

What were we thinking? Reflections on artistic research in music

Paul Draper, Stephen Emmerson, Andrew Brown and Vanessa Tomlinson
Queensland Conservatorium Research Centre, Griffith University, Brisbane, Australia

Abstract: This paper explores the recent emergence of artistic research literature and extends this by examining the practice of the authors as musicians and researchers. Individual case studies respond to questions raised in the literature by interrogating music making processes. Through reflexive narratives, each author explains the thinking behind their music, exemplified in high definition audio-visual recordings of the works. These texts are used, in conjunction as multiple cases to explore and reflect upon the common attributes of the authors' artistic research in music.

Keywords: Artistic research, interactivity, improvisation, music, process, transferability.

Introduction

Since the amalgamation of vocational training providers in Western university systems over the last 30 years or so, practice-based/-led terminology has been widely used to signify that research which interrogates the authors' performative processes. Atypically this has included disciplines such as law, nursing, education, and the creative arts. More recently there has been a growing adoption of the term *artistic research* as a particular focus of 'artists in the university' (Wilson 2014) be they academics or postgraduate research students. Henk Borgdorff describes artistic research,

... to denote that domain of research and development in which the practice of art – that is, the making and the playing, the creation and the performance, and the works of art that result – play a constitutive role in a methodological sense. (2010: 21)

This idea resonates with those of us familiar with postgraduate supervision in music, and in relation to the particular forms of pedagogy, creative portfolio and thesis exemplars which continue to shape our understanding of such reflexive research (Harrison and Draper 2013; Draper and Harrison 2011; Harrison and Emmerson 2009). It is clear that artistic researchers do, in general, use their own musical practice as the source domain for their research investigations. Nonetheless, it is in iterative ways that the work prompts them to make specific adjustments in musical practice and/or to methodologies and questions relating to the development phase of a particular work at a specific time. Hence parallels with conventional research sequencing (questions, method, data, results) may be elusive, as Julian Klein writes:

The fact that most [artists] worked creatively and many systematically, is mostly undisputed. The motivation for knowledge enhancement was on the other hand not comparably obvious overall, even as they surely need to perform and reflect on their work by the use of knowledge they must have somehow acquired and therefore researched for – and this not only recently, but from the very beginning. (Klein 2012: 1)

In this paper we respond to these ideas by interrogating examples from our own recent musical practices. To do so, we adapt the following broad questions from similar work elsewhere (European Platform for Artistic Research in Music 2015) as a starting point:

- Can I provide evidence from my own experience that music and my understanding of it can be transformed by the process of artistic research?
- Do I integrate findings of my artistic research into my music and teaching practices, and if so, how?
- Can I provide convincing examples of artistic research where it is obvious that the musical material itself makes the argument?
- Who are the peers I am relating to in my artistic research and what is the impact of the interrelationship with peers?

Each author answers one of these questions by focusing on a case study of their own creative work, including audio-visual vignettes to provide the reader with visceral appreciation of the music itself. In conclusion the authors draw collective insights from the multiple cases to identify the common findings which emerge. The three case studies are summarised as follows:

- 1) Percussionist Vanessa Tomlinson describes her artistic research into the differences between instrumentalism and music-making. She discusses how her performance practice is transformed by that process and how the ongoing effects are unique to these insights.
- 2) Guitarist /composer Paul Draper positions ‘form-improvisation’ as method. He argues for music as findings and presents this case within an experimental music video piece. The project informs ongoing practice and the supervision of postgraduate research students.
- 3) Pianist Stephen Emmerson explores how improvisation in a duet with custom software and Yamaha Disklavier pianos impacts upon his music-making. The project exemplifies that the research is largely self-evident within, and ultimately transcended by the artistic outcome itself. Computational arts specialist Andrew Brown provides insights into the algorithmic software design that lies behind this work, its concepts, applications and its peer networks.

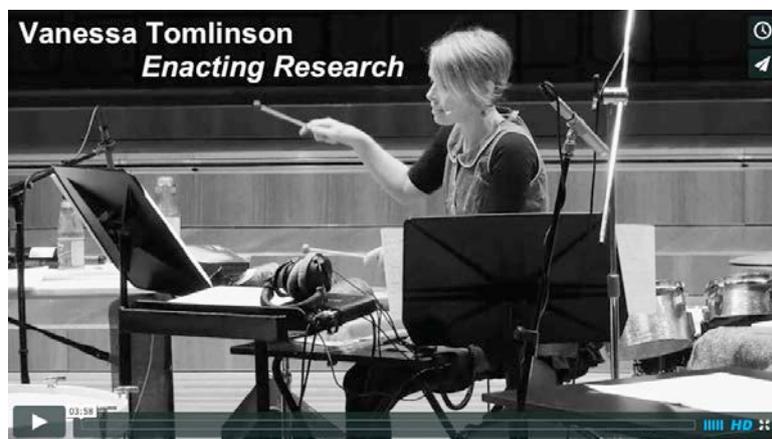
Enacting Research, Vanessa Tomlinson

Can I provide evidence from my own experience that music and my understanding of it can be transformed by the process of artistic research?

