The present performer

A humanised augmented practice of the clarinet

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Declaration

I declare that this thesis was composed by myself, that the written and practical work contained and discussed herein is my own, except where explicitly stated otherwise in the text, and that this work has not been submitted for any other degree or professional qualification.

_____________________________________

Peter David Furniss
Edinburgh
8th September 2017
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Abstract

This practice-based research articulates a performer’s perspective from within the rapidly expanding field of mixed music, wherein traditional acoustic instruments are augmented by means of live electronics. Contemporary technology presents a panoply of sonic and interactive affordances and diverse avenues of potential for a contemporary practice of the clarinet. Pursuing a move from a technically passive approach towards self-efficient onstage operation, the author articulates a journey in which a hybridity of instrumental expertise and technical naivety develops into an embedded practice.

A framework of humanising is proposed to establish codes of practice based on the embodied skill and priorities of the onstage performer. A pragmatic and personal approach emerges to managing issues of sound, control, and engagement, with an emphasis on viable rehearsal and performance practices that ultimately privilege an ongoing attention to liveness. The portfolio of sound recordings and the observances contained in this thesis contribute to a growing body of performer-led accounts in a rich environment for the development of new creative work and collaboration, and to facilitating access to interactive music for performers wishing to explore the field.

A set of case studies trace three broad roles across a spectrum of creative agency within an interdisciplinary practice of the clarinet, situated at a nexus of diverse approaches—from performing composed works (executant interpreter) to non-idiomatic free improvisation (enactive composer), via hybrid works that blur these authorial distinctions (enabled interpreter). Negotiating multiple, interdependent influences within these respective performance ecologies, and moving over time from a status of technical novice towards one of proficiency and expertise (Dreyfus & Dreyfus 1980), a growing sense of embodied instrumentality is encountered (Nijs et al. 2009). The additional technology becomes less an extension of the instrument, rather the performer becomes present in a new holistic entity (Riva 2009; Rebelo 2006), with an attendant, ongoing re-evaluation of personal sound concept. Instrumental musicianship is reframed as inhabiting an assemblage of tools that filter and resonate physical energy, identity, and culture, and is directed towards an optimal performing presence.

Keywords

Music performance, practice-based research, augmented instruments, clarinet, humanising, liveness, presence, Pierre Boulez, Richard Dudas, Alex Harker, Martin Parker.
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Instruments are never stationary but are always given within a constantly changing, indeterminate background or horizon.

Franziska Schroeder & Pedro Rebelo (2009, p136)

The passage from object experimentation to the creation of a musical instrument involves the increasing refinement of hitting, scraping or blowing, such that sophisticated and detailed techniques of control are consciously elaborated as a result of the performer-listener’s conscious exploration of the interactive relationship. Gradually a performance practice evolves.

Denis Smalley (1996, p95)
1 A journey into hybridity

1.1 A meeting place

A growing number of performers of traditional classical instruments are embracing technologies that have, for several decades, been the domain of electronic musicians, composers, DJs, producers and electric guitarists. Computer equipment, pre-recorded media, effects units and multichannel sound are becoming increasingly established features on the stages of contemporary classical music, jazz and free improvisation. Furthermore, the increasing accessibility of computer-based music practice, and its application throughout a widening diversity of popular music styles, are subverting genre distinctions and bringing more classical musicians into contact with electroacoustic and digital practices.

This research addresses the continuing development of musical performance with traditional acoustic instruments and live electronics, also known as mixed music, noting the considerable enhancement and extension of sonic and expressive qualities for both performers and composers. It documents a performer's journey into the digital augmentation of an already established international performance practice, producing publicly engaged performance works and sound recordings fit for public release, and revealing elements of process.
The project entailed a move toward an onstage operation of live electronics, in order to replace the passivity of a two-performer paradigm in favour of a more active and integrated approach. My aim was to develop a creative and reflective practice that asserts a substantial degree of performer influence within mixed music performance, in line with a growing number of musicians in the field. The clarinet, which with its physical attributes of single reed, multiple sound sources, and cylindrical bore, presents a particular set of challenges in the field of mixed music composition and performance.

