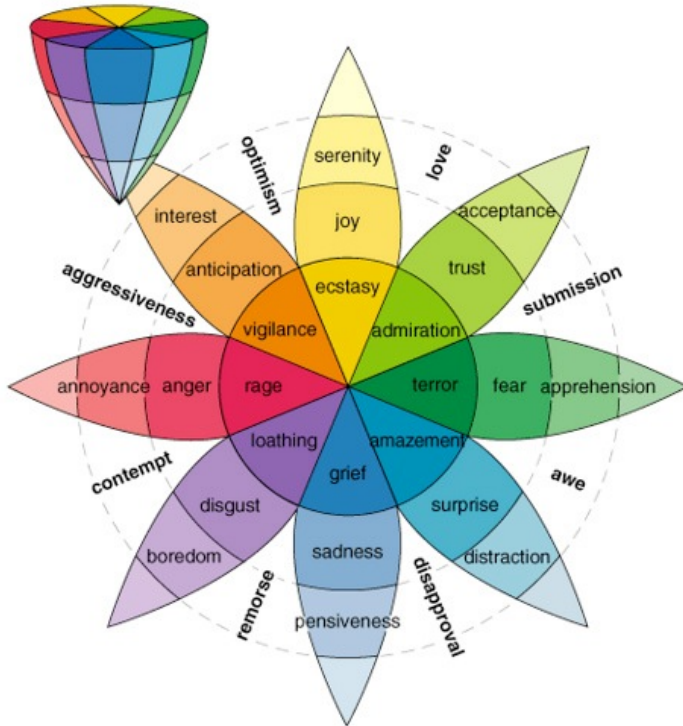


Figure 1: Plutchik's Wheel of Emotions (1980)

Robert Plutchik created a new conception of emotions in 1980. He called it the "wheel of emotions" because it demonstrated how different emotions could blend into one another and create new emotions. Plutchik first suggested 8 primary bipolar emotions: joy versus sadness; anger versus fear; trust versus disgust; and surprise versus anticipation. From there Plutchik identified more advanced emotions based on their differences in intensities. If you look at the diagram below you can see how each emotion relates to the other [1].

Methods: Fisher discrimination

Fisher [12], proposed a statistical method – Linear Discriminant Analysis, which aims to achieve optimal linear dimensionality reduction of multivariate data with categorical observations. It is therefore not strictly a discriminant itself, but its criterion for the discrimination can be used as a method to generate feature scores. Hence the Fisher criterion for discrimination can be used to discover optimal subsets of music features as they correlate to a perceived emotion. This, in the artificial intelligence community is regarded as unsupervised learning which here is used to partition the feature space in a meaningful manner. For notation proposes, let us define MI (Musical Impression) and neg-MI (negative or opposite Musical Impression) as pairs of antagonistic emotions generalized for any emotions' classification framework - in this paper we specifically use the Putchnik's paradigm as already discussed. Then, the Fisher score for a selected musical feature k and emotional axis l can be defined as:

$$FS_{kl} = \frac{(\mu_{\{MI\}} - \mu_{\{\neg MI\}})^2}{\sigma_{\{MI\}}^2 + \sigma_{\{\neg MI\}}^2}$$

where μ and σ are mean and standard deviation for the MI and non-MI samples respectively. FS_{kl} is a statistical measure of importance or relevance of a certain musical feature at a certain emotional axis within Plutchnik's wheel of emotions (Fig. 1) for a set of discrete music samples within a selected MI.

Applications

We report two applications. The first piece is an electro acoustic composition, which is based on a pool of pre-recorded choir passages and a set of modular synthesizer patches also with associated pre-recorded audio files. All annotated audio files were annotated by the composer and a database was generated with calculated FS_{kl} across audio files for each of four {MI, -MI} clusters: (i) {anger, fear}, (ii) {trust, disgust}, (iii) {surprise, anticipation}, and (iv) {joy, sadness}. Then these feature ranks were utilized to bias the composition process, by using the idea of sonata-form and hence using emotionally contrasting musical features to populate each segment of the sonata structure. We call this piece/performance:

Four short cantatas in emotional-sonata-form

- I. anger versus fear;
- II. trust versus disgust;
- III. surprise versus anticipation;
- IV. joy versus sadness;

Emotional sonata form is an idea that evolved naturally during the development of our emotional annotation process. Hence, we propose using musical features that highly correlate with specific MIs to bias the musical discourse. We arbitrarily use the sonata form, which commonly uses the following structure per movement:

- (i) introduction;
- (ii) exposition;
- (iii) development;
- (iv) recapitulation.

Here we approach the structure of each movement by using the sonata form as a structural guide for composing a musical discourse. The sonata-form is then populated with themes based on musical features that are ranked as emotion prevalent. Classically, the sonata form uses more traditional variation tools, i.e. dynamics, key modulation, tempo, etc, so as to construct a musical discourse.

In our case, the introduction (i) is ad-lib but exposition (ii) is monothematic. For instance Haydn was well known for monothematic expositions in which only key was used to contrast the same material. In contrast with Haydn, we use the highest-ranking emotional musical feature for one MI to generate a contrasting exposition, hence, exploiting the inherent antagonist pairs in that MI. During development (iii), other highly ranking features for the MI associated to the movement are introduced to develop the main theme. Finally, in recapitulation (iv), a variation on the exposition is revisited to construct a sense of closure.

From a technical stand point, the four cantatas total to a 16 minutes long composition. The piece is conceived for virtual choir over 8 ambisonics channels with concomitant live electronics via 4 surround channels spatially distributed in real-time by the performer within the modular synthesizer.

Our second piece was an earlier application prior to this paper. In this piece each movement was conceptualized by just populating it with features the highly correlated just one Plutchik's emotion or MI.

The second application was developed prior to this paper. The main author composed and presented "18 themes for 6 movements of 6 individuals with 6 emotions" [13]. This was a partial approximation to this paper's workflow in that Plutchik's classification paradigm was used as a driver of creativity. Hence some compositional experiences, later in the discussion section, apply to this paper. In this piece a modular synthesizer composition was based on the composer's 6 acquaintances' emotions. A short title for this composition was 18{6{6{6}}} which was meant as a pseudo LISPian joke describing how 18 eurorack modular synthesizer patches produced 18 fragments of sound that got labeled with Plutchik's classes of emotions.

In "18{6{6{6}}}" a Plutchik empirical grouping of tertiary emotions into 6 primary emotions was used. Then the composer adventured into improvising 6 movements each using exclusively patches that were correlated with either of 6 emotions as perceived by my 6 close friends/colleagues. It is important to highlight that in this early work third party individuals and not the composer did the annotation of music fragments. Finally, this became a hypothetical imperfect parlor of 6 imperfect individuals for 6 perfect emotions and 6 imperfect music movements. To bring the spirits up somehow the piece was summarized by a child poem:

*Lukes is for Love * &
Joseph is for Joy &
^ Sam is for Surprise! ^
\$ Ann is for Anger \$
% Sid is for Sadness % ,but,
Fred is for Fear #*

Discussion

During the application of this paper's framework, some compositional experiences are pertinent to be discussed by the main author. For instance, in "18{6{6{6}}}" a Plutchik empirical grouping of tertiary emotions into 6 primary emotions was used but none of the synthesizer patches were characterized by musical features – hence Fisher's discriminant were not used. Although only a simple classification of emotions was the gravitational point to drive creativity, the composer could derive a number of insights into which technical aspects of the composition were correlated to particular emotions. It could be said that a high level form of classification and musical feature extraction was a direct consequence of just mapping Plutchik's emotions to certain patches.

As one of many examples, in the movement "\$ Ann is for Anger \$" a stuttering type patch correlated with anger yet exactly the same patch correlated with "% Sid is for Sadness %". The main difference was that the later included a convolution filter at the end of the audio signal. It is almost as if a convolution filter is an entity that could impact the advancement of someone's stages of grief! If the reader is interested in listening, this patch was extensively used in the piece 'One with Viri' released in the CD Trogotronic compilation under two labels, pro-noise [14] and grindcore karaoke [15] with an audiovisual version available online [16]. Certainly, these kind of insights could be far fetched, yet the main idea is using these paradigms as tools for compositional self-reflection, and hopefully, drivers of creativity.

During the composition of the Four short cantatas the overall process was much more involved than with 18{6{6{6}}}. For instance the urge to generate compositional insights whilst just classifying musical fragments was ever present. Nevertheless, although the number-crunching associated with calculating musical features for all themes was somehow tedious due to a lack of computational automation (each script was run by hand for each music/audio fragment) the final results paid off in terms of possibilities but some challenges remain. For instance, time-based musical descriptors such as Amplitude Modulation, Auto Correlation, Envelope Shape Statistics and Loudness were very usable as compositional tools – i.e. to generate variations on themes that were perceived with specific emotions. In the other hand descriptors calculated from the frequency domain, such as, Perceptual Sharpness, Spectral Variation, and Spectral Decrease were difficult to conceptualize aesthetically. Perhaps an audition set can be created with simple audio sections that present with contrasting examples of these musical descriptors so as to train our ears to flavor the presence of them in more heterogeneous audio signals. A blackboard brain-storm example of this compositional process is shown in Figure 2.

It can be argued that the use, or abuse, of Fisher discriminants to generate open-ended mappings of musical descriptors with perceived emotions could lack musicality. The idea of applying Fisher discriminants to solve classification problems, i.e. by creating a training set and then hoping to predict certain qualities of a music passage based on a set of descriptors has been suggested before [13]. This idea of generalization does not apply here. Since the discovered correlations are not meant to further generalize over future predictions but rather to instigate compositional ideas, the only formal constraints were: (i) the dimensionality of the feature set and (ii) the number of different music fragment per MI. Hence a manageable low dimension of features ($n=19$) with a large enough set of pre-composed themes –

ten fold n is a good heuristic – will ensure that calculated Fisher scores will be representative correlates in the feature space. Again, the idea is for the composer to discover correlations between musical features and his/her *a priori* perceived emotions for each music fragment. Then it is up to the composer to use or discard such correlations during the creative process.

We find that although this framework is still on its infancy, the possibilities of utilizing composer's perceived emotions as another compositional tool such as key, dynamics or tonality carries exiting prospects. A natural progression of this framework will be to extrapolate the analysis not only to the composer's perceived emotions but those of an individual, or further, to the emotional aggregate of a cohort of individuals. Although we did this in our second case study, it would be interesting to use a large cohort of people to annotate the music fragments. For instance an online tool could be created to allow participants to audition musical fragments as well as let them chose a perceived emotion from a drop-down list.

Despite the fact that, at times, the final passages did not explicitly evoke the intended emotion, the compositional process was indeed permeated with emotionally evocations as pre-annotated fragments of music were revisited. These made the compositional process gratifying and fluent.

The compositional workflow was highly usable and helpful. Specially when using emotionally prevalent features to populated section of an emotional-sonata-form. We found the overall process to be inspirational and thinking of future variations is exiting. For instance applying the same compositional paradigm to different emotional classification systems

or using different musical descriptors as they apply to other musical forms beyond the sonata form paves the way for exiting new ideas and music.

In summary, a musical composition is presented which attempts to drive creativity based on a pool of pre-composed music/audio fragments classified by the composer's own emotional perception of each theme. The process involves the utilization of fisher discrimination as a tool to statistically rank music descriptors from a pool of musical themes. Such discrimination is based on bipolar class separation of antagonistic emotions as per Plutchik's paradigm.

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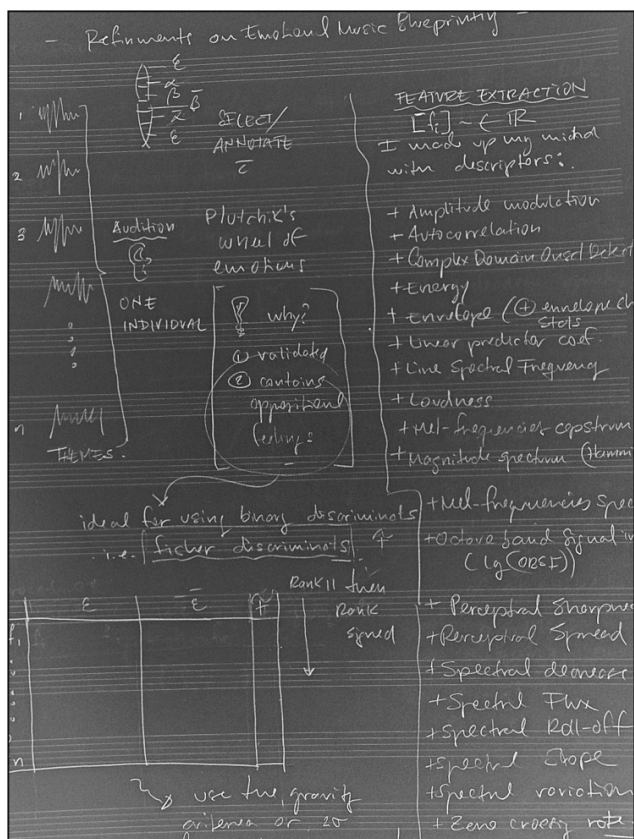


Figure 2: Blackboard brainstorm example of the Four Short Cantatas compositional process [17].

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Technology enhanced one-to-one pedagogy: Bringing the music studio lesson into the 21st century

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Abstract

Within Australia and Britain, most applied music lessons take place in private with a single teacher and student—the one-to-one model. For many years, particularly in the tertiary sector, it has been perceived that teachers of this model are resistant to change, not following trends in education. However, as cultural norms accept innovative technologies and ways of communicating, applied music teachers are also beginning to embrace technologies to enhance student learning.

The purpose of this paper is to propose three ways in which learning and teaching in the one-to-one applied music lesson may be enhanced by the use of readily available technologies. First, we discuss the potential for videos of student performances to be shared in an online space, providing opportunities for self and peer evaluation. Second, we provide examples of how a smartphone may be utilised during the lesson in ways that serve as a prompt and reminder to guide practice when the teacher is not present. Third, we explore the applications of the “flipped classroom” concept for the one-to-one lesson, as a way of making the best possible use of the limited time that the teacher and student spend together.

Keywords

One-to-one music lesson; applied music lesson; tertiary music training; tertiary music institutions; music technology

Introduction

We begin by briefly outlining the cultural practices associated with one-to-one music lessons, particularly in regard to tertiary training. Next, we discuss the evidence within the literature of teachers using technology to enhance their students' learning and facilitate new pedagogical practices. We then describe a series of possibilities for broadening the range of pedagogical practices in the one-to-one teacher's tool-kit: an online space for sharing videos of student performances, providing opportunities to learn from peer and self evaluation, use of readily available technology such as smartphones to provide memory aids that inform home practice, and use of teacher-selected video/audio resources as 'homework' for students. The ideas presented in this paper are propositions; their efficacy as yet untested in this context by empirical research. We draw on examples from our own research and practice, and those within the broader educational literature to illustrate how these ideas might be applied in the context of the one-to-one music lesson.

Cultures of learning in one-to-one music lessons

The one-to-one applied music lesson stems from the ancient master apprentice learning and teaching approach, where “learners spontaneously, or by observation and imitation, internalize a direct replica of the behaviour they see around them” (Lave, 1982, p. 182). Later, elite musical training approaches in European music emerged from the medieval music guilds, which maintained secrecy in their dealings so as to prevent loss of intellectual property or oversupply of craftsmen. This secrecy has been maintained to this day, with one-to-one applied music lessons at the tertiary level perceived as resistant to innovation in pedagogy or content delivery, and teachers seen to protect their “intellectual property” through promulgation of a “guru” status or “stable” of successful students (Davidson & Jordan, 2007; Wexler, 2009, Johnson, 2009).

Frequently, private practice or conservatoire teachers come to teaching after a performing career (Davidson & Jordan, 2007; Gaunt, 2008, 2009), without adequate training in pedagogy. It is commonly argued that tertiary teachers of one-to-one lessons are resistant to change (Carey, 2004; Davidson & Jordan, 2007; Johnson, 2009), however, recent research suggests resistance is more due to a lack of adequate teacher preparation and professional support, with teacher isolation and lack of access to teacher training more likely the culprit of “teaching as I was taught” (Gaunt, 2008, 2009). As Purser (2005) identifies, instrumental teachers who work in professional isolation without job-specific training do not have the benefit of a “pool of accumulated wisdom” (p. 287).

Nevertheless, in developing the musicians' craft, old ways of teaching may persist simply because of the kinaesthetic skill-building requirements of learning an instrument or voice, or because the technologies recently developed to assist learning have not been readily transferable to applied music learning. Zhukov (2004) found no use of digital technologies in the one-to-one teaching and learning space in her study of tertiary classical applied music lessons. In her study, recording of music lessons were rare, however, she found that teachers recommended their students listen to recordings of performances by great artists. Her findings suggest that classical teachers were not taking full advantage of the technologies then available to enhance teaching and learning experiences, although this may have changed in the intervening years, with the promulgation of new digital technologies in communication.