The conversion of any new score into sounding material involves a complex kaleidoscope of decisions. This is reliant on having the technical tools to execute and control the required sounding environment while simultaneously developing the musical understanding of the unfolding of time in the actualisation of the work. It is in this space that my research resides, evident in the emergence of distinctive sonic voices in the performance. There is residual sonic material of the individual performer evident in all I do, just as there is residual sonic material of the composer in all I present. However, it is in the deconstruction and reconstruction of the sonic world that distinctive musical voices can emerge, sharing the same root system.

An examination of what is known /unknown in this process brings insights in how to approach newness, and how artistic achievement may be measured. In this, the enactment of the artwork is the research, inclusive of all pathways explored, and of all knowledge gained. In the *8 Hits* project (2014) the commissioning of eight solo percussion works was undertaken with the intent of developing discreet performance practices for each, all evolved by the same performer of eight different composers’ works. What is retained? What is changed? What is transferable? What is unique? I will highlight two excerpts from the *8 Hits* concert in Video 1 (below) in order to problematize and explore these questions further.

Video 1: *Enacting Research* (2015), available at vimeo.com/profdraper/enactingresearch



The first extract (00'.17"–02'.06") explores Peter Knight's *Make them Dance* as a constructed environment using the bass drum as a resonating object located at the intersection of improvisation and composition. The variables of distortion pedal settings, volume pedal, amplifier settings, placement of contact microphone, placement of objects on the bass drum head, tuning of the bass drum head and interference with the acoustic of the performance environment were then controlled and manipulated in real time. My experimentation in the development phase was extensive and involved mostly an investigation of sonic activity: what sounds good in this environment, and what is the emotional tendency of this environment? Questions of what is performatively possible, and 'how' one actually controls the environment were not discussed with the composer until after the practice phase had begun.

This work did not rely solely on my instrumental skills. Instead it drew on my abilities to listen, to analyse a real-time musical scenario, and to make decisions about how to proceed through the instructions in the score. To confidently and freely play this work, I had to learn how to play and control this newly constructed instrument: coordinate between feet and hands in particular ways; mediate technology; control feedback loops between action and ear; plan and execute. I was mixing sonically familiar material that closely aligned with my improvisational language – long evolving tones, high pitched metallic sounds, and the extensive use of rice – on to a new instrument. I was developing a new performative technique to be mapped on to my pre-existing listening sensibility and create a new sound environment to enact the compositional aims.

A quite different example comes from Kate Neal's *Self Accusation* (02'.08"–03'.52") based on Peter Handke's play of the same name. Scored for voice, percussion and gestures, the work examines the power and banality of public and private speech. Again, the making of this work involved a collaborative development phase which centred around testing out key compositional ideas on the performer: Can the voice and percussion coexist in a conjoined contour? Can gestures be naturalised by using the performer's habitual gestural language as a starting point? Can an *instrumentarium* be developed that sonically stands apart from the voice while also mirroring it? Questions of compositional mapping on to a particular sound world emerge.

Because instruments from my personal collection were selected for the work – circular saw blades, Indian bells, a particular cardboard box or heavy metal mixing bowl – my own sound world became embedded in the composition. There are remnants of my technical and musical relationship to these sounds in the piece, but Kate Neal's language is completely new. My sounds and my gestures were applied in another musical language, resulting in a new sonic world that sits outside of my former experience. There is a process of unlearning and relearning the known required to enact this world: the naturalisation of reformed relationship of objects, techniques, voice, gesture, composer and interpreter; and the development of yet another performance practice.

Performance practice of newly commissioned works requires a deep investigation of the questions that the score poses. There are no shortcuts available, no pre-existing ear training to learn to embody the language being presented. In *8 Hits*, within the same body, one has to musically inhabit a myriad of discreet languages; musical pieces that stand next to one another in the same place but are made from different material. The slower this investigative process, the more I unlearn my instrumental skills and habits, and relearn how to play 'that' piece. The more each gesture and sound is mapped on to my body, the more I learn from relational experience that is interpretation. In my practice this inquiry 'is' artistic practice – research does not reveal more or less of the practice, it is essential and embedded in my approach to music-making.

Re-sequencing Research, Paul Draper

Do I integrate findings of my artistic research into my music and teaching practices, and if so, how?

Before academic life, I had a former career as a performing musician, progressing to recording studio sound engineering, record production and film soundtrack composition, the latter of which led me to my first university guest lectures. I always had a degree of fascination with improvisation: from how some ideas seemed to spontaneously emerge and propel creativity; through to enjoyment and self expression in the instrumental 'solo' of the jazz ethos; but

increasingly in terms of what I see as an intriguing relationship between improvisation and composition (Draper 2012a). This is a research theme to which I continually return, interspersed as it is with parallel interests in research training, music pedagogy and sound production.