The six case studies in Part 2 are supported by recordings in the Practical Elements. These include compositions for clarinet and electronics (real-time, fixed media and hybrid), and some collaborative work that challenges definitions of piece, system and instrument. There are also some examples of my own creative material, using a third-party software system in Max/MSP\(^1\), and one of my own making in Ableton Live. These latter works take the form of improvisations and emerging pieces from improvisatory forays and fragments. A final performance fully situates the study in the stage environment it most centrally inhabits.

**Augmented instruments**

Instruments have long extended the expressive capabilities of human performers, and human curiosity seems to know no bounds when it comes to developing new technology to further existing tools. Technology can augment musical instruments in several ways. Alterations to materials, to body and bore sizes and shape throughout the 19th and early 20th centuries resulted in major changes in the ability of orchestral instruments to project into increasingly large concert halls. These modifications, however, did not dramatically alter the fundamental sounding nature of acoustic instruments. Following the earliest experiments in recorded and synthesised sound in the 19th Century by Léon-Scott, Edison, Helmholtz and others (Collins et al. 2013), technologies developed that allowed music to be performed using the traditional instruments of the concert hall alongside newer, electronically produced sounds. With electricity, the microphone and loudspeaker technology came the significant affordances of amplification, broadcast and recording.

The extension of instrumental possibilities by electronic means is far from new—in fact, its origins extend to experiments in the late 19th century. Advances in technology as the new century progressed brought numerous ways to augment instruments (Miranda & Wanderlay 2006). The practice of real-time, digital manipulation of instrumental sounds was hugely advanced by the arrival of powerful personal computers in the 1970s. The subsequent growth in memory capacity, processing power and relative affordability of

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\(^1\) Cycling’74’s Max/MSP has in the last two decades become established as the leading software platform in the field, and in 2012 was rebranded as simply Max—it will be referred to henceforth as such. [https://cycling74.com/](https://cycling74.com/) [accessed 10.9.17]
home computers, laptops and mobile devices, and the online sharing of peer-to-peer knowledge, have democratised computer music to an unprecedented degree. New digital musical instruments (DMIs) have proliferated in recent decades, alongside parallel practices, such as keyboard-based synthesisers, and electronic wind instruments.

Experimenting with new contexts for instrumental sound and interaction, I prefer not to venture away from the instrument that has been at the heart of my musicianship from the outset. Saxophonist John Butcher\(^2\) conurs:

> I’ve always felt it useful to restrict myself to sonic material rooted in the saxophone’s acoustics – to be aware of its traditions but to play with an ear for what lies hidden around the corner. I’m continually engaged with the mechanical and acoustic properties of a tube of metal in my hands and a piece of wood vibrating in my mouth.

Among the established guides to the clarinet, Rehfeldt (1994) and Heaton (2006) both contain short sections on using electronics. Harry Spaarnay’s highly personal account of a career as a bass clarinet soloist also contains references to a wider use of technology, although surprisingly little given his plethora of performances with electronics (Spaarnay 2010). This rather cursory reduction of mixed electronic music, usually as a footnote to extended techniques—or as a separate discipline with its own organology—betrays an inherent conservatism with regard to orchestral instruments that clings to notions of an idealised instrumental tone, honed over decades or longer to conform to the interpretation of established works by long-dead composers, passed on orally by imitation, and protected in conservatoires (Bijsterveld & Schulp 2004; Leech-Wilkinson 2016). There is currently no published guide to the clarinet that offers full consideration or acknowledgement to the affordances of contemporary electronic and/or digital technology, and to its integration.

**What will we call this music?**

The terms *live electronics* and *interactive music* have been used to describe a variety of practices that include electronic, digital and acoustic instruments, while *mixed music* (Fr. *musique mixte*) emerged from a growing practice at research institutions such as IRCAM, and refers specifically to the combining of acoustic instruments (or the voice) and electronic media. Throughout this thesis, I refer to both *augmented instruments*, *interactive music* and *mixed music* in the same spirit (without the latter’s archaic restriction to music with tapes), and will refer to the *live electronics* of the system, as well as applying that term to the field in general, with or without acoustic instruments.