Existing research

The pedagogical practices of one-to-one music teachers are an area that has mostly escaped the scrutiny of researchers,

partly because of the intimacy and inaccessibility of the teaching space (Carey et al, 2013). Gaunt (2008) asked conservatoire teachers to describe their use of audio and video recording to support learning, with the vast majority suggesting that it was up to the student to initiate recording lessons or practice, if they believed they would find it useful. Thus, there is limited evidence of the ways in which instrumental teachers incorporate digital technology resources and tools in their lessons. One area that has long investigated various technologies in the applied music lesson, however, is in singing. Welch et al (2005) conducted an action research project into uses of VOXed computer software in the singing studio and results indicated “new technology can impact positively on teacher behaviours and student experiences by providing more meaningful feedback through an enriched pedagogy” (Welch et al, 2005, p 225). Callaghan, Thorpe and van Doorn (2004) investigated the use of a visual feedback technology tool to enhance singing student learning and found positive reactions to its use by both teachers and students, while Southcott and Mitchell’s study of recording singing students’ performances found that “all 15 students rated the recording/playback process as ‘helpful’ to ‘very helpful’, and valued its immediacy” (2013, 25).

Some applied music teachers do make use of various technologies in applied music lessons, particularly those in the CCM (contemporary commercial music) industries. O’Byran’s 2007 survey of 17 Australian CCM singing teachers in private practice and tertiary institutions found that while piano, CD player and backing tapes were the tools used by most, CD backing recordings were considered the most important tool in this genre.

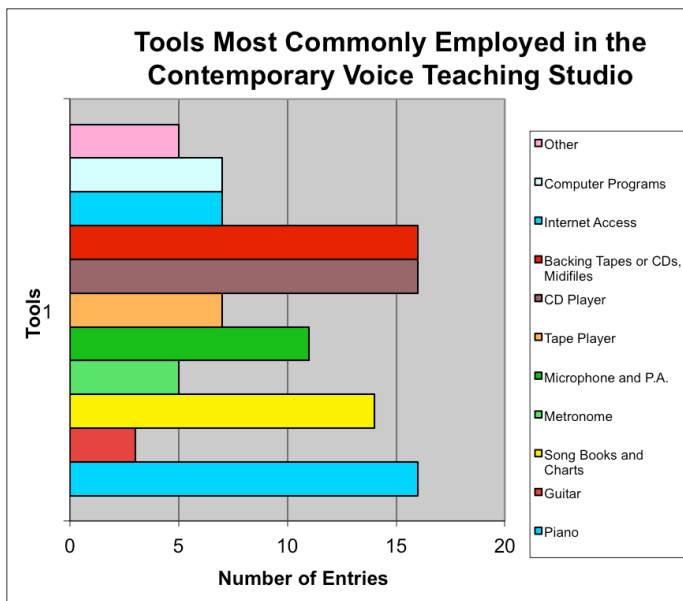


Figure 1. Tools in the CCM voice teaching studio

At the time YouTube (created in 2005) and other video-logs were not in common use, which is reflected in why less than 5% of teachers at the time of the survey made use of Internet access to enhance singing lessons. Also not widely available were smart phones with recording apps or video capability. While video cameras and recordable CDs were available, the cost and relatively awkward user-interface may be two considerations as to why they were not in frequent use. Now, in 2014, Chandler (2014, in press) reports common use of video, computer based recording devices and

composing tools and smartphones in CCM studios, as well as the usual combinations of mic, piano and/or guitar. In the singing studio generally, there are several computer software programs created in the last ten years that analyse the singing student’s voice using internal computer mics to provide instantaneous feedback. These include Sing&See (Cantovation Technology)—which is a pitch display program; VoiceVista (Miller)—a formant tuning program; and Your Voice: An Inside View (McCoy), which is a multi-media voice science and pedagogy program. All of these software programs were developed to enable immediate feedback of the student’s voice during performance, and research suggests the use of technology facilitates can improve teaching and learning experiences, although the percentage of singing teachers making use of these technologies in their studios has not yet been investigated.

Possibilities

In this section, we describe three possibilities that have been tested in broader educational settings. While they do not refer to specific technical aspects of musical training as in the previous section’s computer software examples, they nevertheless offer inexpensive technological options for teachers and students, which, we believe, have potential to enhance pedagogical interaction in one-to-one tertiary music lessons.

Online sharing of student performances

With the rise of social media and YouTube in the last five years, today’s students are comfortable with the idea of sharing their work online and being able to interact with their classmates in an online space. This is happening informally in the Musical Theatre department at the Queensland Conservatorium, Griffith University (QCGU), where students share their recorded show reels and performances on social media sites. By making videos of student performances available online, new avenues for learning are opened up. First, students may be required to reflect upon and evaluate their own performances, facilitating more reflective practice. Second, students may also be required to evaluate and provide constructive feedback on the performances of their peers, enhancing their ability to assess performances.

These skills are highly useful for music teachers, and while conservatoire students focus on performing, research indicates that almost all musicians teach at some point in their professional lives (Bennett, 2009), so developing constructive evaluation approaches may enhance future teaching careers. Tools such as VoiceThread (voicethread.com) can facilitate spoken, typed or video comments, as well as annotation of the original video, which provide rich opportunities for complex and specific feedback to be provided. Of course, the management of cyber-etiquette in this situation needs to be considered, but this should not be insurmountable for tertiary students.

Using a Smartphone to provide an aide mémoire for practice

Learning an instrument or voice involves mastery of specific postures and gestures, typically demonstrated during lessons and practiced daily in between lessons. Because of their specificity, the smallest deviation between what is demonstrated in the lesson and what is practiced at home can mean the week’s practice is wasted, with more time then spent relearning the correct movement in the subsequent lesson.

Most teachers and students now have a camera and video camera (Smartphone) with them during every lesson. Simple photographs of particular postures, or a short video of the teacher performing the movement may provide an *aide mémoire* for the student, increasing the efficiency of daily practice. One of the authors of this article makes consistent use of smartphone and tablet technology to audio-record singing lessons and video the student's postural alignment to facilitate efficient home practice.

While singing technology apps are not yet available in portable form, one hope that such technologies will soon be developed to enhance specific technical aspects of the music student's training. Already available in app form on the Apple Mac OS are guitar tuners, metronomes, decibel meters and a spectrometer, indicating that other technologies to analyse technical musical development cannot be too far away.

"Flipping the classroom"

Much has been made of the "flipped classroom" and MOOC phenomenon in higher education, with many variations on the theme now common in school and tertiary educational settings. In the applied music lesson, most would agree one-to-one contact cannot be replaced by mass online tuition. However, there is potential for teacher-centred and teacher-selected videos to be a valuable supplement to the one-to-one lesson. Rather than a teacher demonstrating the same technique or skill multiple times for each student, directing students to a video demonstration at a particular time may increase the efficiency of the pedagogy, and, as above, provide the students with access to the demonstration at times when the teacher is not present. Similarly, the teacher directing the student to videos (or recordings) of an eminent performer who is considered to be a master of a particular technique or musical style has the potential to enhance the students' learning without taking up valuable lesson time. Such repositories could be established using readily available tools such as Blackboard/Moodle sites, YouTube Channels or Spotify playlists. In the Musical Theatre department at QCGU, one of the authors of this paper (a tertiary singing teacher) uses her YouTube account to show videos of larynxes and approaches to breath management. The same YouTube videos are recommended to all her students and they collaborate with their peers to enhance their learning experience. Having a shared online community for this work would potentially better facilitate this process.

Concluding remarks

Over the course of writing this paper, it has become apparent to us that the use of technology as a way of enhancing one-to-one teaching practices has enormous potential for future research. Based on the literature and our observations in the tertiary institutions in which we work, there appears to be a substantial difference in the use of various technologies between contemporary and 'classical' music genres. We believe that there is potential for greater cross fertilisation of these musical traditions and that this may lead to more thoughtful and reflective pedagogical practices. Further, we recognise that teachers need to be aware of how today's students already use technology and online spaces to enhance their learning, and we encourage teachers to capi-

talise upon this to enhance their own pedagogical processes in the one-to-one music lesson.

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An Evolving Collaboration: Performer and Composer Approaches to Creating Visual Music

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Abstract

This article aims to identify the key factors that contributed to an evolving collaborative practice between a performer (Canham) and a composer (Lopez Charles). Three new works for clarinet, electronics and video, presented as case studies, form the basis of this study. Journals, artifacts including sound recordings of experiments, rehearsals, performance documentation and joint reflection will allow the researchers to describe and reflect upon the evolution of their collaborative practice as it unfolded.

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Keywords

visual music, collaboration, performance, composition, multimedia, digital technology

Introduction

Dannenberg suggests that the use of computers in music composition “leads to new ways of thinking about music composition and performance” [6]. In this project, two participant/researchers set out to document and observe their own collaborative process in the context of the development of a new work for clarinet, electronics and video which was based around interactive components facilitated by the use of computer technology. The aim was to track and identify key factors – including new ways of thinking – that emerged during the process of creating three visual music works.

The Study of Collaboration

Collaboration has been a subject of study in numerous fields including business [15], the arts and sciences, [14] in improvisational contexts in music and theatre [20] and in the field of performer/composer collaboration [see for example 7, 8, 12 and 13]. Performer/composer studies have addressed issues of the nature of collaboration – which are often framed in terms of ‘process’ – and the outcomes of the collaborative work environment – which Hayden refers to as ‘output’ [12]. Analysis and observations about collaboration, subsequently, can be made from a variety of angles which include detailed descriptions of processes involved [14], or a focus on the employment of a collaborative approach with a certain outcome or output in mind.

John-Steiner suggests that “construction of knowledge is embedded in the cultural and historical milieu in which it

arises [14]”. Her view provides an interesting challenge in the study of performer/composer collaborations in so far as these roles have often been perceived to be quite separate. In the western art music tradition, it has been argued that this segregation of roles is a product of the view of the score-as-object, an idea attributed to German music critic E.T.A Hoffman [9]. Hoffman’s notion of ‘Werktreue’, first proposed in the early 1800s, introduced a concept of musical works in which all other aspects of the presentation should be subservient to the score: “musical activities, be they of composition, performance, reception, evaluation, or analysis, should no longer be guided by extra-musical considerations of a religious, social, or scientific sort. They should now be guided by the works themselves [9]”.

The nineteenth century view of composition and performance has endured in two key ways. Both the direction and evolution of practice have been influenced. One of ways in which this influence can be perceived is in the limits the *werktreue* concept has placed on the musicological discourse [9]. A preoccupation with the score has shaped the scope and focus of scholarship, with many other aspects of the compositional and music making process being overlooked. This has included a narrow view of the role the performer [21] and, until recently, limited contribution from performers in academic research [5]. A second consequence of a score-based approach has been the evolution of practice to reflect this emphasis, one example of which is the lengthy period in which improvisation for classically trained performers was not in vogue [21].

In recent years, however, many of the limitations of a nineteenth century view of composition and performance have been addressed or challenged [2, 9, 10, 21, 23]. One advantage of the new directions in thinking and practice proposed has been the examination of a range of creative and artistic roles and relationships. Increasing research based upon a reconsideration of the work of the composer, the view of the performer and the opportunities offered by the addition of computer technology in the composition and performance workspace provide examples of a shifting dialogue.

Challenging Traditional Roles

A common theme in recent research into the activities of composers and performers has been the unmasking of processes that were not previously viewed as central to a discussion about creating new works. Studies of collaboration have been one area of scholarship in which more nuanced pictures of performer and composer have been proposed. These studies also often reflect consideration of other elements influencing collaborative environments, including the use of digital technology.

With regard to composers, Hayden and Windsor [12] highlight the inaccuracy of the commonly held view of the composer as a lone genius when examined in the context of the

creation of new works. Rather, they suggest that composers have always had some degree of interaction with performers, conductors or publishers, but that this has often been neglected in the discourse.

Performers, according to Crispin, [5] negotiate a reality in which many aspects of their practice are deliberately kept half-concealed: the years of training and discipline required in order to develop the connection between performer and instrument is often hidden in the desire to make performances appear effortless. Crispin suggests this reveals a preoccupation with the ideal at the expense of developing a “deep understanding of live performance in all its guises [5]”.

Digital technology has also been recognized as a key compositional and collaborative tool in the twenty first century. Dannenberg, commenting on the rapid growth in capabilities of digital technology and the opportunity these present in creative contexts, suggests that “the biggest challenges ahead are artistic rather than technological. One of the attractions of this pursuit is that there are relatively few precedents and no established theory [5]”.

In the absence of a single established theory, a range of ideas have been proposed in understanding the role of digital technology in artistic collaborations. Within the domain of music making, some studies have focused on the way technology has been used as an instrument for artistic practice – Partti’s study of the ‘digital musician’ is one example [18]. Digital technology has also been harnessed to facilitate the sharing of information among musicians through web-based communities of practice. [19] Literature concerning the design of computer-supported co-operative work systems (CSCW) addresses the influence of social factors on systems design [4]. One aspect of CSCW which is pertinent to this study is the notion of tailorability. [23] Although Dannenberg [6] emphasizes that creating visual music using technology is essentially an artistic challenge, questions of tailorability - how system design decisions are to be made, and who is to make them - remain an issue. These three elements of performer, composer and digital technology are focal points of this investigation of aspects of collaboration.

Research aims

Research questions

The study was built around a central question: *What were the key factors that shaped this collaboration?*

These factors included observation and consideration of the facilitators and constraints inherent in the study, which included:

- Practical and creative matters, including issues of systems design.
- The nature of the working process, identification of patterns of decision making, evaluation and discussion.
- Discussion of the similarities and differences between performer and composer objectives as the collaboration progressed.

In acknowledging that the project united artists with different backgrounds and approaches, there were a series of sub-questions for both researchers which related directly to their own questions about their role in a collaborative work environment.

Composer-related questions:

How can different compositional approaches open up space for contrasting ways of collaborating with a performer?

How can these approaches influence the relationships between sound and image in the creation of visual music?

Performer-related questions:

What makes a performer of an acoustic instrument necessary in the electroacoustic and visual framework?

To what degree can a performer make connections between visual and musical elements if they have no visual score or cannot watch the video during the performance?

To what degree does or should the performer have a role in the creative (compositional) process?

Approach

In this study, the authors and co-participants brought different areas of expertise to the research. Nicole Canham [3] has commissioned numerous new works in her professional career as a performer, and has collaborated with a wide range of artists in diverse settings. Canham’s doctoral research draws upon qualitative research methods, in particular that of case study. Carlos Lopez Charles [17] is a composer whose work has focused mainly on electro-acoustic composition and computer programming. His current PhD study in the area of visual music is concerned with the compositional techniques in this field. The study presents three different examples of composer-performer collaboration which took place over a two-year period. During this time three new works for clarinet, video and electro-acoustic music were created. The creation of each work, presented as a case study, reflects approaches to collaboration shaped by a variety of factors including the participants’ varied expertise. The aim of presenting two cases of earlier collaborative works prior to the current project is two-fold: as a form of triangulation, and to provide a framework for evaluating to what degree the collaborative process evolved between our first and our most recent attempt.

Willis [26] suggests that what we believe to be the “nature of truth (ontology) and what it means to know (epistemology)” (p.10) forms the basis of the ways in which research can be conducted and understood. Given the research aims, which are focused on gaining a greater understanding of multiple perspectives of the same situation, the ontological position of this study is that there are multiple versions of reality rather than a single truth, locating this study within the constructivist paradigm [1, 11, 26]. Reality, then, is constructed through the accounts and reflections of the researchers who were co-participants in the project [11, 25, 26]. The research design reflects a close connection between the authors’ researcher roles and their roles as participants as they worked together to co-construct an account of their evolving collaborative process.

Case Study 1. *Not Alone, for Clarinet, Live Electronics and Video*

Nicole: Reading back over our emails at the time *Not Alone* was being written, I notice that the conversation had a lot to do with practical concerns. I liked the piece a great deal on first hearing and nothing in the score was technically problematic, so my feedback focused on page turns, breathing and some articulation issues. *Not Alone* was my first foray into working with live electronics in a surround sound envi-

ronment. Perhaps as a result of this, the score Carlos provided me was highly detailed to ensure that the clarinet input would make the delay effect respond as envisaged.



Figure 1. Score excerpt, *Not Alone*

The video that accompanied *Not Alone* was created by a colleague after the music had been composed, almost as a creative response to the music.

In a way, it seems as though we were trying to superimpose different ways of working over the top of each other. I commissioned *Not Alone* as part of a multimedia installation/performance piece which involved a larger team of Australian and Mexican artists. *Not Alone* was a collaboration-within-a-collaboration in that sense, as I was also developing a cohesive 60-minute long program. I wrote to Carlos about this on 4 May, 2011, about three weeks before the premiere:

"I included a quote about time for each piece that inspires me on the musical interpretation side of things. In terms of the order, I've suggested it considering three different perspectives: 1. Ease of change of instruments, because I'm changing as we go; 2. Key [tonality] relationships between pieces so there isn't a jarring sensation going from one piece into the next; 3. Narrative possibilities of music in that order."