This piece, *And After All* represents a component in a series of ‘comprovisational’ works (Draper & Cunio, 2013) which draw from my experiences in both musical and scholarly settings. This particular music video began life as a series of improvisations with noise effects, virtual instruments and guitars using digital audio workstation (DAW) software. It was the horizontal shape of the arrangement and the ‘improvisation of form’ that as much as possible was left intact, only to be trimmed, revealed and clarified by artistic reflection. Once this musical arrangement was in place, then video authoring software was used to layer abstract film footage to enhance the piece, with the visual components acting as precisely aligned vertical orchestration of the same form, as ‘visualised sound’ (Chion 1994).

Video 2: *And After All* (2015), available at vimeo.com/profdraper/and-after-all



Across my recent research publication activity, it has become increasingly clear that each step forward in that continuum uses what has come before to trigger the next stage. In the case of my improvisation fascination, while each outcome may function as both closure and beginning (in terms of say, a particular technique), at an artistic level this is little more than ‘how can I do better?’ in terms of the music itself. More accurately, over time an initial ‘research question’ can morph into another enquiry which then takes on a direction of its own. I find this distinctly unlike other musical projects. For example, where the written composition is executed by the multi-track recording of assembled performers who play their parts via an overdubbing process, or in a concert performance where a team of musicians and technical personnel come together to execute and deliver a product – the pleasure may be in the execution, but the terms, repertoire, constraints and other artistic features usually need to be well planned in advance.

In contrast, my comprovisation trajectory allows for the discovery and refinement of my own artistic methods. Shifts in critical listening perspectives form part of this (Draper 2014), for example, a musicological note underpins some of the obvious nods to genre, style and influential artists; sound engineering on the other hand demands a quite different kind of close attention to sonic attributes, just as music theory informs certain other structures, or ‘record production’ is referenced from commercial standards. I find it both remarkable and sobering that throughout history, musicians could not truly review their own performances until the invention of sound recording and its propagation in the 20th century. In the 21st century this has evolved exponentially, where the computer-based DAW with its sound recording /editing, virtual MIDI instruments, audio plug-ins and modelled spaces may allow for improvisation, performance and composition to be a fluid and interactive process, but which also voraciously demands its own particular musicianship (Draper and Millward, 2015; Draper 2012b). Its methodology includes familiarity, practice, repetition, while its ‘findings’ become new methods and its conclusions new music.

On teaching and research training

I supervise a cohort of postgraduate students as program director for my institution's Doctor of Musical Arts degree. While my research practice informs my teaching, my artistry and its questions are also equally inspired by and adapted from the student research community. It is the following encounters that have made the most difference to me as a musician and as a teacher in a positive symbiosis with young music researchers:

- All genres of music making now tend to share, interpret and adapt each other's artistic research concepts. While the idea of the 'replicability' of the results may often not be taken to be literally applicable (like scientific 'proof' might claim), there would seem to be porous borders between musical specialisations that advances the field. The situation often functions as a precedent, or a metaphor for the unfamiliar one (Schön 1983).
- While many postgraduate music research projects may begin life with a traditional approach to research questions, literature review and methods, these same core features may be dramatically re-purposed, indeed 're-sequenced' by the time that musicking is complete. Methodology may become a central component of research findings and which in turn sets provisional aims for future research. The question itself evolves into 'better questions' by project's end.
- In research writing, while techniques borrowed from the humanities and social sciences may initially apply, this often transforms to reflect a distinctive fit for artistic purpose. This notably includes compelling first person writing, auto-ethnography as part of an accepted paradigm, and the investigation of self-produced works – be they performances, recordings, compositions, websites or teaching designs. The concept of triangulation in such research demonstrably includes 'the self', while the notion of validity is reframed in far more confident terms than it may have been in the past.

Improvising With the Machine (Part I), Stephen Emmerson

Can I provide convincing examples of artistic research where it is obvious that the musical material itself makes the argument?

In 2013, my conservatorium acquired two electronically enhanced Yamaha Disklavier grand pianos (Wikipedia 2015). These instruments have enabled pianists such as myself to engage on acoustic instruments with the interactive software systems that Andrew Brown and his colleagues had been developing. Over the past year I have performed on the Disklaviers in various public concerts (mostly in the *Musician and Machine* series in Brisbane, Australia) where Andrew and I developed a type of Suite in four movements. Each of these involve different forms of interaction we termed *Mirror*, *Steps*, *Shards* and *Reflection* to reflect the algorithmic processes (see Appendix) that 'perform' on the second piano and interact with myself on the first. The accompanying video shows an example of the first two movements from a performance in the *Australian Piano Duo Festival* in September 2014.

Video 3: *Australian Piano Duo Festival* (2014), available at vimeo.com/profdrapper/emmerson-machine



The nature of the software is such that different settings work more or less successfully in responding to different musical styles. The ability to control the response and especially the degree of randomness bears strongly on this issue. My initial experiments explored the possibilities within a free style of improvisation with little sense of key or consistent metre, and a high degree of unpredictability in the ‘machine’ responses proved stimulating. However, by limiting the responses to particular scales, intervals or registers, more conventional tonal styles can be explored effectively as illustrated in the video example here. This particular concert was running behind schedule and so a decision was made to improvise with only two rather than the four movements we had prepared (in fact these were the two that are most conducive to a more traditional harmonic language).