\(^2\) Original article in English (2011): [http://www.pointofdeparture.org/PoD35/PoD35Butcher.html](http://www.pointofdeparture.org/PoD35/PoD35Butcher.html) [accessed 10.7.16]. Published in German translation (Nanz 2011, p167-177).
There have been several attempts to classify these hybrids, including the terms extended (Penny 2009; Normark et al., 2016), augmented (Schiesser & Schacher 2012; Thibodeau & Wanderley 2013; Kimura et al. 2012), and prefixes hyper- (Machover 1995; Palacio-Quintin 2003), meta- (Impett 1994; Burtner 2002), infra- (Bowers & Archer 2005), and even mutant- (Neill 2009), have been coined to emphasise the particular approach chosen. While some quibble over nomenclature and specificities of interaction design, I will here use the term augmented to refer to my own practice as additional to the instrument(s) in which I already have expertise. Here I align myself with, for example, IRCAM’s Augmented Violin Project (Kimura et al. 2012), and the Magnetic Resonator Piano (McPherson 2010), which are not only non-destructive and unobtrusive to the physical material instrument itself, but also add to, rather than compromise, the important defining quality of an instrument: its becoming a particular kind of sounding object as part of a unique lived experience of practice.

Reclaiming

With advances in processing speed and the availability of affordable hardware and software in the 1990s, sophisticated musical interaction with computers is no longer restricted to large institutions (Roads 1996). Musical works that in the past could only be performed within a research environment (or under the supervision of their staff) may now be mounted by the resourceful performer in a reclaiming of repertoire that should be celebrated. Roland Karnatz notes that “performers became involved in the process and an audience was able to witness it.” (2005, p11), emphasising a blurring of performer-composer-programmer distinctions in interactive music (Impett 2001, p118), and a claiming of initiative by the performer:

... interactive technology has become considerably more user-friendly and enabled performers with limited knowledge of the original programming language access to the process of interaction. The performer can now play the role of composer and make compositional decisions as to the form and content of an interactive work.

(Karnatz 2005, p11)

There may be a wider resistance within Western classical circles to the idea that using electronics and digital technology belongs to a tradition of refining, extending and adapting instruments and techniques through history—that it rather constitutes a kind of radical reinvention, or even replacement, of valued tools and hard-earned craft. Reasons for this may be rooted in a fear of, or disdain for, ubiquitous digital technology, or a lack of familiarity with the aesthetics and working practices of the Electroacoustic and Computer Music communities. Moreover, I suggest it stems again from a deep-rooted conservatism, to the detriment of experimentation for makers, composers and performers alike within the mainstream community.
A new instrumentalism

A small but growing number of classical performers of orchestral instruments, however, have been embracing and negotiating instrumental augmentation on their own terms for the past two decades, following notable pioneers such as Gordon Mumma (horn), George Lewis (trombone), Jonathan Impett (trumpet), Larry Beauregard, Simon Waters, Anne La Berge (flute), F. Gerard Errante, Esther Lamneck (clarinet) and Mari Kimura (violin). This is only a selection of influential performers, many of whom continue to practice, innovate, and hold academic positions that promote the growth of augmented practice. Among currently active musicians from a classical music background, a far from exhaustive list would have to include Sebastian Berweck, Sarah Nicolls, Michael Young, Xenia Pestova (piano), Zoe Keating, Seth Parker Woods (cello), Mark Summers (viola da gamba), Elizabeth McNutt, Taina Riikonen, Jean Penny, Sabine Vogel (flute) and fellow clarinettists Mathias Mueller, Öğuz Büyükberber, and Marij van Gorkom (bass clarinet).