Conceptually, bringing in the time quotes as my own interpretive aid had to do with the 'time' theme of the larger program. It was, however, quite different from the musical frame of reference that Carlos had first discussed with me. He was interested in delay effects used by electric guitarists in the 1980s, and was keen to find a way to transfer this idea into a piece for clarinet. Carlos was also left to consider all the technical matters that I didn't understand, or perhaps hadn't thought through coming from a background of mostly acoustic performance. Carlos' system design had a reactive function to performer and composer input: my sound was processed with a delay feedback effect and Carlos varied the volume and the spatialisation of the delayed clarinet sounds. In performance, I felt as though my playing and his live diffusion of the sound were similar to making chamber music, although I never experienced the full perspective of the spatialised performance.

Case Study 2. *Las flores y las nubes*, for Clarinet, Live Electronics and Video

Carlos: My goal for this piece was to have a higher degree of integration between video and music than in *Not Alone*. Early discussions with Nicole focused on the technical aspects of how I wanted to approach this challenge. I also made a point of working with Nicole using improvisation as a basis for testing and developing ideas. We had two improvisation/recording sessions before a period of time apart.

Although I intended to take a less conventional approach with this piece, I still made most of the compositional decisions on my own. I composed the video first and then the

electroacoustic tape part, trying to make an audiovisual piece that could stand on its own and over which I could then add a clarinet part. To make the video, I used a custom-made program that allowed me to vary the size, movement and color of up to 12,000 points. Using this idea as a model for the composition of the tape, I created a patch to control different variables of a flow of short (15 ms. to 200 ms.) electronic sounds produced by a very sophisticated FM-based synthesizer.



Figure 2. Still image from *Las flores y las nubes*

At this stage, I was consciously avoiding the incorporation of clarinet sounds into the tape because I felt that approach (which is quite common) to be too standard. The Max/MSP patch that I made for the clarinet was programmed so that it changed its variables automatically at specific moments of the piece, which meant that synchronization of parts was critical. For this reason, I included a click track that would enable the performer to synchronize with everything else very precisely. We didn't see each other after our improvisation sessions until 3 weeks before the premiere of the piece, so the clarinet part was completed by me and then discussed and revised in our final rehearsal period. I sent a very detailed score, along with a patch, a video and a click track to Nicole six weeks prior to our planned rehearsals. As it turned out, none of the work from our improvisation sessions was included in the finished score.

In our first rehearsal, I realized that the clarinet's sound did not blend as well as I wanted with the electronic sounds that I had chosen. I decided to integrate some transformed clarinet sounds into the tape part that would allow for a tighter connection between tape and clarinet. Adding these sounds, using a reverb effect and making minor changes to the score helped to achieve a higher degree of integration between the clarinet and the electronic part. We eventually used improvisation for the ending of the piece.

Nicole: *Las Flores*, like *Not Alone*, was premiered within a larger multimedia performance. The context of the premiere also reflected some of the broader technical and programming challenges that we were negotiating. This included practicalities of how the video was to be projected, the projection surface (black), the style of projection (via Matrox) resulting in a wrap-around style image, and the low level of light necessary in order to have the videos look most vibrant.

The technical and programming concerns surrounding the performance as a whole also impacted staging options. Although I performed almost the whole program from memory, I had to perform *Las Flores* with music in a fixed space so that I could access the click track to ensure that my part and the electronic part were together in performance. In order to accommodate the video requirements of the piece, I was

obscured from view by some large pieces of black foil blocking the light coming from the scone on my music stand. Transitions from one piece to the next were also critical in this performance. Carlos had left the ending of *Las Flores* quite open which gave us the opportunity to weave together a number of elements. This included some improvisation in performance on my part for the ending of the piece, which also incorporated mechanical instruments made by an artist-colleague. Whilst I felt sonically embedded in this piece, I didn't visually feel a part of it and it was difficult for me to be seen by the audience.

Case Study 3: *Points, Lines Plane for Clarinet, Live Electronics and Interactive Video*

Nicole & Carlos: We had originally planned to re-work *Las Flores*, and so we set aside some time for discussion and experimentation. This included individual and joint reflection on what we felt worked well, and what might be improved based upon our experiences of both *Not Alone* and *Las Flores*. Feedback from Carlos concerned finding a better blend with clarinet and tape. Feedback from Nicole was concerned with having a better visual connection between performer and video, and exploring more meaningful ways of connecting with the visual element as a performer. Feeling able to make connections between the performative aspect of the visual component and other visual elements, namely the performer as visual component, was impeded by the necessity of performance with score and click track. We were also keen to set some new challenges and parameters for this collaboration. We wanted all the elements to be able to interact, as a basis for creating a collaborative environment where we would challenge our traditional roles as performer and composer. The goal was to develop a working process which might enable us to foster a collaborative environment where roles felt equal and to some degree interchangeable.

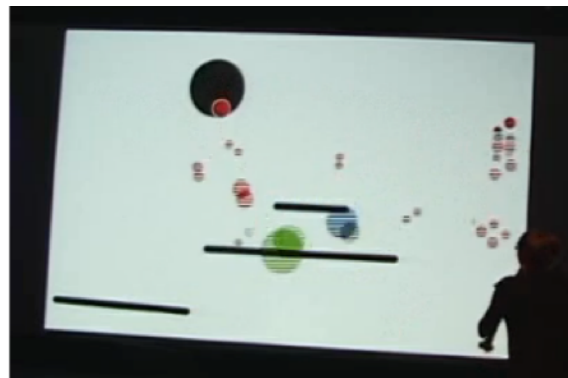
Nicole: One of our conversations stands out to me – I had been discussing with Carlos some of the problems I find with using a click track and he suggested, “what if we get rid of the click track?” We then moved on to considering how we might structure the score and this led to the thought... “what if we get rid of the score?” These two questions for me, and the possibilities opened up by leaving both click track and score behind, were the beginning of a completely different approach, and a new piece.

Carlos: Reflecting on my discussions with Nicole led me to realize that the issues that we were trying to address (in particular those of *music-video* and *performer-video*) could be solved by establishing interactions between electronic sounds, instrumental sounds and moving images through the use of the computer. Inspired by Josh Nimoy's “Bouncing Balls”, I created an interactive system based on the idea of balls that make electronic sounds each time they bounce against lines drawn by the user. I programmed a patch in Processing to control the moving images and used Serge Le Mouton's *sampler~* object in Max/MSP to play the audio samples each time a ball bounced. When bouncing against a line, the horizontal coordinate of a ball is mapped to a sound's position in a two-channel (left right) stereo field, while its vertical coordinate is mapped to its pitch (high to low). The communication between Max and Processing was established through the use of OSC messages.

Figure 3. Mapping of the balls' coordinates when colliding with a line

In a way, this system was already offering an answer to the sound-image integration in the piece, but the relationship

between the performer and the visuals still had to be addressed. In order to do this, I used Miller Puckette's *bonk~*



Max/MSP object to detect the clarinet's percussive attacks and Tristan Jehan's *analyzer~* object to track its loudness.

Nicole: Our first session working with Carlos' new system gave me a lot of ideas in terms of how the clarinet and the video might relate in an interactive setting, particularly with the use of my instrument as controller. Visually, I was very taken with being able to trigger pitched, bouncing balls with my clarinet sounds. A secondary task, and one that came out of these sessions, was then to consider how I might sonically relate to the sound being produced by the balls once I had triggered them. This included my own 'homework', which was to develop techniques that in some ways mimic or approach the sound that the balls produce.

Carlos: A challenge of the instrument-as-controller approach is that it seemed to me to have some compositional and technical limitations. Incorporating a physical interface with different multi-slider controllers that would also let me manipulate the behavior of the balls in a more flexible way seemed to be a good solution. Using the multi-slider allowed me to improvise with Nicole and create a wider range of musical ideas than if I just let the system react to her input. It also gave me the possibility of an interpretive role in the piece, not only a compositional one.

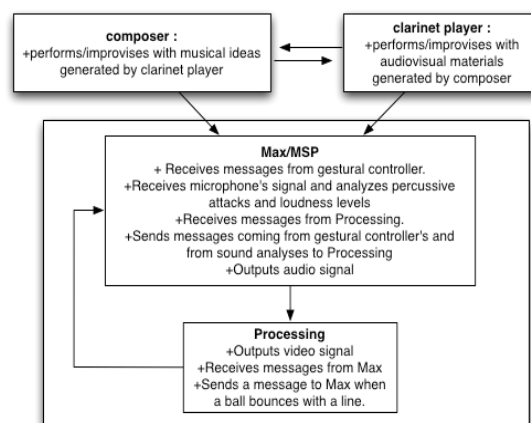


Figure 4. System design for the performance of *Points, lines, plane*

Analysis

Our framework for analysis of these descriptive accounts draws upon the work of John-Steiner, Weber and Minnis in two ways [15]. Firstly, we draw upon their definition of collaboration:

The principals in a true collaboration represent complementary domains of expertise. As collaborators, they not only plan, decide, and act jointly, they also *think together*, combining independent conceptual schemes to create original frameworks. Also, in a true collaboration, there is a commitment to shared resources, power, and talent: no individual's point of view dominates, authority for decisions and actions resides in the group, and work products reflect a blending of all participants' contributions [15].

We also adopt John-Steiner, Weber and Minnis' approach of "looking for commonalities and differences across settings, tasks, working methods, goals, and values" [15] as a tool in understanding and interpreting our collaborative process.

Challenging Traditional Roles

Changes of approach to our roles within the collaborative environment highlight advantages and problems with the notion of true collaboration as outlined by John-Steiner, Weber and Minnis. Case Study 1 provided an example of a fairly standard commissioning arrangement. Within that framework, roles of composer and performer were essentially quite separate and the collaborative aspect of the work is best described as a 'layering' of these elements to produce the finished piece. Advantages of this approach within the context of *Not Alone* included differing concerns and levels of expertise that needed to be taken into account for both practical and artistic reasons. The performer, for example, was more than happy to defer to the views of the composer in relation to the presentation of the score and the live electronics environment because that was a new area in which she had limited experience. This was also the first time the artists had worked together. Limitations of this approach impacted the artistic outcome in the sense that the relationship with performer, electronics and video did not always appear to be connected in the performance of the piece.

In Case Study 2, our roles had begun to shift. One advantage of this shift was that discussion and early work sessions reflected a desire to let performer and composer into the domain of each other's practice. Interestingly, and perhaps unsurprisingly, the direction and timing of these conversations followed the development of the piece in relation to composer and performer roles – that is, early conversations had a lot to do with Carlos' compositional ideas and approach, and later discussions just prior to, and after the premiere were more concerned with the technical challenges faced by Nicole and Carlos in performing the work. A limitation faced in Case Study 2 was the incompatibility of the timelines of composer and performer as they are traditionally understood: often a work can be almost complete before a performer becomes involved in a practical sense. Additionally, planning, development and rehearsal environments present different challenges to a live performance context which usually takes place later in the collaborative process, rather than at the beginning, for example.

Case Study 3 reflects a different approach again in that both performer and composer perspectives were included in the

planning and discussion from the beginning, with systems design, compositional ideas and approaches to interpretation being given more consistent consideration. Advantages of this level of integration compared with the other two case studies are that both composer and performer felt more able to interact across the three key areas of the collaborative partnership. No one is excluded from a particular artistic relationship combination in this format. A limitation of this approach is that the amount of video and audio processing that can take place in real-time is determined by the system's computing capabilities [16]. This creates a situation in which the video and audio materials have to be designed within the system's constraints for the sake of a higher degree of interactivity. From the composer's perspective, this is not necessarily a drawback, given that composing interactive visual music is not only about combining sounds and images, but also about composing the relationships that will be established between them and the performer(s). However, reflecting on how to minimize the compromise between what a system can do in real-time and what the artist would want it to do is an important factor to consider in contexts like this.

Changes to Practice

There were four notable changes to practice across the three case studies. Face to face interaction, joint decision making and regular and repeated collaborative work facilitated a number of changes to individual performer, composer and collaborative working approaches. Choices in the way in which computer systems were designed and employed also played a significant role in the evolution of a sense of joint practice.

Face to face interaction

Face to face interaction became an increasingly important factor in facilitating the development of new working processes between performer and composer. This has not only been the case for joint experiments, but also for determining the nature and structure of our independent work. Increased awareness of each other's individual skills and expertise brought about through our joint creative work has played a major part in shifting priorities reflected in the decision making and planning processes, allowing for the development of both more nuanced roles for composer and performer, and a reflective approach to systems design.

Joint decision making

Composer and performer jointly agreed what they would independently work on in Case Study 3. Resulting changes to practice have included more deliberate division of tasks and responsibilities, defining together pre-compositional material and determining parameters for performance. A fluid approach to systems design has greatly facilitated the conceptual shifts evident through these three cases of collaboration: the system has become an interface between composer and performer in which new roles, approaches and artistic outcomes have been defined and facilitated. In contrast, the approach taken in Case Study 1 was much less concerned with details of the role and tasks of the other with relation to the use of digital technology: it was designed by one artist for a specific purpose, and presented to the other without a great deal of prior discussion or consultation.

Regular and repeated collaborative work

The opportunity to undertake three different collaborative projects in a relatively short space of time (less than two

years) is viewed by both participants as a significant factor in the development of their joint collaborative practice. In that sense, the case studies form a single example of an ongoing, evolving collaborative practice. The possibility of the collaborative 'next step' in the form of ongoing performance opportunities has been a critical factor – from both research and artistic perspectives – in providing an outlet and incentive in which to explore and implement changes to practice.

Changes to systems design/tailorability

Another observable feature of the evolving collaborative process is demonstrated in the systems design choices and/or use of digital technology in each case. In addition to discussions about the artistic possibilities and uses of different programs, an important consideration in the development of the system for Case Study 3 was the style of interaction between composer and performer that this system could afford. Notably different in this approach, as compared with case studies 1 and 2 was the objective to create a system that would facilitate jointly agreed artistic and collaborative objectives. This is in contrast to the idea of composer and performer supplying complementary, but separate components of the collaboration. In this sense, digital technology has a dual function, and in a way that mirrors changes to performer/composer interactions, a more nuanced role. It plays both a critical artistic part, and also functions as a tool for achieving new collaborative objectives.

Individual reflection and joint discussion

Reflection upon a range of factors over the course of the collaboration was highly illuminating for both participants. Artistically, discussing and evaluating the strengths and weaknesses of each piece was an important factor in understanding quite different traditional roles and creative perspectives. Conducting a review of theories of systems design, creativity and collaboration for the purposes of this study provided us with ideas for the theoretical framework in which we could place our actions and decisions, or interrogate other understandings of collaboration.

In more general terms, reflection and discussion seemed to facilitate a blurring of boundaries between performer and composer roles as our conversations generated new levels of interest and ownership in a wider range of the creative tasks. As the collaboration unfolded, the consequences of these discussions and reflection is evident in the revised approaches to creative decision making, including the different approaches taken to systems design. Case Study 2 provides a good example of the composer increasing his frame of activity to music and visuals, whilst we see the performer increasing the scope of her concerns to include her relationship to the visual elements of the piece alongside her music making/interpretive role.

Conclusions

In this study we have aimed to document and describe key factors contributing to an evolving collaborative relationship between a performer and a composer. Three areas which most facilitated change in the collaborative contexts outlined were 1) challenging traditional roles, 2) changes to practice and 3) reflection (both separately and together).

As a contribution to understandings of collaboration beyond the scope of these three cases, both from the perspective as researchers drawing upon established theories of collabora-

tion and our own professional experiences as artists, we suggest that our study is useful for:

- a) Highlighting ways in which the challenging or blurring of traditional roles can facilitate new insights and approaches to practice;
- b) Appreciating the capabilities of systems design as both an essential artistic tool and facilitator of new levels of interaction between performer and composer in the composition and performance of visual music;
- c) Recognising the value of collaborative work environments for artists as a place of ongoing development and learning.

To that end, discussing, reflecting upon and employing in practice a range of theoretical perspectives on collaboration may be highly useful for composers and performers. Within the visual music making framework, working with tailor-made computer technology in a collaborative environment offers great possibility as both creative tool and interface in new performer/composer relationships and interactions.

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Left to Their Own Devices

Agency, Schizoanalysis, BYO Technology and Young Adolescence

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Introduction

Prime minister Kevin Rudd envisioned a 'technological revolution' for Australia and its future generations. He believed that education of our young people was the most effective strategy to see the productivity of Australia sustainably span beyond the mining boom and the attraction of our beaches to Japanese tourists (Rout, 2012, para. 4). In 2008 the Rudd administration began a project with an aim to fund every child in every school in Australia to have laptop. Following the end of the Rudd administration, and the depleted two billion budget for this project, the technology purchased with this funding becomes more and more outdated. This leaves students, families and schools in a compromised position with regards to access to current and up to date technology (Topsfield, 2012, para. 7-8). One solution offered to provide young people with the relevant technology is some version of a 'bring your own technology' (BYOT) scheme (Topsfield; Lee & Levins, 2013).