The first movement opens with some simple gestures that were to make the nature of the *Mirror's* piano response explicit to the audience. Stylistically it starts with an obvious nod to Debussy before moving into a regularly metrical passage. Having worked in recent times on Bach's *Goldberg Variations* (saturated with ingenious canonic imitations), for me there was something deeply satisfying about creating a loose form of canon through what is, technologically, the simplest of responses. Canons involve a specific form of contrapuntal listening where part of the present is both predetermined by the past – what has just been heard/played – while another part is simultaneously anticipating the future and what will follow. Although this way of ‘double’ listening was familiar to me in playing Bach, my relative lack of experience in exploring this idea in an improvisational context heightened my enjoyment of playing with it. The second improvisation, *Steps*, starts by exploring some of the harmonic and textural possibilities of this setting before moving into a type of rhythmically driving passage that I had previously used more often within *Shards* where the responses were far less predictable.

The development of such interactive digital systems is clearly an area of music research with exciting possibilities for me. These developments provide stimulating tools for performing musicians such as myself to expand the nature of their creative work and research outputs. It was also clear to me that without any detailed knowledge or understanding of the technological processes involved, the interactions between *Musician and Machine* can be a compelling experience for an audience – the disconcerting movement of the second piano keys provides an interesting visual dimension, as are my own obvious performance responses. As one audience member observed, seeing a piano that appears to be playing by itself can strongly suggest imagery of a ‘poltergeist’. Subsequently, I will be explicitly exploring such imagery in a multimedia concert in October 2015 entitled *Doppelgänger*.

In this sense, an artistic outcome that stirs the imagination transcends much of the research that lies behind it. The embedded technology itself is invisible to the audience and is not their concern, as is the process through which the performer has previously explored the interactive potential and learned to respond creatively to it. The focus of both musician and audience is on the spontaneous creation of the artistic outcome and it is the musical interactions themselves that offer a compelling form of artistic research, as what Borgdorff refers to as “art that invites us to think” (2012: 72). In themselves such outcomes not only raise various questions about the nature of musical creativity, but they embody research answers in an artistic form. That such questions that cannot be articulated or addressed adequately in words provides the strongest rationale for recognising the art itself as a valuable form of research.

As Andrew describes below, the primary purpose of the system is to stimulate human creativity and this has certainly been the case for me. Improvisation is an aspect of my musicianship that I regret not to have developed more in the past but I am very pleased to have the opportunity to do so at this point in my performing career. I am only at the early stages of realising the musical potential of this interactive environment, but I will be taking a six-month period of study leave in the second half of 2015 to further develop my skills and research in this area.

Improvising With the Machine (Part II), Andrew Brown

Who are the peers I am relating to in my artistic research and what is the impact of the interrelationship with peers?

For me the interesting part of human-software musical improvisation is the stimulation of human creativity with fairly minimal automated input. We have been examining the notion of a reflexive approach to creativity, which via a system that reflects back at the performer, their own inputs in a slightly distorted way. There is a psychological history here around a fascination with the self that is manifest in things and wanting to see oneself from an external perspective, whether in a hall of mirrors where one sees oneself in altered ways or, in the more modern sense, of taking *selfies* with a phone camera.

Much interactive computer music software works with extensive computational machinery, that is, with complicated algorithmic systems. Our research is interested in ‘how simple can it be?’. In a sense, ‘what is the essence of some of these processes of creative interaction?’. We have been experimenting with the notion of just employing simple reflections of what musicians play. This approach also assumes that the musicality is in the performer and the computer system does not have to emulate musicality because it is really just ‘aping’ what the performer does. If there is no human input but one wants a machine to be musically expressive, the software needs to be programmed with complex rules about musical expression. By simple echoing strategies, it is assumed that musicality is already there in the human performed data, and the computer software just has to capture and throw it back out during its performance.

In that sense we have been working in a tradition most recently advocated by François Pachet, from the Sony Computer Systems Laboratory in Paris, who is part of our research team. Pachet created a system called *The Continuator* which employed a dialogic process similar to our work (Pachet 2002). When material was played then stopped, the Continuator echoed back some variation of that material. Pachet’s experiments showed that people were fascinated by the kinds of slight transformations that the Continuator produced and were both creatively stimulated and engaged with playing with the system. We extend Pachet’s research by undertaking these interactions simultaneously; not just as a dialogue but as a duet. Historically this is similar to compositions by Jean-Claude Risset, whose *Duets for one pianist* were interactive piano duets also based on reflective transformations (Risset 1990).

In a more contemporary context, delay and looping pedals have been used by, for example, Australian musician Lindsay Pollack (2015) whose solo work integrates the innovative use of echoes to construct performance pieces and particularly resonates with our investigations. The first movement in this suite, *Mirror* (see Appendix) is a simple delay where everything is reflected back exactly. But then as the Suite progresses through its variations, the software agents undertake different kinds of transformations of the material, going beyond an echo, to become much more interesting. This is an intentional approach, to start with a direct mirroring as a way for the audience and the performer to think ‘well this is just the beginning’, and then as we work through the last three movements, each more complex than the first.