Shared by all of these musicians is an engagement with technology beyond that of their established instrument, not only in necessary and fruitful collaboration with technical experts, but in the home studio, the practice room, and importantly, onstage in performance. Their motivation is an advancement of expression, a making way for new avenues of expression that are afforded by the same contemporary technology that has radicalised our daily lives in the digital era. Audiences of contemporary classical music are, by the commitment of these and other similarly adventurous performers, becoming increasingly familiar with a concert stage not only occupied by musicians and their traditional instruments, but replete with laptops, cables, microphones, mixers, control devices, visual feedback displays, and loudspeakers.

The broadest of contexts

Performance is distributed, social, contingent and embodied (Small 1998, 1999; Impett 2000, 2001). When we play a musical instrument we are managing the distribution of certain more or less predetermined sound requirements and proclivities (Green 2014, p5), in order that they be shared among others, over an agreed time frame, and within a given space (real or virtual). The physical and acoustic properties of the environment, of our instrument and of bodies (our own and that of the listeners) are in this sense all part of the instrument in the wider sense. These factors are minutely and continually nuanced among the manifold complexities of performing, to a large extent unconsciously by the experienced musician.

The phenomenological complexity of musical experience – not identical with its number of elements or “difficulty” – is seen as a critical parameter in all areas of musical activity. Its generation and dynamic maintaining is essential to the affordance of interaction, emergence and self-organisation, both internal to the musical construct and in the context of its composition, performance and reception. The behaviours which comprise this complex may be cultural, personal or “musical”. They unfold in continuously reforming dynamical hierarchies, the self-
organisation of the whole adapting to maintain contextually critical values of energy, interaction and complexity. (Impett 2001, p108)

The complexity Impett refers to here reflects Small’s (1998) reading of music as centred around layers of interweaving relationships. I embrace, alongside many others, Small’s term *musicking* to encompass the curating of sound within this synthesis of bodies, brains, technologies and architecture (Waters 2007; Green 2011, 2013; Hayes 2014; di Scipio 2003, 2015). A further ecological metaphor has emerged from the field of live electronics to describe the dynamic system of interdependencies (di Scipio 2003) that underpin the design and practice of musical instruments. Waters (2007) draws on Bowers (2002, p79) and di Scipio (2003) in establishing the term *performance ecosystem*, which has become widely adopted and is consistent with interdisciplinary practice and research in the Arts as a whole over the last decades (Bell 2016).

Saxophonist Evan Parker articulates the influence of performance ecology in an ideal practice of improvisation, described as “played by a group of musicians who chose one another’s company and who improvise freely in relation to the precise emotional, acoustic, psychological and other less tangible atmospheric conditions in effect at the time the music is played” (Bailey 1992, p81; cited in Emmerson 2007, p27; my emphasis). These cascading fields of relative influence soften in their direct influence on the performance as experienced in the concert space as they widen in scope (Born 2010).

This research describes a period of familiarisation with new tools, during which it became increasingly beneficial to focus on exerting influence within, rather than control over, an assemblage of technologies. And as incipient skill became acquired and to an extent embodied, augmenting the clarinet became less about an extension of the clarinet, rather my instrument and technique widened into a broader inhabitation of technology, providing a frame for a broader culture of influence. The ecological approach to instruments is perhaps more readily understood in the novel context of Digital Musical Instruments (DMIs). Older instruments have longer histories whereby they have gathered normative habits and assumptions, with the classical tradition largely espousing a paradigm of mastery that emphases a more dialectic approach.

**A spectrum of roles**

My practice inhabits a continuum of authorial autonomy, from enacting a meticulous set of instructions on the one hand, to improvising with entirely uninhibited free association and self-expression on the other. Extreme examples are rare, and the contemporary shift towards interdisciplinarity in the creative arts, and artistic research, has encouraged a growing middle ground that privileges performer input in the composition process, via collaboration (Pestova 2008; Nicolls 2010; Roche 2011) or improvisation.
I follow Sarah Nicolls to an extent in the organisation of the case studies, by identifying three broad creative performing roles, which at times blur and shift from one to another:

- **ROLE A** *executant interpreter* of composed and notated musical material
- **ROLE B** *enabled interpreter* of composed works, with co-authorship of some or all aspects of musical material
- **ROLE C** *enactive composer* of unique, or sequentially variant, musical works, improvised at the clarinet

I will argue that negotiating the sound, liveness, and balance of influences within each feeds into an approach to the others. The organisation of the Practical Elements also represents a trajectory through these roles, from precisely notated material (Boulez, Dudas), to works with varying degrees of indeterminacy (Harker, Parker/Furniss), and into free improvisations, and the development of replicable pieces that privilege improvisation.