This paper makes an argument that effective BYOT (eBYOT) is applied schizoanalysis. This paper also proposes that there are observable health and well being benefits in the following examples of applied schizoanalysis. Schizoanalysis is a theory that was introduced by French theorist Gilles Deleuze and psychoanalyst Felix Guattari that is designed to address what they believed to be the shortcomings of psychoanalysis and capitalism. When I refer to eBYOT I am referring to successful examples of BYOT programs that effectively integrate into the community, effectively provide opportunities for education and effectively facilitate agency for young adolescents. Examples of how eBYOT is hinged to schizoanalysis will be covered followed by examples of the health and well being benefits of applied schizoanalysis and eBYOT. For the sake of the limited scope of this paper I will focus on the health and well being of young adolescents, though arguably all participants probably experience benefits as well. These are of course examples from eBYOT which needs to be differentiated from poorly implemented BYOT. In an effort to paint a picture of what poorly implemented BYOT might (and in some cases probably does) look like two critics of BYOT are cited next.

Differentiating eBYOT

The Critics

Two education technology bloggers that see little benefit in BYOT are Fraser Spiers and Gary Stager. In order to effectively describe the difference between effective BYOT and ineffective BYOT this next section will briefly outline some of their major criticisms of BYOT followed by the rebuttals of BYOT proponents. Both Stager's and Spiers' criticisms refer to a specific model of BYOT. In his blog Stager (2011, October 8) states that BYOT could "enshrine inequity", that on one hand the more affluent kids could have the advantage over the poorer kids and on the other hand the classroom

will be reduced to the weakest device in the room. Spiers' (2010, October 10) criticisms include the following: that to support BYOT is to declare that government shouldn't or doesn't need to invest in technology for schools; and that a model of BYOT in which every student is assumed to have a working internet capable smart phone, is too dependent on variables that cannot be controlled by the teacher or the school, and chaos would be lurking to pounce on every moment.

Rebuttal

A general rebuttal can be gleaned from the sagely advice of the father of telematics, Roy Ascott in his text *Art and Education in the Telematic Culture*. In the following quote he can be seen to responding to BYOT critics. He can be seen as saying that it is not BYOT in and of itself that is the problem, but simply the potentially poor implementation of the system and what is fed into the system:

"Garbage in, garbage out" is, I suppose, the phrase to invoke here. That is to say the universal machine – which the computer is – can contain as much creative thought and express as much emotion as we put into it (p. 10).

BYOT proponents do not deny the validity of these criticisms but point out that BYOT in and of itself is not the problem. It is the implementation, integration and follow through of BYOT that makes the difference. In response to Spiers' fear of chaos it is worth noting that BYOT does not necessarily equate to every learner in the classroom having a different device, though if that were appropriate to a particular context it could (Lee & Levins, 2012). In some cases BYOT simply means that the schools and parents work collaboratively to decide which uniform device to buy and use. An example of this is the case of Manor Lakes P-12 College in Victoria. In this school, where the socio economic mix is below the national average, the effective implementation of BYOT for their middle years students meant a comprehensive collaborative decision making process that included parents being advised by school. The parents decided to buy iPads through either a buying program provided by the school or through the supplier of their choice. The program has seen a 100% uptake (Lee & Levins, pp. 68-69). Each school and community has to hash out a BYOT system will work for them. Many of the BYOT pilot programs have a blend of school provided devices and BYOT devices. In response to Spiers' alluding to BYOT as an effort to shift cost to families Mal Lee (2011, p. 36) is keen to clarify that to implement BYOT is in no way a measure to abandon existing investment in technology. In one educator notes that since BYOT implementation in their school the students that can't afford their own technology benefit because the demand on school machines has declined, which also addresses Stager's concerns for equity (Lee & Levins, 2013). What makes a BYOT program and effective one? Well it should be becoming clear that there is not one right answer to that question. But what would be the point of writing this paper if not to attempt to provide not one definitive answer to that question, but a

frame work to work with? I propose that the frame work required would need to be a frame work that is open ended and is defined by its ability to change and adapt to emergent need. Schizoanalysis is argued by some to be such a system.

Applied Schizoanalysis

Deleuze and Guattari never explicitly give a clear frame work for Schizoanalysis.¹ Ian Buchanan places the burden on those who read Deleuze and Guattari to make simple enough structures from their reading of schizoanalysis with which to find meaning in schizoanalysis (2013). That stated, I have chosen three qualities with which to hinge effective BYOT to applied schizoanalysis:²

1. effective BYOT is intrinsic in nature as is schizoanalysis; schizoanalysis is an intrinsic doctrine or a doctrine of immanence, by doctrine I am referring to system that has the potential to answer everything³ (Buchanan, 2013).
2. this quality of being intrinsic enables eBYOT to foster a plurality of flows of production and outcomes, this ability is quintessentially schizoanalytic.
3. this quality of plurality combined with agency associated with an intrinsic doctrine foster participating families, students and educators to become what is referred to in schizoanalytic terms, a nomad.⁴

In the following paragraphs I will further unpack these three criteria and their relation to eBYOT starting with Ian Buchanan's notion of schizoanalysis as an doctrine of immanence.

Intrinsic Doctrine

In order for a thing must be intrinsic, it must be able to exist independent of any contingencies but must also allow for the capacity to encompass contingencies (Langton & Lewis, 1998, pp. 334-336). Deleuze and Guattari (2004) have purpose engineered schizoanalysis to be a doctrine that is open-ended and intrinsic in nature (pp. 3-5, Buchanan, 2013; Holland, 1999, p. 20). Schizoanalysis shares a view with its cousin, the extrinsic doctrine(s) of transcendence that is limited to theories like Freudian/Lacanian psychology and capitalism, that all of the constructs of subconscious with which to participate in the world come from desire (Buchanan, 2013). With great liberty Deleuze and Guattari refer to these constructs that are born of desire as production itself, as without these constructs there would be no human production (2004, pp. 25-28). A simplified explanation of the extrinsic position is that all production comes from a desire for something. This implies that desire is born from lack and that we desire for things outside or transcendent from our selves. Examples of this include: the desire for pain relief from a pill, for peace, or for a Porche as it is desired by others. Schizoanalysis provides a radically different take on the source of desire. It puts forth that all production comes from a desire to, a desire to manage pain, to enact peace or a desire to go fast (Buchanan, 2013). Schizoanalysis then as an intrinsic doctrine of immanence accommodates for those moments when one is driven inexplicably in the terms of the extrinsic regimes to undertake processes that don't necessarily yield predictable outcomes.

As Marx notes, what exists in fact is not lack, but passion, as a "natural and sensuous object." Desire is not bolstered by

needs, but rather the contrary; needs are derived from desire: they are counterproducts within the real that desire produces. (Deleuze & Guattari, 2004, p.27)

This type of intrinsic production is exemplified by the way in which eBYOT was integrated at the Forsyth County School District in Atlanta Georgia in the United States. This school district has been a leader in the use of instructional technology for over a decade and a half. What's interesting about the uptake of eBYOT in this district is the fact that it was never formalised or intentional. It eventuated because the dedicated teaching staff had a passionate desire to educate students. This led to a desire to use technology to strengthen home school collaboration which then lead to the observation that to limit the same devices that were educating students at home didn't make sense any more. This desire, not born from lack but from the passion or desire to educate produced a eBYOT program that is considered an exemplar for the whole nation if not the world⁵ (Lee & Levins, 2013, p. 46 - 47).

Multiplicity and Pluralisms

For a doctrine to be intrinsic and of immanence it will likely be required to at some point have the capacity to accept multiplicity of truths, pluralisms that may seemingly contradict each other under extrinsic terms (Buchanan, 2013; Deleuze & Guattari, p. 46). The education and technology research body Futurelab is an example of eBYOT policy as an instrument of a pluralistic intrinsic doctrine. The aim of Futurelab is to, as effectively as possible, integrate and facilitate the uptake of BYOT into education and lives of young people. Pluralism and multiplicity is made official policy of Futurelab in their handbook as one of the major tenants is the principal "One size does not fit all." The Futurelab handbook cites many success stories but specifically warns that these can only be used as guideline as every community is different (Becta, 2010, p.9). Mal Lee's (2011, p. 36) article that is actually titled "One size does not fit all" argues that a central command system where by the government might implement uniform technology policy is just as problematic as poorly implemented BYOT, in that it does not cater for the contingent nature of each community. This exemplifies the chaotic and complex nature of technology implementation of any kind in schools, rendering complexity immanent no matter the strategy employed to cope with that complexity. A prudent question to perhaps ask is: Which is more likely to prepare our young to manage the immanent and imminent complexity, as system by which we limit our possible solutions so that we may have comfort by knowing what they are, or a system in which we expect to find and indefinite amount of solutions? Schizoanalysis being a system designed to accommodate the expectation of the latter allows its participants a quality of agency that is not inherent in its extrinsic counterparts by fostering what is referred to in schizoanalytic terms a nomad.

The Nomad

Deleuze & Guattari never come straight out and state nomadism as some sort of schizoanalytic goal, but they do provide clues suggesting that their notion of the nomad is in some way a step in the right direction. One clue is embedded in their comments on the nomad's use of polyvocal expression, which is akin to the pluralistic nature of schizoanalysis as it literally means a multiple of voices, it is implied that these many voices can occupy the same space or even body at the same time. They compare the nomad's polyvocal expression to its extrinsic counterpart, biunivocal expression,

which is akin to binary logic, literally meaning two voices that are not the same and do not occupy the same space or body. The nomad's polyvocal mantra is "I am everyone and anyone" where as the extrinsic subject is limited to biunivocal expression which is more like "I am different than you" and worst case scenario "I am better than you". Most of Deleuze and Guattari's examples of comparing nomadic polyvocal expression with biunivocal expression are related however I see an interesting comparison in eBYOT policy. "I am everyone and anyone" allows the nomad to mutate and change while traversing different contexts. The nomad inherently knows or rather lives the previous example of Futurelab's policy "One size does not fit all". Futurelab is in essence institutionalising a policy that builds a system ready for change and has the capacity to manage pluralisms; in its it is applying schizoanalysis' nomadic principles its is fostering nomadic expression and production.

Mental Health and Well Being Benefits

Simplicity and Complexity

This next section of this paper will address the two following questions: How has the 'technological revolution' changed the experience of growing up and being educated for young adolescents in Australia?; and: How is the relation of the schizoanalytic nomad to eBYOT policy relevant to the young people that policies like eBYOT effect? The simple answer to the first question is that the 'technological revolution' has added complexity to the lives of young people. The complex answer starts with the position that the relation of young adolescent Australian's experiences and technology is a discourse that is as rich and complicated as the many facets that make up each individual. These layers of complexity can be equally problematic and/or beneficial to the lives of young adolescents. Yet another layer is added to the discourse of technology and young adolescence when technology is positioned at the intersection of both contributing complexity to the lives of young adolescents while at the same time providing the tools for these young people to negotiate and make sense of complexities.

To answer the second question: Schizoanalysis assumes that complexity is immanent and we derive the simple from that complexity in order to make meaning and sense (Buchanan, 2013; Deleuze and Guattari, 2004; Holland, 1999, p. 41). eBYOT is one instrument educators can use to help young people successfully navigate such complexities. The importance of which is referred to in the following paragraph.

Flux Generation

Robert Rafians (2012, p. 65) article "Flux Generation" suggests that the most important skill we can pass onto young people to prepare them to cope with the tsunami of complexity on the horizon is the skill to be open to learn new skills necessary when they are needed; in flux. Featured in the article is DJ Patii who almost flunked out of high school and consistently got kicked out math classes for being disruptive. He is now one of the world's most renowned experts on chaos theory and has consulted for the US military, LinkedIn and eBay (Rafian, p.62). "Generation Flux" is a cautionary tale, warning that minds like Patii's, and even more to the point mind sets like Patii's, are needed to actually shape systems, not be kicked out of class.

The Growth Mindset of the Nomad

Patii would probably fall into what researcher Carol Dweck terms as someone with a growth mindset or an incremental learner. He did not give up. He practically failed high school but did not let that fix his mind set. He convinced his science teacher to give him a C so he could graduate high school then go to Junior College where he conquered Maths and Physics. According to Dweck incremental learners are more likely to thrive, Patii is no exception. A growth mindset entails the belief that one can change and improve (Dweck, 2012). This can be related in terms of the schizoanalytic nomad in that nomadic subjects are not fixed entities (Deleuze and Guattari, 2004; Holland, 1999, p. 36). The nomad with their growth mindset can be a class clown and barely pass high school and still go on to be a chaos consultant for the US military. Whereas if a student has what Dweck terms as a fixed mindset or entity learner they are less likely to thrive (2012, Buchanan, 2013). The previous example of Forsyth School district and its organic uptake of eBYOT is also exemplar of the use of Dweck's growth mindset. With their intrinsic desire to, the participants of eBYOT at Forsythe are nomadic incremental learners. They were not focused on an extrinsic desire for an exemplar eBYOT program, they let their desire to successfully educate lead them through the incremental steps to successfully develop their premiere eBYOT program. Dweck (2012) has thoroughly documented the the health and well being benefits of this way of thinking, ranging from feelings of contentment, lower levels of stress, and successfully achieving ones ambitions. The notion of the nomad embedded in eBOT as applied schizoanalysis, shares with Dweck's growth learning model a sense that our notions of self are fluid and dynamic and hence has the capacity to facilitate the same health and well being benefits.

Access to Community

The benefits of a nomadic student that learns at home and at school are countless and profound. The home that provides a fostering attitude for education produces happier and more productive individuals (Bethelsen & Walker 2008 pp. 34-35 & 40-41; Tillman, 2006, p. 76). Coming from a home that collaboratively supports computer literacy and provides internet access in the home has far reaching implications for the future productivity of young people (Lee & Levins, 2012, p. 32). This break away from the brick and mortar model of education has been long anticipated by many (Gatto, 2006).

The Young and Well, Cooperative Research Centre (CRC) has undertaken research that has shown the important benefits of ubiquitous access to the the internet to the welfare of young people (Colins et al., 2012). An example of what these benefits can be are in this first hand account of one of the participants in the CRC Youth Brains Trust, a project that includes young people in technology research. Mikhela Swinson tells of the benefit of internet access to her mental health and well being, she recounts how she found a safe and flexible environment where she could investigate symptoms she had in relation to her mental health.

I did struggle with a mental illness for a lot of my teenage years, and I still say I'm in recovery from that. And the way that I actually got help was exactly what I just said, it was through social media, looking, finding out that other people suffered from the same problems, I wasn't completely alone with it. (ABC-RN, 2012)

Social media researcher Danah Boyd (2009) confirms the benefits of social media for young people. She states that young people are forced to do a majority of their "hanging

out" online as the trend in parenting leans more toward a tendency to keep young people safe and at home (pp. 79-81). Research reflects Mikhela's heuristic observations of her own situation by confirming that these social media environments provide young adolescents with the tools to become creative thoughtful and reflexive individuals, and that these social mediascapes offer young adolescents the opportunities to gain nomadic agency in the formation of their own identities (Clarke, 2009; Marwick & boyd, 2011). Proponents of eBYOT then offer that communities and families can best facilitate these beneficial elements of social media is to foster their children to become nomadic agents in the formation of these social media worlds (Lee & Levins, 2012).

Conclusion

Whether BYOT is a strategy being used by government to cut corners or it is a naturally developing trend driven by passionate educators, or both, BYOT is spreading in schools. BYOT is a complex undertaking. There are valid concerns about BYOT that need to be addressed, but they need to be addressed by reflexive mitigation, not by sweeping BYOT in general under the carpet. In order to ensure that effective BYOT policy is delivered a sensitive, pluralistic, intrinsic and open ended frame work is required because each community has its own sets of needs. Deleuze and Guattari have engineered a doctrine, Schizoanalysis, that provides such a framework.

Schizoanalysis is a doctrine engineered by French theorist Gilles Deleuze and psychologist Felix Guattari to provide a frame work of immanence. It is designed to make up for the shortcomings of extrinsic doctrines like Freudian and Lacanian psychology and capitalism. This paper cites examples that frame effective BYOT as schizoanalytic. The three qualities of schizoanalysis that are embedded in the examples of effective BYOT are the intrinsic or immanent nature of both, the capacity for plurality and multiplicity in both as well as the production of the schizoanalytic nomad in the examples of BYOT.

Using this lens, that effective BYOT is and example of applied schizoanalysis, provides this paper with the opportunity to cite examples of health and well being benefits for young adolescents participating in BYOT programs. These examples include providing participants with an increased ability to manage complexity, sense of agency with regards to shaping their own mindset and opportunities for community engagement.

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EndNotes

- ¹ It is my suspicion that that is because they want to keep Schizoanalysis pure from the type of non-autocriticality which they associate with psychoanalysis and capitalism; simply put, if a doctrine is too well defined, it is likely that that doctrine does not have the capacity with in itself to change itself (Holland, 1999). Ian Buchanan
- ² I have endeavored to chose qualities that I hope do not interfere with Deleuze and Guattari's desire for autocritical pureness.
- ³ This does not mean that Deleuze and Guattari consider schizoanalysis to be a complete doctrine, but rather they imply that there can be no such thing as a complete doctrine as the quality of completeness would render the doctrine non-autocritical and incapable of answering emergent questions (Buchanan, 2013; Deleuze & Guattari, p. 117; Holland, 1999).
- ⁴ One might say that the schizoanalytic nomad is the counterpart for the psychoanalytic functional human being.
- ⁵ It is worth noting that the administration at Forsyth School District has a reputation for supporting change.
- ⁶ Deleuze and Guattari go so far as to label polyvocal as legitimate and biunivocal as illegitimate. So though they do not come out and clearly state it they certainly imply that schizoanalysis might be a system that at the very least discourages segregative attitudes like racism.