The project provided an opportunity to explore how distorted the material from the original performance can be, yet still be recognisably coherent with it. Through this Suite we play with this notion of predictability as well. The first and second movements – *Mirror* and *Steps* – are deterministic, that is, they always play exactly the same reaction to a given input, so when a note is played it is clear what the response will be. The latter two movements – *Shards* and *Reflections* – introduce a sense of randomness and unpredictability, particularly *Shards* which randomises note pitches within a certain distance of the original input making it metrically predictable because delay time is deterministic, but far less anticipated harmonically. In order to compensate for randomised pitches being a bit too ‘crazy’ in these particular movements we constrained the pitch class of the automated part to ensure that the generated material maintained some kind of coherence. All musical composition needs a balance of novelty and familiarity or coherence. We used randomness to provide novelty, and constraints to provide coherence.

Through these works we are exploring and demonstrating how creativity can be stimulated by technological interactions as a musical dialogue with the performer. Our current technique for articulating a relationship is through these reflexive transformations and in how the various kinds of transformations and interactions produce different creative experiences and musical results.

Findings

If ‘art’ is but a mode of perception . . . ‘artistic research’ must be the mode of a process. (Klein 2010: 4).

On Process

These case studies demonstrate that the enactment of new musical works involves the intersection of ideas and practices, and the development of new understandings and modes of operation. The practice acts as a site for situated experience for the musician /researcher and the practical outcomes make the musical products as artistic conclusions accessible to others.

Our case studies and reflections reveal that an attention to the role of *process*, and its exposure through performance, documentation and commentary assists in transforming musical practice into artistic research while providing a substantial contrast to the often ‘mystical’ or hidden aspects of art-making. It is exactly this documentation of process that is at the heart of our insights into what it means to do artistic research. It is in this ‘doing’ where the primary diversion from traditional research resides, or conversely, where the distinctiveness of artistic research emerges. Process then is inextricably linked to methodologies which continue to evolve throughout the work to the point where so-called ‘research methods’ represent core findings as a staging post for new artistic projects which may follow.

On Improvisation

What was less understood at the outset of this study was the somewhat surprising commonalities present in what we had originally conceived of as three quite different ‘experiments’ in musical genres. In each case, musical improvisation formed a key component in revealing various decision-making processes along the way. It was the exact design context for such ‘freedom of movement’ that allowed for the process-as-methods material to emerge.

. . . the fundamental relationship is here understood to be between improviser and improvisation not between improviser and improviser . . . [this] exemplifies the ‘hyperawareness’ necessary for effective improvisation to take place . . . this is not an awareness of the other but of the inevitable situatedness of the improviser in a work, the contingency of that work, and of the agility necessary to avoid becoming trapped in the communicative community created by it. (Peters 2009: 63)

In each of our experiments therefore, there was an interplay between parameters we might have thought stable (instruments) and epistemologies we considered more fluid (musicianship). This was not the case and it was in fact the shifting nature of these foci that allowed us to unpack the core knowledge attained. As Borgdorff writes:

Experiments are not merely methodological vehicles to test knowledge that has already been theoretically grounded or hypothetically postulated . . . Experimental systems are characterized by the interplay of ‘technical objects’ [TOs] and ‘epistemic things’ [ETs] . . . [ETs] may turn into [TOs] . . . thereby ensuring the relative stability in the experimental system that enables new epistemic things to appear . . . [TOs], if deployed differently may sacrifice their stability and diffuse into epistemological questions . . . Experimental systems must be sufficiently open to allow these indistinct things to come into view; enough space must be present to produce what we do not yet know. (2012: 188-189)

On Knowledge Transfer

Through these works we have explored and demonstrated how our artistic creativity can be stimulated by various problem-based interactions that couple tightly with the musician. Our communication of results is multifaceted in that there are a number of audiences in play. As pianist Stephen Emerson outlines his in-concert contexts: ‘without any detailed knowledge or understanding of the technological processes involved, observing the interactions between *Musician and Machine* can be a compelling experience for an audience’. Similarly for Tomlinson’s radio broadcasts or Draper’s social networks, it is clear that the artworks – tacitly as answers to artistic research questions – communicate their findings and engage the wider public in satisfying ways.

In terms of research and research training communities, there is the commonality of musical aspirations and/or disciplinary knowledge that functions authentically. While the prevalent research desire for a ‘replication of results’ may not be an entirely appropriate analogy here – especially in light of an individual quest for artistic achievement – as Tomlinson writes, ‘it is in the deconstruction and reconstruction ... that distinctive musical voices can emerge, [yet] *sharing the same root system*’. In other words, while perhaps seemingly unfamiliar as a highly specialised project, the work and its articulated processes can function as a metaphor to inspire new works, as an adaptation in further ‘experiments’ leading to embodied discovery.