Papers Reviewed by Abstract

Digital Futures: Exploring the Role of Technology in Community Empowerment, Social Activism and Cultural Change	Leah Barclay
Desktop Video Production for Research and Teaching	Matt Hitchcock & Paul Draper
Art-Engineering Collaboration	Natalie Lloyd
From Photo to Photo-Realistic: Digitising the Planet	Thomas Verbeek
There's an App for That! Using Mobile Devices to Improve Audience Engagement	Glenn Luttrell
User Experience Design for Hyoomans	Nic Wittison
Trialling Second Life Machinima to Promote Discussion and Support Learning in the Australian Sugar Industry: Stakeholder Responses are Encouraging	Cliffe, Stone, Coutts, Mushtaq, Reardon-Smith, Farley, Doyle, Lindesay, Loch, Hasset & Jacobson
Generative Methods for Music Video Composition	Julia Stefan
Time in Media Programming	Andrew Sorensen
Kallawaya Ronda - Brisbane	Gerardo Dirié

Digital Futures: Exploring the role of technology in community empowerment, social activism and cultural change

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The advancement of digital technology in the last decade has truly cultivated a paradigm shift in how artists interact in both physical and virtual worlds. These changes have evolved creative possibilities and enabled access to a global audience. As technology propels our increasingly visually dominant society into the future, the value of our auditory perception is often neglected. Listening provides more information about our surrounding environment than any other sensory perception. In a world where the dramatic ramifications of climate change are becoming a reality, this research explores the possibilities of acoustic ecology and digital technology in community empowerment, social activism and cultural change.

In a recent addition of *Musicworks*, Joel Chadabe stated that the current artistic practices of electroacoustic composers are rooted in the idea that new technologies, unlike traditional musical instruments, can produce sounds used to communicate core messages, including information about the state of our environment. He claims that we are all participating in the emergence of a new type of music accessible to anyone, which can be used to communicate ideas that relate more closely to life than those communicated through traditional musical forms. He believes we need to think of ourselves as “leaders in a magnificent revolution rather than the defenders of an isolate and besieged avant-garde” [1].

Through a series of case studies, this research reflects on four electroacoustic music projects completed through the author’s doctoral research. The projects were created in cultural immersion, ranging from the centre of the Amazon rainforest to exploring significant rivers in India, Korea, China, and Australia. The findings and observations from each project highlighted the value of creating electroacoustic music in community engagement and using multi-platform digital dissemination of the resulting experiences. This resulted in the development of the *Sonic Ecologies* framework, a practice-led methodology that explores the possibilities of electroacoustic music composition in ecological crisis. The creative projects introduced in this paper are ultimately acting as a catalyst in reconnecting to the environment through digital technology and sound.

[1] Chadabe, J. “A call for avant-garde composers to make their work known to a larger public,” *Musicworks*, 2011. 111: pp. 6.

Leah Barclay is an Australian composer, sound artist and creative producer working at the intersection of art, science, technology and the environment. Her work has been commissioned, performed and exhibited to wide acclaim across Australia, New Zealand, Canada, USA, Europe, India, China and Korea. She has been the recipient of numerous awards and has directed and curated intercultural projects across the Asia-Pacific.

Barclay creates complex sonic environments that draw attention to our ecological crisis and endangered ecosystems. These works are realised through immersive performances and multi-sensory installations drawing on environmental field recordings, data sonification, multi-channel sound diffusion, live performers and ephemeral projections. Her practice-led PhD at Griffith University involved site-specific projects across the globe and a feature length documentary exploring the value of creativity in environmental crisis. She is currently based in Australia working on a series of new commissions including the opening ceremony for the 5th IMC World Forum on Music, the interactive installation *Vedic Remnants* and *The DAM(N) Project*, a interdisciplinary venture exploring global water security through the lives of displaced communities in the Narmada Valley of North India.

In 2013, she Co-Chaired the *Balance-Unbalance International Conference* in Australia, a major event designed to use art as a catalyst to explore intersections between nature, science, technology and society in a changing climate. In addition to her creative practice, she serves in an advisory capacity for a range of arts and environmental organisations, including *Ear to the Earth* (New York), *InterCreate* (New Zealand) and as the Vice President of *The Australian Forum for Acoustic Ecology*. She is currently the Artistic Director of *Biosphere Soundscapes*, a large-scale interdisciplinary art project connecting the soundscapes of UNESCO Biosphere Reserves across the world. <http://www.leahbarclay.com>

Desktop Video Production for Research and Teaching

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We will present the preliminary findings of an investigation into the use of video documentation at the nexus between professional artistic practice, research and university teaching. We present the tracking of a series of research and teaching confluences where video materials have been used to document and communicate techniques and understandings. These case studies are unpacked to show how the use of video materials supports the nexus between research and teaching and techniques and tips for the efficient production and distribution of these materials is discussed. This work builds on the ongoing work of the authors into the development, deployment and curation of multimedia materials for academic activities.

Matt Hitchcock and **Paul Draper** work in the Music Technology area of the Queensland Conservatorium Griffith University. They are each practicing musicians, active researchers and passionate about music learning and teaching. They each have a strong history of innovation in the use of technologies for music making and education.

Art-engineering collaboration

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The current transformation of the hub of engineering at Curtin, into a Living Laboratory by installing Internet-accessible sensors throughout the building during semester 1, 2014 is underway. A creative multi-disciplinary project with a team comprising academics from Engineering and Art is to be implemented in 2014 in parallel and integrated with the Living Laboratory project. It is our team's vision to create media rich online resources – centred around the chemical, mechanical, electrical and civil dimensions of the Engineering Pavilion – that will expose students to professional practice and the development of engineering judgment through technological and/or virtual environments linked with the physical environment of the Pavilion. The opportunities opened up by the Engineering Pavilion Living Laboratory project will enable us to enhance students' exposure to professional practice and to help develop their engineering judgment. Many aspects of professional practice and judgment could be included: safety training and awareness, installation and commissioning of equipment, predicting responses of materials in situ, understanding dynamic behaviour, estimating quantities, awareness of the size of equipment and structures, performance and design standards . It is believed that there will be scope for engineering and art students themselves to develop material as part of their course units, especially the engineering final year capstone projects, engineering and arts research-based units, and visualisation technology units. This project and its development of media rich resources and interactivity of technical and visual displays for student use and learning , is anticipated to lead to develop greater multidisciplinary collaboration between Engineering and Art. It has the potential for evolving multidisciplinary research initiatives. At this stage of planning and imminent implementation, the Engineering-Arts implementation team welcome creative input to explore the possibilities and expand the potential of this collaboration.

From Photo to Photorealistic - Digitising the Planet

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Areo is a photorealistic rendering research company that has been digitising the planet since 2006. Based in Dunedin, New Zealand, Areo has produced multiple award-winning computer games by recreating real life (3D) environments. It is the accuracy of these "real-life" environments that has seen the company develop photogrammetry software for industry, enabling surveyors, miners, architects, engineers and planners to understand their subject in greater detail. This presentation is a live-demo technical showcase of Areograph technology and its application in the industry, spanning forensic crime scenes, heritage building reconstruction and drone planes mounted with cameras for aerial surveying.

Thomas Verbeek is a Masters student researching computer graphics at the University of Otago, New Zealand. He works as a software developer and 3D artist for a photorealistic rendering research company called Areo (www.areo.co.nz). His personal website is www.thomasverbeek.com

There's An App For That!...

Using Mobile Devices to Improve Audience Engagement

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The ANU's College of Asia & the Pacific is working to improve audience engagement for attendees at lectures, seminars, conferences and other events by using the mobile devices that attendees are already bringing along. This presentation will discuss the different methods and tools that were used at our annual Asia Pacific Week conference in July 2013 and how we brought these tools together using the Guidebook Event App. The methods and tools fall into three categories:

1. Multimedia and interactive content for presenters
2. Interactive tools for the audience such as "Poll Everywhere" and "Google Moderator"
3. Social media interactivity through Twitter and Facebook

The presentation will discuss the lessons learned from exploring each of these methods and how we plan to use those lessons in the future.

Glen Luttrell is the Technical & Logistics Coordinator for the Digital Learning Project at the ANU's College of Asia and Pacific. Glen has brought nearly 20 years of IT support experience and translating the technical to the everyman, to the his current role of bridging the gap between teaching and the technical - facilitating the use of new technologies in the teaching and learning experience. He is currently coordinating content production and translation for one of the ANU's first EdX.org MOOC's – "Engaging India" set to launch in March 2014, as well as numerous other projects to enhance the College's use of Moodle and other learning technologies.

User Experience Design for Hyoomans

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Users are terrible at using software. They make mistakes, press the wrong buttons and touch everything in the wrong order. The interesting challenge for developers and researchers is making sure users don't notice how terrible they are by crafting resilient, intuitive and non-offensive software experiences. This talk gives you a run down of why User Experience Design should matter to your project and why it's important to think about it BEFORE you start developing. It covers the basics of User Centred Design and User Testing as well as highlights some of the common usability traps people fall in to when developing software. By the end of the talk you should have an understanding on how to approach the creation of new interfaces and how to iterate and design Hyooman proof apps.

Trialling Second Life machinima to promote discussion and support learning in the Australian sugar industry: Stakeholder responses are encouraging...

Neil Cliffe 1,2, Roger Stone 1, Jeff Coutts 3, Shahbaz Mushtaq 1, Kathryn Reardon-Smith 1,2, Helen Farley 2, Joanne Doyle 2, Janette Lindesay 4, Adam Loch 5, Amanda Hassett 6 and Noel Jacobson 6.

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Well-designed and facilitated participatory learning processes focussing on stakeholder discussions can lead to significant learning, skill development and decision-making outcomes in industries such as agriculture. Virtual World machinima, which simulate farmer discussions, have significant potential as an alternative information delivery method in agriculture extension environments, where funding and policy support is declining and access to high speed internet is increasing globally. This research trials and evaluates a Second Life machinima designed as a discussion support tool for improved climate risk management in the Australian sugar industry. The machinima set and characters were developed to represent a typical farming situation and farmer personalities with specific attributes that would make it contextually relevant for the target farmer group. Major set elements included a farm house, machinery shed, tractors, a cane harvester and a sugar cane crop as backdrop. Other elements such as tools, tyres, a fridge and a farm dog were included to provide minor details in support of major design elements. Scripts for the machinima avatar conversation were written in an idiom which attempted to characterise the vernacular used by the targeted farmer group. The informational content of the machinima script considered the use of seasonal climate forecasts in cane harvesting planning and decision making.

A pilot evaluation of the machinima, using semi-structured interviews (17), was conducted with canefarmers (7), extension officers (6) and Canegrowers organisation representatives (4). Interviewees were asked to respond to questions around key attributes of the machinima design and the informational objectives of the avatar conversation, with comments coded thematically. Interviewees were also asked to rate the value of the tool in 'supporting canefarmers to take some action, small or large, in relation to the information presented'. First impressions of the machinima were largely positive. Most interviewees identified readily with the characters and settings depicted in the machinima, and related the animation to a typical canefarmer shed meeting. Key messages identified by interviewees were consistent with the informational objectives of the script; although, some felt that the message could be better targeted to farmers with a higher level of understanding of climate and production risk. Developing scripts appropriate to the target topics for discussion appears to be critical in ensuring audience engagement with the machinima. The pilot evaluation indicates that machinima could provide useful support for discussion and decision-making around climate risk as well as other significant industry issues.

Acknowledgement: This research is supported by the Digital Futures (CRN) Project funded through the Australian Government's Collaborative Research Networks program.

Generative Methods for Music Video Composition

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In this paper I propose the design of a system for dynamic real-time editing of music video sequences on the Internet, utilising probabilistic parameters and algorithmic decision-making for progression. I will explain how these processes give music videos the potential to be different every time they are accessed, and provide users with an enhanced viewing experience and creators with a new tool for video composition. As the advancement of online technology influences the ever-changing habits of media consumers, user uptake of new technologies suggests that it is entirely possible to transition away from video's prevalent mode of presentation as a linear sequence of shots. Factors such as viewer engagement and usability drive the need for ongoing exploration in the use of video for entertainment, information and advertisement. The production of a music video with generative methods is described as a semi-automated process, whereby human tasks are not to be replaced by computational execution, but are shifted to become increasingly conceptual. A framework for this novel mode of video composition is outlined and a creator's transformed experience when using such a system is described and compared to traditional methods of editing.

Time in Media Programming

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Change is a central tenet of time-based media. Human beings are naturally predisposed to ascribe temporal structure to this change. And yet for millennia the idea that time exists as a universal property has been increasingly called into question. In this talk Andrew will briefly discuss the notion of time, why concepts of time are so important to digital media practitioners, and why media programming is fundamentally impacted by our formal conceptions of time.

Andrew Sorensen is a computer scientist, computational artist and active performer and composer of electronic music. Andrew's interests lie at the intersection of computer science and creative practice – particularly the development and application of programming languages in computational arts practice. Andrew often builds his computational works live in front of an audience, developing software as an integral part of a performance. Andrew has been invited to perform throughout Europe and Asia and is the author of the Impromptu audio/visual programming environment.

Kallawaya Ronda – Brisbane

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In this Artist's Talk, the composer refers to creative strategies, inspirational resources, pedagogical approaches and health and ethical concerns related to the electroacoustic work and collective dance Kallawaya Ronda (2011). Commissioned by the National Institute of Creative Arts and Industries of The University of Auckland, and presented for the first time at the Australasian Computer Music Conference of that year. The project responded to the environment of an academic conference by giving access to participants to an experience that is unifying, sensually stimulating, while facilitating a momentary displacement of the ego. Kallawaya designates traditional itinerant healers amongst the Kallawaya culture in Bolivia. This association to healing practices guided relevant decisions during the gestation of the composition. The work combines transformations of samples from tarka flutes along with live tarkas performed by guests from the audience.

Participants to conferences are usually bound to low physical activity during such events. Thus, in Kallawaya ronda – a multi-channel surround sound composition – the composer invites a dozen participants from the specific conference to be placed within a circle of 8 loudspeakers. The participants are quickly guided to memorize and play a short melody in the tarkas (a set of traditional Andean wind instruments) and to move sideways in a gentle, enticing alternating foot pattern that makes the circle move clockwise while electronic sounds traverse the performance space in various surrounding trajectories. Kallawaya ronda gives to the participant access to the exploration of physical and mental health effects of low impact choreography, breathing techniques, instrumental performance and body correlation while experiencing a composed surround electroacoustic work in a group situation. As the round gains intensity, the performers are gradually led to reduce the size of the circumference, challenging them to calibrate smaller movements and coming into closer proximity to the other participants. The round concludes with a compact group of people standing still and listening in an exalted state to the last sounds from the loudspeakers. The composition and performance blends practices ranging from Indigenous American round dances, naturopathic strategies in the use of breathing – here mediated by the performance of a short, mnemonic melodic pattern – traditional instrumental performance, and the use of digital technologies allowing for a mesmerising experience of sound spatialisation of related sound materials and the body in motion.

Born in Cordoba, Argentina, composer **Gerardo Dirié** is an accomplished conductor, performer, and educator. He works as a senior lecturer in music at the Queensland Conservatorium Griffith University. As a composer, he has had many acclaims and performances in the United States, Latin America and Europe. In July 1994, he was a prize winner in the National Tribune of Electroacoustic Music in Argentina. As a result, his piece *Tu casa o este océano* was selected for performance at the 1994 International Tribune of Electroacoustic Music in Paris and at the International Tribune of Composers (UNESCO) in Finland. His choral work *Canto de Amores Entre Ausencias* won the Honorary Mention in the NISSIM ASCAP International Composition Competition in 1993. In 1991, 1992, 1993, 1995 and 1996 he was distinguished with the Standard Awards from the American Society of Composers, Authors and Publishers for the performance of his compositions. This included the performances of *Puerto de Cántaros* by the Cosmopolitan Symphony Orchestra with Tania Leon conducting, in Town Hall, New York; *Two Impromptus* for two pianos, in Caracas, Venezuela; *El baile del quinto día* for solo violin in Spain; and a retrospective concert of his music for soloists and live electronics performed by The Hueco Ensemble in Manhattan. During the most recent years his music has also been performed in India, Malaysia, Turkey, Colombia, Venezuela, Belgium, Germany, and Denmark.

Exhibitions

Tears of the Sun	Gordon Moyes
Generative Jewellery	Daniel Della-Bosca
Previs Production in the Digital Art Zone	Louise Harvey

Tears of the Sun

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This exhibit is a single mission from an upcoming larger video game. The format is a slow paced military giant robot simulation game. The proposed mission will demonstrate rescue and security concerns (looting, banditry, evacuation & disaster relief) during a global warming induced hurricane and related flooding scenario in a built up area.

The larger game is being designed to engage 35+ year old males who are resistant to considering issues of climate change to do so in a way that provokes their interest and thought without being triggering barriers to learning. It is being designed to walk the player through the consequences of global warming during the latter half of the 21st century. The player takes on the life of a member of the military & security forces, piloting a giant robot style fighting vehicle. Enrolling at 16 years old in 2050, the player will live the experience of securing anticipated security hot spots over the following 50 years. The player is drawn into the world by sitting in their giant robot cockpit (consisting of up to 3x computer monitors, 2x iPads and special flight controllers) to undertake their missions.

Gordon Moyes is one of Australia's leading video game developers. Having worked more than 15 years on major projects in Brisbane, Los Angeles and Boston, he has recently turned his focus to academia where he now leads the Bachelor of Games Design for the Griffith Film School, Griffith University. Commercial credits include Producer of Destroy All Humans! 2: Make War not Love, Programmer for 1997's Dark Reign: The Future of War, Director of the adorable iPhone title Cluck It!, and numerous titles in between. Research interests include using video games for subtle ideological re-alignment, with a current focus on global warming. Works such as My Mechanical Romance — highlighting the absurdity of preventing giant robot marriage — have been exhibited at the Queensland State Library, and the precursor to this exhibit, Winds of War — exploring scenarios of energy security in a post peak oil, global warming affected world — was recently exhibited at Crane Arts, Philadelphia.

Generative Jewellery

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The physical forms in the exhibition are the result of generative design, in particular they are variants and permutations of fractal forms principally the Julia set. The forms represent the boundaries of manifestation in physical and structural terms. They are at the edge of physical realisation through the processes of additive fabrication and investment casting and constitute in material terms, evidence of the present boundaries of transformation of digital to physical processes. The works are intended to exist in the form of wearables, as objects of contemplation, it is desired that the response to them is lived and their inherent complexities permits extended haptic and visual investigation by both the wearer and the observer.

Daniel Della-Bosca teaches Digital Design at the QCA, Gold Coast campus. Working in fractal mathematics with the Iterated Function System, fractals can generate elegantly complex three-dimensional form that can be easily assimilated and acknowledged by the viewer. His research interest is in the relevance of mathematics in understanding the natural world.

Previs Production in the Digital Art Zone

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Previs (previsualisation) is a virtual representation of a shot, usually performed in 3D software, as a moving image. It could be described as being the blueprint of a film. The Previsualization Society provides the following definition:

Previs is a collaborative process that generates preliminary versions of shots or sequences, predominantly using 3D animation tools and a virtual environment. It enables filmmakers to visually explore creative ideas, plan technical solutions, and communicate a shared vision for efficient production.¹

The benefits of utilising previs in film and animation production are well-recognised, and it is now used in most feature film production.² Increasingly, it is being implemented in student productions also, and it is my involvement in the production of a short film for the Griffith Film School that has led to the creation of this previs work.

The process of creating the previs revealed a challenge that many other amateur and student filmmakers would doubtless also encounter: how or where to acquire the necessary 3D assets (character models, props and environments) to populate the 3D previs scenes. In feature film production, the budget covers the modelling of these assets by the previs department. For the amateur filmmaker however, the resources of money, time and/or modelling expertise for asset acquisition is often absent.

This was the dilemma that I encountered when faced with the construction of previs for the GFS short film project mentioned above. Fortunately, I was able to find a solution in an apparently overlooked and much-maligned source: DAZ 3d. This is a 3D software program that in its early years was directed at beginner/self-learner 3D artists. The DAZ3d web site provided users with an extensive online content marketplace of rather poor-quality 3D assets that could be used to populate DAZ3d scenes. The artistic outcomes from this product tended to look inept and in the eyes of the wider 3D community, users of the product and the product itself were subsequently branded as woefully unprofessional.

However, time has moved on, and while the unprofessional tag may still remain, the inferiority of the DAZ3d product has not. On visiting the DAZ3d web site late last year, I was pleasantly surprised to find a huge range of high-quality, low-priced assets in its online marketplace. All of the characters, props and environments that I could possibly need were available there, and best of all, these could be exported from DAZ3d in a format that I could use in my 3D program of choice, Autodesk Maya.

The 3D previs footage that was subsequently created demonstrates the outcome of this solution, and it is hoped that other filmmakers and educators may benefit from being made aware of this option.

Louise Harvey is currently a full-time lecturer in 3D animation and modelling at the Griffith University Film School in Brisbane Australia. After completing a doctorate in Visual Arts (animation) in 2007, Louise has worked on a number of Australian live action and animation productions, including the film *Australia* and the animated TV series *Animalia*. Her roles on these productions have included Visual Effects Coordinator, and Previs (previsualisation) lead artist.

¹ The Previsualization Society n.d., Previs Documentary – Part 1, viewed 20 May 2014, <http://previsociety.com/previs-documentary-part-1>

² Harvey, L. 2010, Designing efficiency: the benefits of previsualisation in film and animation teaching programs, Edulearn 2010 conference proceedings, Barcelona.

Performances

Shifting Nature	Leah Barclay
Four Short Cantatas in Emotional-Sonata-Form	Jesus Lopez-DoNaDo
Ibis	Josten Myburgh
Intelligent Tracking	Jayashree Panjabi
Folding Time: Research into Transduction in Collaborative AudioVisualism	Scott Baker & Lloyd Barrett

Shifting Nature

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Shifting Nature is an environmental sound installation based on field recordings made during Leah Barclay's Sound Mirrors project, in which she travelled through Australia, India, Korea, China and Brazil capturing the sounds of significant rivers and collaborating with their surrounding communities. The source materials range from hydrophone recordings of the Amazon River Dolphin in central Brazil to pilgrims chanting at dusk on the banks of the Pamba in southern India. Shifting Nature explores rivers as the lifeblood of communities and underscores the value of listening in our current state of ecological uncertainty, weaving diverse cultural and natural soundscapes into a dense and unpredictable sonic environment.

Shifting Nature was recently featured at the 5th ICM World Forum on Music in Brisbane and ISEA2013 (International Society for Electronic Art) in Sydney, Australia.

This work can be installed in a discrete location during the conference, and the installation is flexible to available space. Shifting Nature can also be presented as a live immersive performance. All of the technical requirements can be provided by the artist.

Leah Barclay is an Australian composer, sound artist and creative producer working at the intersection of art, science, technology and the environment. Her work has been commissioned, performed and exhibited to wide acclaim across Australia, New Zealand, Canada, USA, Europe, India, China and Korea. She has been the recipient of numerous awards and has directed and curated intercultural projects across the Asia-Pacific.

Barclay creates complex sonic environments that draw attention to our ecological crisis and endangered ecosystems. These works are realised through immersive performances and multi-sensory installations drawing on environmental field recordings, data sonification, multi-channel sound diffusion, live performers and ephemeral projections. Her practice-led PhD at Griffith University involved site-specific projects across the globe and a feature length documentary exploring the value of creativity in environmental crisis. She is currently based in Australia working on a series of new commissions including the opening ceremony for the 5th IMC World Forum on Music, the interactive installation Vedic Remnants and The DAM(N) Project, a interdisciplinary venture exploring global water security through the lives of displaced communities in the Narmada Valley of North India.

In 2013, she Co-Chaired the Balance-Unbalance International Conference in Australia, a major event designed to use art as a catalyst to explore intersections between nature, science, technology and society in a changing climate. In addition to her creative practice, she serves in an advisory capacity for a range of arts and environmental organisations, including Ear to the Earth (New York), InterCreate (New Zealand) and as the Vice President of The Australian Forum for Acoustic Ecology. She is currently the Artistic Director of Biosphere Soundscapes, a large-scale interdisciplinary art project connecting the soundscapes of UNESCO Biosphere Reserves across the world.

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Four Short Cantatas in Emotional-Sonata-Form

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Four short cantatas in emotional-sonata-form, is a performance to support the project: Fisher discriminants as a framework for Plutchik's emotional theme annotation in music composition. This ongoing doctoral project at the Queensland Conservatorium is a compositional workflow aimed to guide composers to discriminate or favor certain music themes and selected musical features as they relate to the composer's previous emotional responses to these themes. This workflow applies Plutchik's emotions classification framework. It also utilizes Fisher discrimination as an statistical tool in a two fold manner: (i) to guide the classification of themes as per the composers perceived emotions and (ii) to discover prevalent musical descriptors.

Four short cantatas in emotional-sonata-form is composed of four movements:

- I. joy versus sadness;
- II. anger versus fear;
- III. trust versus disgust;
- IV. surprise versus anticipation

The four cantatas total to a 16 min long composition in which the sonata-form is explored by using emotion prevalence rather than more traditional variation tools, i.e. dynamics, key modulation, tempo, etc. The piece is composed of five subsections as per the traditional the sonata-form

- (i) introduction;
- (ii) exposition;
- (iii) development;
- (iv) recapitulation.

Here the idea of sonata-form is extrapolated to populate the four classical sessions with contrasting emotionally annotated passages. Aesthetically, the piece is conceived for virtual choir over 8 ambisonics channels with concomitant live electronics via 4 surround channels spatially distributed in real-time by the performer within the modular synthesizer.

Jesus Lopez-DoNaDo is a doctorate candidate on music composition at the Queensland Conservatorium Griffith University. He works at the crossover of emotional psychology, music composition and computational intelligence. In his doctoral thesis he is exploring ways to generate a compositional framework guided by individuals' emotional responses.

Ibis

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In the improvisation "Ibis", I perform very still music, working with quiet events being passed around by microphone (for saxophone), no-input mixer and pickups on guitar, and exploiting the different means of sound transmission offered by these means. Inspired by Ryoji Ikeda, the approach to improvising in this case uses sounds in 'raw states', which in Ikeda's case refers to sounds such as sine tones, white noise and digital clicks. In my performance, the sounds transmitted through the microphones, pickups, instrument and microphone cables and pre-amps remain in their unprocessed 'raw state', being transformed only by moving them around, compressing or expanding them in time or using them to produce digital noise artefacts. Through this each component in the setup becomes an instrument, allowing the unique signature of the gear to be pressed onto the music and used as a device to direct, influence and ultimately produce the composition. The aesthetic result is sparse, artificial and delicate, and resembles some sort of electronic landscape more so than a carefully structured composition, enticing (but not persuading) the audience to hear it in this way through a patient pace of development.

Josten Myburgh is a 19 year old third year student composer at the Western Australian Academy of Performing Arts. He has studied under Perth-based composers Lindsay Vickery and Stuart James, as well as Domenico Sciajno from Palermo, and his eclectic compositional output includes notated chamber ensemble works, sound art installations, improvisation systems, lengthy works for electronic playback and collaborations with video and contemporary dance artists. As a student Josten has been recognised as one of the top 100 students out of 25 000 in terms of academic achievement at his university, and is a member of the Golden Key International Honour Society. As a performer, Josten has premiered works by Alvin Curran, Lindsay Vickery, Cat Hope and Freya Zinoffiev, and has toured internationally with Decibel New Music Ensemble, performing the music of John Cage and Giacinto Scelsi, as well as a program of Australian works featuring his piece "UNAWARE_". He currently works as a curator for Tura New Music's 2014 "Club Zho" series, as well as performing regularly as a solo performer, with improvisation duo Mr Government, and as part of Decibel.

Intelligent Tracking

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Intelligent Tracking is a 13 minute video on the work of Dr Tim Molteno who heads the Physics Electronics Laboratory at the University of Otago, in Dunedin, New Zealand. It looks at three state-of-the-art technologies he has developed in the area of satellite tracking. What started out as a project to track the movements of endangered species has now developed into technology that may help increase yields in the sheep and cattle industries in New Zealand. The video uses long-form documentary story-telling techniques including digital animation, to make cutting edge and somewhat complex digital technology more accessible to a general viewing audience.

The subject of the video work, Dr Tim Molteno, has a Ph.D (Otago) in nonlinear dynamics and topological analysis of chaotic systems. He then undertook postdoctoral work at the University of Toronto in nonlinear systems, including granular flow and spatio-temporal chaos. He later worked in Boston for Sapien Inc, a high-tech consulting firm, on large data systems for the oil and gas industry, and then for a startup on real-time analysis of video and images. The main focus of his research is the development of new techniques for measurement, and the implementation of these techniques in novel devices that not only make new kinds of measurement, but also quantify the uncertainty in those measurements.

Jayashree Panjabi began her career as a presenter on the children's series Playschool, but after two years opted to move behind the camera where she spent nearly a decade as a producer/director with Television New Zealand before leaving to begin a freelance career. She joined Natural History New Zealand (NHNZ) in 2002 and for eight years worked exclusively as a senior producer in the international arena, making series and one-off documentaries for international clients such as Discovery Channel, Animal Planet, NHK and National Geographic. She then went on to Beyond Productions in Sydney where she worked as a writer and post-producer on the series "Taboo" for National Geographic. Her latest work documentary work has been as a series producer with Rock Wallaby Productions in Doha, Qatar making a series for Qatar's National Day. Jayashree currently works as a business manager for the University of Otago in Dunedin, but she still finds time to make short documentaries on leading scientists at the University.

Folding Time:

Research into transduction in collaborative AudioVisualism

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Folding Time is a processual work designed as a study into collaborative transduction of audio and visual elements. Starting with simple waveforms and TV static a complex feedback network is initiated where a synchresis of sound and image generates and evolves the performance in emulation of a natural ecosystem.

The transductive synchresis is demonstrated and perceived as occurring in 3 main ways:

- direct: sound to video / video to sound
- indirect: sound as data modulating video / video as data modulating sound
- causal: through a process of contextual suggestion, performative tropes and prepared supplementary AV material

Despite utilising current accessible technologies Folding Time draws influence from historic live mixed media performances by Alvin Lucier and Woody and Steina Vasulka. We also acknowledge a debt to Rudy Rucker, who lead us to critical work on feedback networks by Peitgen, Jürgens and Saupe(2004).

Scott Baker is a Multimedia artist from Melbourne, Australia and has over 20 years experience working across the areas of installation art, experimental music, video and illustration. For the past several years he has been exploring synaesthetic modalities with the audio-visual project Abre Ojos. Combining vintage analogue electronics with 21st century digital technology the Abre Ojos project is designed to provide experiences using sacred geometric animations and audio frequencies. The project has released multiple DVD's and has been performed live around the state and nationally including performances at Eclipse Festival 2012, Rainbow Serpent, Federation Square and the Tote Hotel. Scott is also a digital media, screen and graphic design teacher at Swinburne University of Technology in Melbourne. Abre ojos is an old Spanish sailors saying meaning "open your eyes", "look out" there is danger all around. <http://abreojos.net>

Lloyd Barrett has over a decade history with experimental music in Brisbane. He was an active member of the curatorial team involved with Small Black Box and the Audio Pollen radio show / performance series. He has performed, exhibited and presented at Liquid Architecture, Electrofringe and What is Music festivals along with numerous Room40 events at the IMA and Brisbane Powerhouse. He is a music technology lecturer at Queensland Conservatorium Griffith University and is conducting PhD research into audiovisual performance which has informed the development of this work. <http://secretkillerofnames.net/>

Workshops

Quartz Composer 101	Scott Baker
How Do I Game Design	Paris Buttfield-Addison, Jon Manning & Tim Nugent
Sonification: Can Bloogle Resonators Enhance Representation of Time, Space and Culture through the Person-Environment-Occupation Model?	Sandra Kirkwood
The Psychology of Embodied Creativity: Preparing the Creative Space before Approaching the Digital Space	Simon Thatcher

Quartz Composer 101

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This is an introduction to Quartz Composer for new or novice users showing the basics of patching through to output choices and integration with other applications such as Final Cut Pro. Starting with a basic demonstration of how the modular environment of Quartz Composer works the workshop will progress into the creation of a Quartz file addressing all of the elements listed below. A small section of the workshop will look at the process of collecting raw material using a digital still camera and finding public domain video from sites such as <http://archive.org> and then processing them with Apple Motion. A demonstration of simple video loop making techniques, basic image manipulation and formatting (codec, frame rate and dimensions) for optimising performance will also be included.

Scott Baker has almost 20 years experience as a multi-media artist working across the areas of installation art, experimental music and interactivity. For the past five years he has been exploring synesthetic modalities with the audio-visual project Abre Ojos. Scott has extensive Mac OS and application experience across the creative fields.

How Do I Game Design?

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While video games are the most glamorous of the electronic arts, splashy graphics and amazing sound isn't the defining feature of games. Rather, games are games because they are the world's only interactive medium. Good interaction needs to be designed, and the master crafters of engaging interaction design are game designers.

In this workshop, you'll learn how to apply the art and science of constructing enjoyable, engaging games. This is entirely non-electronic; we're not talking about programming, game engine development, or how to approach a publisher with your totally rad idea about how you can have, like Mario only there's explosions. Instead, we'll be taking a deep dive into game design theory. Everything you'll work on will be done with pens, paper, and human brain-meat.