Conclusion

These explorations of our music making have shown the distinctive attributes to be process-as-methods, improvisation design, and dissemination as product and metaphor. Yet it is also the case that the art of musicians is a living, time-based and interactive endeavour that cannot be fully captured by digitally recorded proxies, or by simply “taking the . . . exhibition and laying it out on a slab for writing’s subsequent autopsy” (Overton 2014: 8). We fully acknowledge this. But as we also have shown, nor is music supernatural in its operations or emerges fully formed from so-called genius or sheer inspiration. What we have detailed is the authentic and often difficult negotiations that test and extend our aspirations in a quest to better speak to the world around us through our music and our scholarship. The end of this project now presents the opportunity for new works, and we hope, inspires other artists to appropriate and extend. Our findings do not present the *only* approach, but they do shed light on methods that can be adopted in artistic research for the benefit of artists and research methodologists alike.

REFERENCES

1. *8 Hits*. 2014. ABC Classic FM, *New Music Up Late*. Vimeo video, 1:37:18. Recorded November 1, 2014, posted November 18, 2014. Accessed April 7, 2015. <https://vimeo.com/114347927>
2. *And After All*. 2015. Paul Draper. Vimeo video, 4:03. Recorded January, posted February 9, 2015. Accessed April 7 2015. <http://vimeo.com/profdraper/and-after-all>
3. *Australian Piano Duo Festival*. 2014. Stephen Emmerson. Vimeo video, 2:35. Recorded September 2014, posted February 28 2015. Accessed April 7, 2015. <http://vimeo.com/profdraper/emmerson-machine>
4. Borgdorff, Henk. 2012. *The Conflict of the Faculties: Perspectives on Artistic Research and Academia*. Leiden, The Netherlands: Leiden University Press.
5. _____. 2010. “The Production of Knowledge in Artistic Research”. In *The Routledge Companion to Research in the Arts*, edited by Michael Biggs and Henrik Karlsson, 44-63. London: Routledge.
6. Chion, Michel. 1994. *Audio-Vision: Sound on Screen*. New York, NY: Columbia University Press.
7. Draper, Paul. 2014. “On Critical Listening, Musicianship and the Art of Record Production”. *Journal on the Art of Record Production*, No. 8, (eJournal) available at <http://arpjournal.com/on-critical-listening-musicianship-and-the-art-of-record-production/>
8. _____. 2012a. . “Toward a Musical Monograph: Working With Fragments From Within the Improvisation-composition Nexus”. *Journal of the Art of Record Production 6* Accessed March 1, 2015. <http://arpjournal.com/toward-a-musical-monograph-working-with-fragments-from-within-the-improvisation-composition-nexus>
9. _____. 2012b. . “A Musicianship for the Recording Studio”. In *Sound Musicianship: Understanding the Crafts of Music*, edited by Andrew R. Brown, 321-330. London: Cambridge Scholars.
10. Draper, Paul, and Cunio, Kim. 2013. “The ‘Little-r’ in Artistic Research Training”. In *Research and Research Education in Music Performance and Pedagogy*, edited by Scott Harrison, 105-117. London: Springer.