This workshop is based on the Mechanics-Dynamics-Aesthetics framework (as devised by LeBlanc et al), and is based on a series of small exercises in which participants rapidly iterate on game designs. It's designed for interested students of game design, teachers seeking an interesting perspective on creative computing, and enthusiasts looking to understand how games work.

Topics covered in this workshop include:

- Why games work, and how to analyse and build engaging experiences
- The Mechanics-Dynamics-Aesthetics framework: what it's good for, and how to use it
- How to deconstruct a game and understand what makes it fun
- How to modify an existing game and know what you're doing

Paris Buttfield-Addison and **Jon Manning** are co-founders of Secret Lab, a mobile game development studio based in Hobart, Tasmania, Australia. Both are also a PhD candidates at the University of Tasmania (UTAS) and co-authors of "Learning Cocoa with Objective-C Third Edition" (O'Reilly Media, 2012) and "iPhone and iPad Game Development For Dummies" (Wiley, 2010). They are currently co-writing "iOS Game Development Cookbook" (O'Reilly Media, ~2014) and "Mobile Game Development with Unity" (O'Reilly Media, ~2014). Secret Lab has built 100s of mobile apps for people around the world, including "Meebo" for iOS, Android, and BlackBerry (Meebo, Inc; Mountain View, CA; acquired by Google in 2012); "Play School Art Maker" for iOS (2011), "Foodi" for iPad (2011), "Good Game" for iPhone (2012), "Play School Play Time" for iPad (2013) (Australian Broadcasting Corporation); "National Science Week" for iOS (2012-2013); and many others.

Tim Nugent is a PhD student in the field of mobile awareness at the University of Tasmania, currently investigating how people can better share information in busy environments. He has been doing iOS development for several years as well as having presented iOS and mobile talks at several AUC /dev/world/ and CreateWorld conferences as well as mobile research papers at the Australian Human Computer interaction (OZCHI) conference twice.

Sonification: Can bloogle resonators enhance representation of time, space and culture through the Person-Environment-Occupation Model?

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In this workshop, participants are encouraged to create their own sonifications with bloogle resonators in a dynamic social context. The significance of socio-cultural representation will be demonstrated in relation to musical performance on bloogle resonators in educational, occupational therapy, and creative arts practice contexts. The Person-Environment-Occupation Model (P-E-O) has been a catalyst for numerous applications to enhance peoples' occupational performance. The P-E-O model was developed by Canadian occupational therapists, Mary Law and colleagues in 1996 as a transactive approach to occupational performance. Research indicates the usefulness of the P-E-O model for representing change over time at identified points across peoples' lifespan. However, this workshop considers whether the P-E-O Model could be represented in an alternate way, through acoustic sonification with bloogle resonators. The following paper describes in some detail the ideas addressed in the workshop.

Abstract

The Person-Environment-Occupation Model (P-E-O) has been a catalyst for numerous applications to enhance peoples' occupational performance. The P-E-O model was developed by Canadian occupational therapists, Mary Law and colleagues in 1996 as a transactive approach to occupational performance. Research indicates the usefulness of the P-E-O model for representing change over time at identified points across peoples' lifespan. However, this paper considers whether the P-E-O Model could be represented in an alternate way, through acoustic sonification with bloogle resonators. Methods of literature review and activity analysis are used to introduce the potential for sonification of the P-E-O model through researching musical performance on an easy-to-play instrument known as a bloogle resonator. The significance of socio-cultural representation is discussed in relation to musical performance in educational, occupational therapy, and creative arts practice contexts.

Introduction

The Person-Environment-Occupation Model was developed by Canadian occupational therapists as a useful tool for explaining concepts of professional practice to others (Law, Cooper, Strong, Stewart, Rigby, & Letts, 1996). The Model is represented by the authors as a visual diagram that shows the interconnectedness between people, environments and occupations. The visual diagram of the P-E-O Model assists therapists to achieve the best fit by working with clients to influence relationships between the person-environment-occupation components. Since the model was developed by Mary Law and colleagues in 1996, therapists have applied the Model extensively to working with people with a disability, but the visual nature of the diagram has never been questioned in the research literature. This study is intended to scrutinise whether the concepts of the P-E-O Model could be demonstrated through non-visual modalities, such as through sounds – a process known as sonification. Literature review will reveal more about sonification and whether it has potential to represent broad concepts of time, space and culture that people encounter in contemporary material world and virtual contexts. My working hypothesis is that the na-

ture of the visual diagram of the P-E-O Model may limit conceptual understanding; and that representation of the P-E-O Model in an alternate way may enhance representation of time, space and culture.

At this early stage of research I have chosen to conduct an activity analysis of playing a simple musical instrument, known as a bloogle resonator, to explore representation of the P-E-O Model concepts through sound. This is an innovative study because the use of musical instruments for dynamic modelling of occupational therapy concepts was not found in OT Seeker, a database which lists research that forms an evidence-base for occupational therapy practice. The findings of activity analysis with bloogle resonators are discussed to determine potential application to occupational therapy, creative arts practice, and professional education. Because the research is still under development, recommendations are made for further experimentation with sonification as a way of representing conceptual models. The methods are not yet in use with client groups for therapy, but techniques of sonification are being developed in workshops with musicians, artists and professional colleagues.



Figure 1: Person-Environment-Occupation Model

Background and History

As a musician, my creative practice intersects with my vocation as an occupational therapist and the principles of “doing, being and becoming” (Wilcock 1999, Kirkwood 2011). Action learning philosophies are well known to many disciplines. Aristotle spoke of praxis in Poetics 6 with the meaning of ‘action’ (Belfiore 1984, Aristotle 1996). Capitalising on this thinking, action learning philosophies have been espoused by educationalists such as, Friedrich Fröbel, founder of the kindergarten movement in Germany in 1840, followed by the progressive education precepts of John Dewey, Rudolf Steiner, and Maria Montessori. The post World War One development of the profession of occupational therapy was founded on the moral value of being actively engaged with daily routines of meaningful activities to promote adaptation and well-being in mental health hospital facilities (Meyer 1922/1977). “Arts and crafts activities constituted the main tools of occupational therapy practice from the beginning of the profession until about the 1960s”(Schmid 2004, 80).

Mary Reilly, occupational therapist stated the hypothesis on which our profession is founded... “That man though the use of his hands as they are energised by mind and will, can influence the state of his own health” (Reilly 1962, 2). This highlights how peoples’ active participation is thought to be connected with their state of health. The primary role of occupational therapists today is “working with people and communities to enhance their ability to engage in the occupations they want to, need to, or are expected to do, or by modifying the occupation or the environment to better support occupational engagement” (World Federation of Occupational Therapists 2010, 1).

The P-E-O Model grew out of multi-disciplinary approaches of trying to influence peoples’ behaviour by altering aspects of the social and physical environment, rather than trying to cure or repair individual body structures and functions (Bronfenbrenner 1977, Kielhofner and Burke 1980). Ideally, occupational therapists support and enhance peoples’ occupational performance in home and community settings. However, occupational therapy is often provided in clinical facilities that are sanitised and removed from the client’s usual socio-cultural environment. The application of the P-E-O Model therefore becomes problematic in these settings which are devoid of the usual inter-personal relationships and consequences of actions. The tendency to simulate, rather than perform daily living tasks in home and community settings makes it difficult to predict how people will function when they are discharged from a health facility. Safety is now a primary consideration, with less emphasis on action learning through creative activities and collaboration with others. “Since the 1960s, the use of arts and crafts as therapeutic activities has diminished in practice and professional education”(Schmid 2004, 80).

A secondary benefit of this study is that it analyses the value of identified creative arts activities within occupational therapy practice to build understanding of concepts (Peloquin 1989, Schmid 2004). Critical discussion has occurred over the use of music in occupational therapy, but there has been no consensus because there is large variation in musical competence of therapists, and in some centres music is performed by specialist music therapists or others for diverse reasons (MacRae 1992). Occupational therapy specialisation in music has been applied to certain areas, such as with people who have a learning disability (Williams 2013), and for engagement with music heritage and culture (Kirkwood 2008). Occupational therapy students are encouraged to explore emerging roles as part of their professional practice education. The innovations discussed in this paper may be relevant to the development of emerging roles and creative arts practice within and beyond the occupational therapy profession (Thew 2011).

Methodology

The purpose of this study is to explore musical performance of person-environment-occupation transactions on an easy-to-play musical instrument, known as a bloogle resonator.



Image 1: Bloogle resonator. Photograph by author, 2013.

This study uses activity analysis and literature review to explore the key research question “Can bloogle resonators enhance representation of time, space, and culture through the Person-Environment-Occupation Model?”

The method of activity analysis has been used extensively throughout the history of occupational therapy (Creighton 1992). The person and situation-specific parameters vary from one individual to another, but a single activity has been selected for the purposes of this study -- musical performance on a bloogle resonator, also known as whirly tube, sound hose, or corrugaphone. Bloogle resonators were chosen because they are easily accessed, inexpensive, and can be played by most people with minimal tuition. A workshop was held on August 10, 2013 with four professional colleagues to analyse the capacity of bloogle resonators to represent person-environment-occupation transactions over time, space, and in reference to identified cultural situations. Activity analysis involves describing the capacity of the instrument for musical expression and the different ways that it can be played to achieve particular ends.

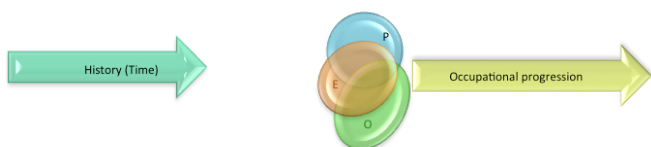


Figure 2: Three-dimensional diagram of P-E-O model showing occupational progression over time

Musical experimentation with bloogle resonators will help to determine if sonification is useful for representation of the components of the P-E-O model. If the findings of this study reveal that sonification can enhance conceptual representation, then this supports active engagement of stakeholders in new forms of creative collaboration within occupational therapy, creative arts practice, and professional practice education. In this study, 'stakeholders' refers to all people who have an interest in the research including clients, therapists, educators, researchers and creative arts practitioners.

Literature Review

Person-Environment-Occupation Model

The P-E-O model was originally represented by the authors as a two-dimensional Venn diagram (Law and Cooper et al. 1996). The three inter-locking circles reveal the extent of the interdependence of transactions between people, their environments and the occupational roles that they carry out as part of everyday living (see Figure 1). The degree of overlap of the three circles represents the goodness-of-fit for occupational performance which is adjusted through adaptation to life circumstance (Law et al. 1996). Theoretically, when the overlap between the P-E-O components is greatest, this constitutes better occupational performance; but this needs to be more thoroughly evaluated on a case by case basis because there is great variation in how the model has been applied in case studies (Strong, Rigby et al., 1999). Literature review reveals that there has been very limited application of the P-E-O Model to culturally diverse scenarios.

The authors also included a three-dimensional diagram of the P-E-O model that is a tube which is divided into cross-sectional views at particular intervals throughout a person's lifespan to show varying degrees of overlap or 'goodness of fit' between person-environment-occupation over time (Law et al., 1996). The three-dimensional modelling is useful because it provides a temporal dimension which represents change in a persons' occupational performance throughout their lifespan (see Figure 2). The concept of time is represented as linear in this model, which has social-cultural implications that is relevant to the discussion presented later in this article. It appears that the visual model was developed by therapists as a conceptual representation which was intended for application to an unlimited range of practice scenarios. The question needs to be asked, whether visual representation is the most appropriate form of modelling.

Visualisation is predominant in the conceptual diagrams used in health research literature in general. It is customary to represent conceptual models through tables, histograms, pie charts, bar graphs that are readily accessible in computer software programs and easily published. For example the Periodic Table of Visualization Methods shows numerous diagrammatic ways of representing theoretical concepts (Lenger and Eppler 1977). A visualisation method is defined by Ralph Lenger and Martin Eppler (1977, 1), as "a systematic, rule-based, external, permanent, and graphic representation that depicts information in a way that is conducive to acquiring insights, developing an elaborate understanding, or communicating experiences."

A conceptual model is able to represent the current understanding of a process of interest but this is influenced by cultural understandings and perceptions (Dayé and De Campo). Models generally facilitate communication between people of different disciplines. Four stages have been identi-

fied in the process of constructing conceptual models (Pickett and Cadenasso 2002). Firstly, the components of the model such as specific people, environments and occupations are identified and described or recorded. The characteristics such as the geographical location, the identity of the people or virtual communities, and the designated time period are defined in order to apply the appropriate spatial and temporal scaling to the model in which peoples' occupational performance occurs. Once this information is constructed and possibly mapped on the P-E-O Model diagram, it is then possible to articulate the possible interdependence between components and to identify constraints on behaviour of the system. The metaphor of an eco-system is sometimes used, but may not be applicable in all cases. The therapist monitors how changes in the P-E-O transactions influence a person's occupational performance to achieve goodness-of-fit between components.

Visual representation of data has limitations. Marshall McLuhan, Canadian philosopher of communication theory stated that, "...the medium is the message...that the personal and social consequences of any medium ...is introduced into our affairs by each extension of ourselves, or by any new technology" (1964, 7). Alternatives to visualisation are sought through this study of sonification of the P-E-O Model transactions. There may be additional components that become evident through activity analysis of playing bloogle resonators – part of critical reflection on my creative practice. Of particular interest are time, space and culture – since these factors have been described as relevant to sonification in the social sciences (Dayé and De Campo 2006). Christian Dayé and Alberto De Campo (2006, 353) state, "Our basic assumption is rather that the predominance of the human eye has obscured the perceptual capabilities of the other senses. As a consequence, they are hardly ever used in research."

Visual Form of Bloogle Resonators

It is serendipitous that the tubular form of bloogle resonators coincides with the 3-dimensional visual representation of the P-E-O model. This facilitates explanation of the model by showing that the length of the tube depicts the persons' occupational progression and career development over time. The model could be simulated visually by entwining three bloogle resonators to demonstrate the close inter-relationship of the person-environment-occupation components, but the plastic corrugated walls of the resonators do not allow shaping of the components which would change throughout the length of the tube. Construction of bloogle resonator tubes with more flexible materials would allow the P-E-O transactions to be physically demonstrated in accordance with change in the shape of components over monthly, yearly, seasonal, or with random occurrences according to the timescale adopted. Contrasting colours for the three tubes are important for distinguishing each of the P-E-O factors and stakeholders may have particular colour preferences as part of the artistry of their creative practice. The design of the bloogle resonators can be customised through colour choice if they are purchased off the shelf, but other features would need to be tailor-made through an individual design and manufacture process. Visual artists may assist creating a better creative product.

Sonification

As discussed, the visual form of bloogle resonators is somewhat useful, but there are greater possibilities for mod-

elling through using them as a musical instrument which emits whirring sounds when rotated – while holding one end in the hand. Bloogle resonators can create individualised musical soundscapes through a process of sonification which will be explained further from review of literature.

Sonification is an interdisciplinary practice defined as, “the use of non-speech audio to convey information” (Kramer and Walker et al. 1999). More recently, sonification has been defined, “when sound is used as a medium that represents more than just itself” (Grond and Hermann 2012, 213). Stephen Barrass (2012a, 178) however, avoids the term ‘representation’ by introducing the concept of ‘usefulness’ into his definition: “Sonification is the design of non-verbal sounds to convey useful information.” Barrass (2012, 178) states that, “Usefulness allows multiple sonifications of the same data for different purposes and provides a basis for evaluation, iterative development and theory building.” This design theory is helpful because it distinguishes between information and data and introduces functionality into the discussion. There are a wide range of applications of sonification in the literature that ranges from literal representation of data, more accurately termed ‘audification’; to representation of concepts or data through sound art, improvisation and musical composition which has varying degrees of aesthetic appeal. My method of performance resembles Barrass’ (2012b) definition of ‘acoustic sonification:’ “Acoustic Sonifications are physical objects designed to make sounds that convey useful information about a dataset of some kind. Unlike other sonifications, they do not require a power supply, and the sounds are interactively produced in real time through physical interaction with an object.”

Australian music therapist, Alan Lem reports using a form of computerised sonification with adult clients with physical disabilities (Lem and Paine 2011). The video examples by his co-author, Garth Paine show how sound technologies are responsive to peoples’ physical movements, thereby encouraging further musical expression. Algorithms that produce the sounds are activated by various measurable factors such as range of motion and intensity of response (see <http://vimeo.com/2329210>). This technological application is a way of translating clients’ body movement into musical composition that is more complex than the commercially available counterpart, the Soundbeam. Soundbeam is an electronic musical response device which provides literal sound response to body movement in front of a beam (see <http://www.soundbeam.co.uk/>).

The Jambot computational music agent is another interactive music system. It has been designed for real-time musical improvisation and refined through mediation between imitative and intelligent actions (Gifford and Brown 2011). These technological systems of improvisation are potentially beneficial for people that have physical disabilities or communication disorders which prevent them from conveying useful information through traditional musical instruments. Toby Gilford and Andrew Brown state that the findings of their research may contribute to understanding human-computer non-verbal communication interfaces, which means this has potential as a form of sonification as well.