11. Draper, Paul., and Harrison, Scott. 2011. "Through the Eye of a Needle: The Emergence of a Practice-led Doctorate in Music". *British Journal of Music Education* 28 (1): 87–102.
12. Draper, Paul, and Millward, Frank. 2015 (in press). "Music in Perpetual Beta: Composition, Remediation, and 'Closure'". In *Music and Virtuality*, edited by Shiela Whiteley and Shara Rambarran. New York: Oxford University Press.
13. *Enacting Research*. 2014. Vanessa Tomlinson. Vimeo video, 3:58. Recorded November 1, 2014, posted March 17, 2015. Accessed April 7, 2015.
<https://vimeo.com/profdraper/enactingresearch>
14. European Platform for Artistic Research in Music (EPARM). 2015. *(Re-)processing Research: Musical Practice as Both Source and Target Domain for Artistic Research in Music Conference*. The Association Européenne des Conservatoires, Académies de Musique et Musikhochschulen (AEC), 23-25 April, Graz, Austria. Accessed April 9, 2015.
<http://www.aec-music.eu/events/event/european-platform-for-artistic-research-in-music-2015>
15. Harrison, Scott, and Draper, Paul. (2013). "Evolving an Artistic Research Culture in Music: An Analysis of an Australian Study in an International Context". *Research and Research Education in Music Performance and Pedagogy*, edited by Scott Harrison, 9-25. London: Springer
16. Harrison, Scott, and Emmerson, Stephen. 2009. "The Challenges of Supervision of a Doctorate in Practice Based Research in Music: Perceptions of Students and Supervisors". *TEXT* 6. [online]. Accessed April 9, 2015.
<http://www.textjournal.com.au/speciss/issue6/content.htm>
17. Impromptu (2015). Impromptu is an OSX programming language and environment for artists with an interest in live or interactive programming. Accessed April 2, 2015.
<http://impromptu.moso.com.au>
18. Klein, Julian. 2010. "What is Artistic Research?" *Gegenworte*, 23, 24–28. Accessed April 9, 2015. <http://www.julianklein.de/e/index.html>
19. LindayPollack.com (2015). Artist website. Accessed January 20, 2015
<http://www.linseypollak.com>
20. Newbury, Daniel. 2010. "Research Training in the Creative Arts and Design". In *The Routledge Companion to Research in the Arts*, edited by Michael Biggs and Henrik Karlsson, 44-63. London: Routledge.
21. Overton, Neill. 2014. "Double Indemnity: Practice-as-research". In proceedings of *The Future of the Discipline, ACUADS conference*, 2-3 October, Melbourne, Australia. Accessed April 2, 2015. <http://acuads.com.au/conference/article/double-indemnity-practice-as-research>
22. Pachet, François. 2002. "The Continuator: Musical Interaction with Style". In proceedings of the *International Computer Music Conference*, 211-218. September 2002. Göteborg, Sweden: ICMA.
23. Peters, Gary. 2009. *The Philosophy of Improvisation*. Chicago, IL: University of Chicago Press.
24. Pure Data. 2015. Pure Data is an open source visual programming language. Accessed April 2, 2015. <https://puredata.info>
25. Risset, Jean-Claude. 1990. "From Piano to Computer to Piano". *International Computer Music Proceedings*, volume 1990. Accessed April 7, 2015.
<http://quod.lib.umich.edu/i/icmc/bbp2372.1990.001/1>
26. Schön, Donald. 1983. *The Reflective Practitioner: How Professionals Think in Action*. London: Temple Smith.
27. Wikipedia. (2015), *Disklavier*. Accessed April 7, 2015.
<http://en.wikipedia.org/wiki/Disklavier>
28. Wilson, Jenny. 2014. *Artists in the University: Repositioning Artistic Research Within the Australian University Sector*. PhD thesis, University of Melbourne.

Appendix: Suite In Four Sections

Below is a short description of the four software interactions in the suite with screen shots of the two programming language implementations – the upper half of the Figure in *Pure Data* (2015) and lower in the *Impromptu* environment (2015).

Figure 1: *Mirror*. This process is a simple delay of the performance, initially set to be a one second interval.

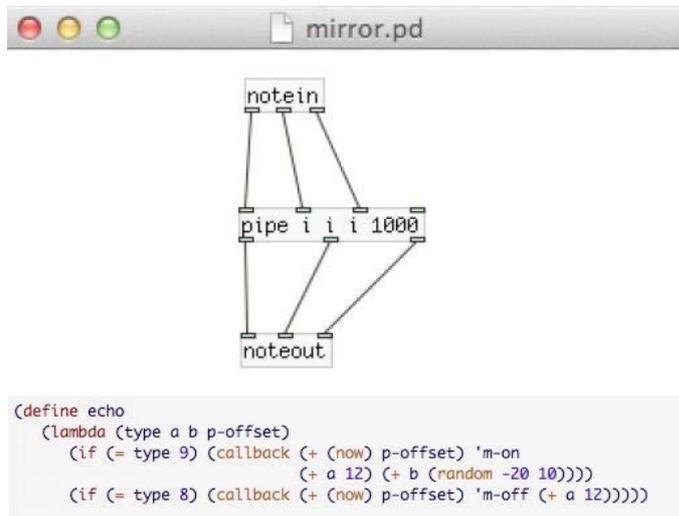


Figure 2: *Steps*. This process is an arpeggio of 3 consecutive 4th intervals from the performed note. The time between steps in the arpeggio is initially set to 1/8 of a second. Notes performed by the computer are quantized to a C major scale.

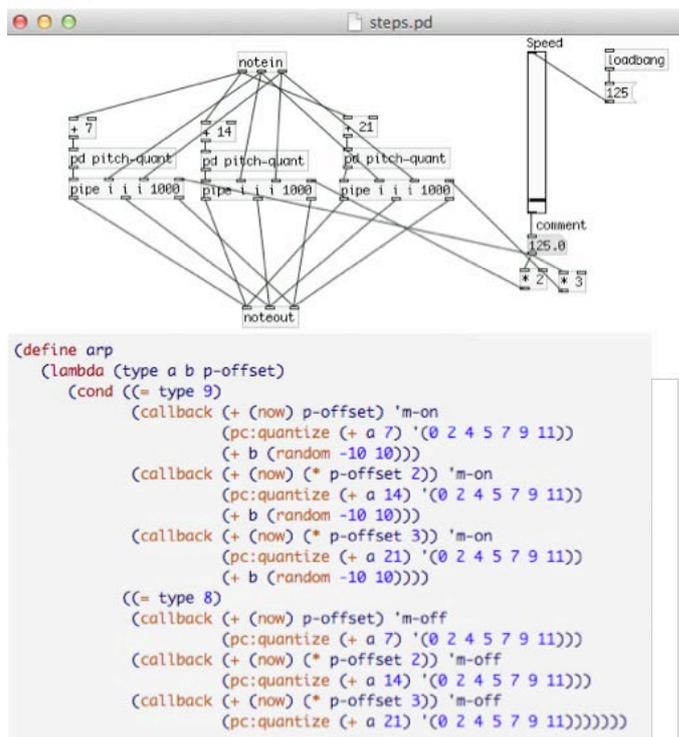


Figure 3: *Shards*. In this process notes are delayed by half a second and their pitch is randomized within 1.5 octaves of the original pitch. Performed pitches are quantized to a C major pentatonic to constrain harmonic complexity.