Technological devices with multiple perspective hierarchies have been developed for constructing relational diagrams in audio which apply to model-making: “Overall, all participants were able to use the auditory interface to construct full diagrams that properly represented the systems they were asked to model” (Matatla and Bryan-Kinns et al. 2008, 102). Matatla and colleagues discuss the aspects of sonification

that facilitated ease of use for understanding how devices work. These examples of technological devices from the literature reveals that research on sonification has generated a plethora of complex technological solutions before exploring the more basic responses that are possible from using simple musical instruments to convey useful information. Another key finding is the importance of the role of listeners in deriving meaning from sounds through creative inferences they make in the act of listening. Sonification relies on peoples’ perception. The “act of listening to music involves simultaneous changes in variables such as frequency, amplitude and spectral distribution and integrating them into a comprehensive mental image” (Ben-Tal and Berger 2004, 230).

Andrea Polli (2012) reports that multiple identities and similarities can be represented through sonification and listeners identify patterns and detect trends which they prioritise for listening. Engaged creative listening allows processing of multiple strands of information at the same time. The temporal nature of sound makes it useful for sonification of time-oriented data which reveals recurrent patterns and trends. For example, sonification has been used effectively for representing change in annual weather patterns, and the temperature and salinity of the ocean at various depths (Polli 2012). Lorella Abenavoli (2012) reports on digital sonification methods for scaling and amplifying the seismometer-recorded vibrations and fluctuations of the Earth’s internal movements that are usually inaudible and too slow to be apprehended by the human ear. The scale modelling brings sonification of time and space together in aesthetic representation of the “Pulse of the Earth” that can be appreciated through the senses of touch and hearing. Sonification is commonly used in health practice through instruments such as the stethoscope, to listen to the functioning of body organs that are not visible (Dayé & De Campo, 2006).

Various forms of sonification have been described by Barrass (2012a, 180):

- Sinification – numerical increases in data result in increase in frequency of a sine-tone
- MIDification – Various electronic orchestral instruments play notes at different volume levels, according to categorical changes in the data.
- Musification – The narrative qualities of music are used to provide sonifications related to affect, valence, arousal, or other dimensions of experience.
- Vocalisation – Vowel and other vocal sounds are synthesised to vary in response to quantitative and qualitative data.
- Iconification – Aspects of a variable may be performed through sounds that are related to the context, such as the sound of rain chosen for representing the degree of annual rainfall.
- Stream-based – Granular synthesis techniques allow variables to be separated spatially into figure-ground sounds, which reveal particular features.

Findings of Activity Analysis: Musical Performance with Bloogle Resonators

Musical performance with four professional colleagues was carried out in a conference workshop on 10 July 2013 at

Queensland College of Art. This demonstrated that the first possibility of the use of the bloogle resonator is to make sounds by rotating it in circles above the head. This requires a firm grip and stabilisation of the trunk and shoulder girdle for coordination of rotator cuff, arm and hand muscle actions. The faster the bloogle resonators are rotated the higher the pitch of the tone they emit. Participants were able to easily demonstrate playing three different tones, which allows each of the different components of the person-environment-occupation to be represented by a team of people. Various postures were adopted for playing the bloogle resonators and this can be incorporated into choreography of dance and physical activity routines. Because they have the element of fun, bloogle resonators may encourage people to join in expressing themselves through spontaneously, using ad lib vocalisation and physical actions to express emotions and ideas. Participants were encouraged to move around and use this body in space as they played the instrument. This stimulates the visual, auditory, vestibular and tactile senses which may heighten participants' level of cognitive arousal or alertness. The heightened physical activity resulted in reports of increased heart rate and respiration which may have value for incidental exercise.

The sonic potential of bloogle resonators lies in being able to use the following musical elements to depict features of time, space, and culture. The elements that can be varied with bloogle resonators include:

- Rhythm, sound and silence, repetition
- Volume or amplitude
- Pitch / frequency
- Quality of sound (timbre)
- Spatial location
- Body movement and coordination (physical activity)

Most importantly, music-making occurs over time and this is regulated by duration of phrases, repetition tones in rhythmic patterns, and choice of tempo or pace. This allows sonification with bloogle resonators to change in correspondence with variation of P-E-O components over time. The result is a kind of storytelling sequence, in which the bloogle resonator becomes an extension of the arm that helps participants to express themselves through gestures, sounds and silences. The movement occurs in a position and through a space that is related to the spaces used by other participants. This makes it possible to enact a time sequence of events in relation to position in space. The musical expression can thereby incorporate a multitude of person-environment-occupation transactions that can be compressed in time.

Bloogle resonators take minimal skill to play, so people can improvise musical tones to match verbal descriptions or stories which they wish to tell. This form of musical improvisation has aesthetic features which participants can strive for in the artistry of their storytelling, musical composition and choreography. A feature of musicking on bloogle resonators is that it allows people to adjust through the pace (tempo), rhythm, and cycles of their performance or and silences that they adopt. This gives a sense of control for sonic modelling that is capable of abstract ideation of cognitive and theoretical concepts. Participants were able to choose body actions and sound patterns that best communicated the concepts that they wished to convey. In the early stages of becoming familiar with bloogle resonators, participants just played

around to experiment with what is possible. Symbolic representation may develop with further practice, and this could relate to cultural traditions understandings of time and more freedom in moving about to express oneself through gestures. Because sonification is a non-verbal form of communication, participants are able to represent emotions that they may not be able to fully explain through language. The act of performing music facilitates expression of an inner world which gives access to projection of feelings and abstract ideas. Musical performance is therefore an effective way of representing perceptions and attitudes toward person-environment-occupational transactions as they change over time. The audience interprets the meaning of the performance through their own perceptions and associations, thereby creating personal meaning. In tribal cultures, all people are involved in music making through playing instruments, song and dance (Blacking, 1973, 4).

Qualities of Musical Expression

Most people have access to low-technological music-making devices and could participate actively in dynamic modelling of person-environment-occupation transactions if they were given the opportunity in a suitable location. Using bloogle resonators to represent P-E-O concepts through musical performance has advantages over pure audification of computerised data because music-making is physically active, engaging, creative and interactive. Musical performance is sensitive to changes in dynamic relationships and transactions between people and environments that are situated in real time, or in virtual spatio-temporal contexts. Social participation allows musical relationships to develop over time in environments within or outside of healthcare institutions. People can design soundscapes through recording tracks and building up electroacoustic compositions layer by layer – resulting in sonic polyphony. Expertise in musical technologies and sonification devices may be required for more complex modelling. Innovations in cymatic synthesis are available at Stephen Barrass' website (see <http://stephenbarrass.com/>). William Duckworth's (2005) describes virtual musical interactions online which are interactive. Social networking produced new dimensions for the I-Orpheus opera performed at Southbank, Brisbane on 31 August, 2007 (see <http://www.billduckworth.com/iorpheus07>).

There are some layers of musical expression that may not be able to be achieved through simple musical instruments, such as bloogle resonators. For example, musical performance, costumes, stage design and dramatisation in opera can express emotions, such as love, rage, sorrow, and repressed feelings or conflict. A variety of musical devices are used, such as melodic invention for 'word painting;' which means to use melodies or harmony in a way that evokes the meaning of the word, or associated feelings. Melodic descending phrases may be suggestive of sighs. Melodic tones can be played in succession to express emotions, especially when chromatic harmonies are used. If musical tones are played simultaneously in chords this provide accompaniment to melodies that can be harmonious or dissonant. A cadence brings a section or piece of music to a close through ending with a final rhythmic or harmonic gesture. The closure may release tension of emotion when the dissonance resolves and moves by step to the tonal centre. Most of these more complex expressive devices require a wider range of musical instruments and expertise.

There are unlimited possibilities of interlocking musical elements which are coordinated simultaneously, or in asynchronous relationships with body movements. Ethnic groups exploit these possibilities through performance of corroborees or other cultural traditions.

Socio-cultural Considerations

Culture and historical traditions affect the sonic representation of person-environment-occupation transactions through music-making. Bloogle resonators may look like plastic toys, but they are not inert because they have potential for socio-cultural representation. This is evident in the YouTube video-recording of Canadian astronaut, Don Pettit playing what he calls “the didgeridoo,” in *Science off the Sphere: Episode 9 Electric Didgeridoo* (American Physical Society, 2012).

In this video, Pettit plays the vacuum hose in a similar way to the blowing a didgeridoo – which looks similar to a bloogle resonator. Aboriginal peoples in Arnhem Land, Northern Territory are credited with developing the use of hollowed out logs for didgeridoo performance as part of their traditional song and dance customs (Neuenfeldt, 1997). The video performance evokes association with Aboriginal musical heritage and culture through the using the term ‘didgeridoo’ for the vacuum cleaner hose. Pettit is concerned with demonstrating principles of physics for a science lesson, but does not explain the socio-cultural links with intangible cultural heritage of Indigenous Australian peoples. He describes his performance as “being a musician,” and tries to dress accordingly by re-designing his space uniform, which many people found humorous, according to comments posted on the YouTube site: “These videos are hilarious and amazing” (see <http://www.youtube.com/watch?v=bAsjotsz-jA>).

Using the vacuum cleaner hose for music-making inadvertently translocates the traditional Aboriginal use of the didgeridoo through virtual technologies to the context of the International Space Station – a small multi-cultural community of people orbiting the Earth. It is commonplace for people to play didgeridoo-like instruments in non-traditional Aboriginal contexts on the Earth (Neuenfeldt 1997). The interpretation depends upon peoples’ past history of listening and their socio-cultural associations – influenced by their memory and previous person-environment-occupational transactions. It could be argued that this example of teaching and learning about physics occurs in a new cultural context that has not yet been negotiated with Traditional Aboriginal culture bearers, but now that may be possible through email and Twitter communication.

A contrasting musical example is Astronaut, Chris Hadfield’s original composition and performance of the “Is Someone Singing (ISS)” song which was recorded on the International Space Station and synchronised with a musical performance by the Wexford Gleeks school choir and a Canadian rock band (Chris Hadfield and Barenaked Ladies, YouTube 2013). The song was commissioned by CBC Music California and The Coalition for Music Education in partnership with the Canadian Space Agency to advocate for music education in Canadian schools (Grossman 2013). Through global social networking, people were able to voice their opinions about this collaborative performance through tweets. Peoples described the personal significance of the performance through You Tube feedback: “This is the kind of stuff that pulls folk together from all over the globe.” “I don’t usually cry, but I did for this.” “This is one of the most beautiful

things I’ve experienced.” “God’s gift!” “I’m feeling patriotic.” “Awe inspiring.” This online communication generated new potential for musical mediation of culture which is an aspect of people-environment-occupation transactions in the new dimension of extra-terrestrial music encounters. Numerous people stated that it brought them to tears, or to a new realisation of the connectedness of the human race on Earth and in space. Some comments were removed, so it is not possible to evaluate the full impact of the musical performance on people-environment-occupation component transactions globally. Further research is needed to prepare for future applications of music and sonification technologies to new geographical locations as people spend more time travelling and living in space. There is possibility for using the P-E-O Model more broadly than was originally envisaged by the authors in 1996. There is value in looking for new ways to represent P-E-O transactions and music-making hold unlimited potential.

Discussion

The brief account describes some of the possibilities for musical composition and improvisation on bloogle resonators to represent P-E-O model transactions. The skill level of the performers may affect how effective the musical performance is, but bloogle resonators are easy to play and access. Bloogle resonators are limited in their musical expressiveness due to the physical properties of their construction. A wider arsenal of high-technology and low-technology musical devices could be used for more expressive sonification in future research.

The interdependence between person-environment- and occupation is clearly demonstrated in performance of traditional Indigenous Australian song and dance traditions in corroborees. The context and social relations determine the meanings and associations of performance on bloogle resonators, and even a didgeridoo that was made from a vacuum cleaner hose. Various musical cultural traditions could be explored to systematically evaluate their potential for shaping and supporting peoples’ rendition of person-environment-occupation transactions. Further research is required to determine which sonic modalities of expression are most useful for artistic practice, therapy and education which to date has relied so strongly on text and visual diagrams in Western societies. Performance ethnography has been described as an educational method for exploring and enacting social relations, cultural connections and political factors (Alexander 2005, Denzin, 2003). This opens channels of communication for negotiating musical culture and heritage in different contexts. Bloogle resonators are a simple instrument to use for experimentation, but a wider range of musical instruments, song and dance may facilitate better understanding of the P-E-O model. In conclusion, this study has confirmed that creative arts practice and sonification technologies may have application to modelling person-environment-occupational transactions.

Recommendations for future research and practice

In the future, it is important to consider the potential of sonification and musical collaboration in various contexts to advance teaching and learning objectives. Song and dance can be used to facilitate social relationships of people from

diverse cultural backgrounds, and people connected through remote and virtual information communication technologies. The socio-cultural impact of digital music technologies need to be carefully considered, and possibly negotiated for use in teaching and learning programs. Bloogle resonators and didgeridoo-like instruments have wide-ranging potential to extend socio-cultural relationships and to represent concepts or models. The significance of sonification lies in the potential for stakeholders to participate and to share ideas through an active learning model-making process in a suitable, supportive environment. This creative collaboration builds capacity for relationships that enhance environmental and social awareness, thereby promoting changes in social and cultural practices (Polli 2012).

Sonic modelling may result in a richer inter-disciplinary blending of art and science. Suzanne Peloquin (1989, 219) states that, "The art of practice in occupational therapy is intrinsically centered on relationships, on the qualities that make relationships meaningful and on the meaning of occupation in a life." There is a role for occupational therapists to use participatory music-making in their practice to enhance meaningful representation of concepts, along with the benefits of music-making that have been described in research literature (Williams 2013, McDonald and Kreutz et al. 2012). Artists can contribute to design and adaptation of musical instruments to improve capacity for musical expression and sonification. Occupational therapists, musicians, designers and creative arts practitioners have a role to play in improving the design of bloogle resonators. Music educators may also assist in developing peoples' musical skills so they are better able to represent person-environment-occupation transactions. A wider range of musical instruments and sonification methods are recommended to provide greater choices in musical performance. Further exploration and activity analysis of a wider range of sonification modalities is suggested for future research.

Conclusion

Answering the question posed, bloogle resonators have some capacity to represent time, space, and culture through the Person-Environment-Occupation Model, but further practical research is needed to maximise musical expression of personal P-E-O scenarios in relation to context. In summary, there are at several possible uses of bloogle resonators that can contribute to model development and action learning in arts, education and occupational therapy practice. Bloogle resonators can be used for musical expression, and increasing peoples' level of engagement with physical and creative activities which stimulate sensory-motor responses and facilitate interactive communication. The second use of the instrument is for visual modelling of the Person-Environment-Occupation model. Finally, it has been demonstrated that bloogle resonators are not just inanimate objects, but signifiers of intangible musical heritage and culture. Musical performance on bloogle resonators therefore can have multiple meanings. A new musical performative environment has been described on the International Space Station which challenges occupational therapists to explore the old and new spatio-temporal dimensions of dynamic modelling with respect for cultural diversity on the Earth, and even in extra-terrestrial musical encounters of a teaching and learning kind.

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The Psychology of Embodied Creativity: Preparing the Creative Space before approaching the Digital Space

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Anyone working within the creative industries would be aware of the challenges that occur when working creatively within a digital arts space that's often time-limited. Similarly for any digital artist, the experience of a creative block can become a difficult transition to work through. Consequently, there appeared to be a need in the professional community to design and implement an experiential based workshop that both provides a theoretical overview on the psychology of creativity but more importantly experiential exercises that can allow for one to safely develop their own relationship with the creative process, even at times of stress and creative blocks.

This theoretical and experiential workshop is designed to assist participants to safely explore ways of tapping into the creative process in addition to discovering ways of nurturing and protecting that process. The workshop is intended to give one an experience of creativity as it is felt in the body, before even approaching the keypad. Whilst it is experiential in nature, it also includes important conceptual and referential information about the creative process. Topics include: where creativity can be found in the body, ways to access, nourish and protect one's creative self, creativity as an opportunity for self-awareness, the destructive side of creativity, mindfulness and embodied approaches to creativity, the role of convergent/divergent reasoning within the creative process.

In addition to a theoretical discussion on the psychology of creativity, three experiential introductory exercises are facilitated that borrow from mindfulness and other body-oriented modalities. The workshop functions best at a running time of 90 minutes. It has been successfully facilitated for groups as large as 90 and intimate as 20. No resources are required other than the usual equipment necessary for the projection of slides.

Simon Thatcher has been practising as a Psychologist since 1996 in a variety of public and private settings. During the past seven years, alongside his private practice, his provision of consultancy services to various creative agencies in the advertising industry led to the identification of the need for, and development of, creative- based self-care workshops. His additional qualifications in body and somatic psychotherapy complimented further the design, structure and facilitation of strategies to assist those working with the creative process. It remains clear to Simon that the creative process and developing a felt sense within the body cannot be separated. To date, this experiential based workshop on the Psychology of Creativity has been successfully implemented for in both Sydney and Melbourne companies such as Lion Nathan, Unilever, Nestle, Naked Communications and the 2013 national ASPAH (Australian Society for Performing Arts Healthcare) conference.