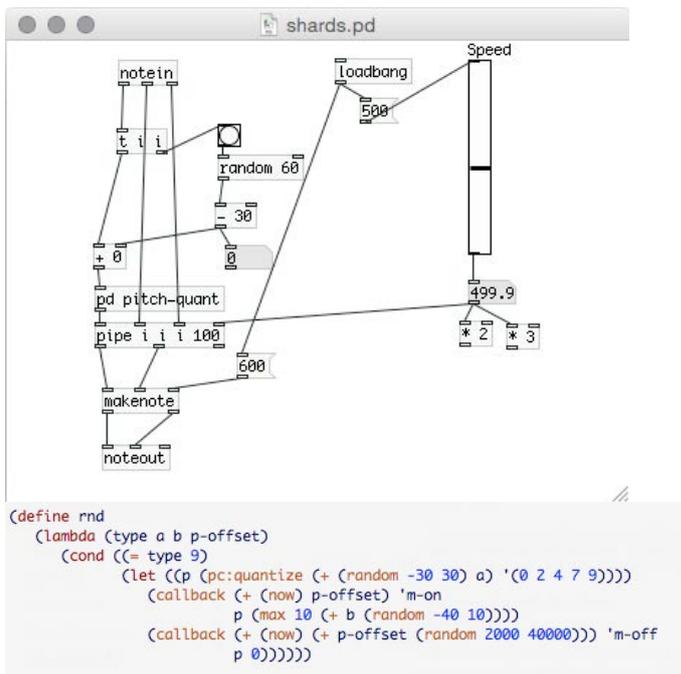
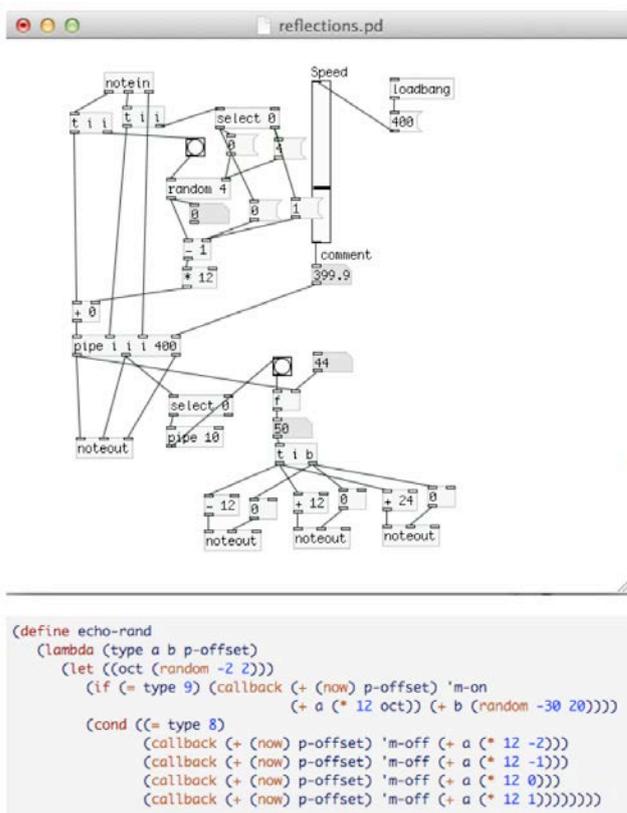


Figure 4: *Reflections*. In this process a single delay of around .4 of a second is applied to all notes and each note has a random octave displacement up to two octaves away from the original pitch.



About The Authors

Paul Draper is a professor of artistic research and program director of the Doctor of Musical Arts at the Queensland Conservatorium. He is a jazz musician, composer and record producer who publishes widely on practice-based research, web 2.0 culture and record production.

Stephen Emmerson is a concert pianist who teaches and supervises students at the Queensland Conservatorium and is program director of the Master of Music program at the Australian National Academy of Music in Melbourne. His performances are heard regularly in radio broadcasts and on CD via Melba and Move Records.

Andrew R. Brown is a computation arts specialist and professor of digital arts at Griffith University. His current performance practice is laptop live coding and he is a chief investigator on ARC Discovery research projects that develop interactive software agents.

Vanessa Tomlinson is a percussionist, composer, improviser and curator with a particular interest in Chinese music, found sounds, and acoustic ecology. She is head of percussion and program director of the Master of Music program at the Queensland Conservatorium, and co-directs the APRA award winning ensemble *Clocked Out*.