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**Fig. 1.1** Three creative roles of executant interpreter (of composed and notated works), enabled interpreter (where some or all of the material contribution is indeterminate), and enactive composer (improvisation, or improvisation-led composition, from and at the instrument). The roles may blur and switch within a single work (e.g. Harker’s *Fluence*).
1.2 Hybrid skill

The initial stages of this research involved a discrepancy of know-how which was considerable. The addition of live electronics under onstage operation—while continuing to engage in a public performance practice—presenting a dilemma of hybrid levels of skill. A scant familiarity with audio technology and computing, beyond those fundamental requirements for a participation in contemporary technologised society, is not untypical for a performer of my generation\(^3\) and musical background in classical orchestral and chamber music, although it would be inappropriate to generalise.

![Dreyfus model of skill acquisition](image)

**Fig. 1.2** The Dreyfus model of skill acquisition maps the journey from novice to expert. Novice and competent status is marked by a decomposed rather than holistic understanding of new situations, with analytical, as opposed to holistic decision making. At the other end of the scale, mastery is experienced periodically at high levels of expertise and absorption.

Dreyfus & Dreyfus (1980) outline five stages of skill acquisition: novice, competence, proficiency, and finally expertise and mastery\(^4\) (Fig 1.1). Progression is achieved in the main via “a reliance on [the] everyday familiarity” of experience, in terms of mental functions of

\(^3\) (schooled predominantly in the 1970s, after the slide-rule, but before the full onset of the digital age)

\(^4\) Expertise is nominally the highest level of skill in the schema. However, they propose an understanding of *mastery* as “when the expert [...] can cease to pay conscious attention to his performance and can let all the mental energy previously used in monitoring his performance go into producing almost instantaneously the appropriate perspective and its associated action.” (p14) This is similar to notion of *flow* (Csikszentmihaly 1995; Privette 1983).
remembering, recognising, deciding and developing awareness (ibid., p15). Any musician with decades of experience manipulating the instrument to give outward shape to inner expression will have necessarily contended with these mental functions and stages. Rehearsing, performing and recording the pieces presented here required an initial move from novice to at least competent in technical terms, in order to be viable. Reaching the level of expertise seemed both desirable and yet impossibly remote in the given timeframe, and therefore there was call from the outset for patience and pragmatism.

As an example of the marked difference of a decomposed-analytical and holistic-intuitive skill level, consider the following personalised, ordered and (by now) almost unconscious procedure, from the intention to play the clarinet, to the emergence of its first sounds:

1. open the case
2. assemble the instrument from its constituent sections
3. moisten and prepare a reed, meticulously chosen and prepared over time
4. adjust various parameters in the set up of mouthpiece and ligature
5. manage the stiffness and alignment of the main joints to enable the appropriate keywork correspondence (allowing for factors of wear over time)
6. shift mental focus from assembly to the intention to produce a sound
7. re-adjust the moistened reed to ‘bully’ its position in relation to the mouthpiece rails
8. prepare the body for making a sound, attending to issues of posture, appropriate levels of tension in the upper body and facial muscles
9. become attentive to the sound of the room
10. develop a mental anticipation of the instrumental sound (in dynamic, pitch, timbre)
11. develop a physical preparation of the instrumental pitch (preparing a fingering or set of anticipated fingerings)
12. inhale in a deliberate manner, particular to the act of playing the instrument and the above intentions
13. blow into the instrument with attention to the above

Within a matter of milliseconds I will subsequently engage an aural-tactile causal feedback loop, and make minute adjustments to lip tension, jaw pressure, fingering, posture and breath control. As an acquired and embodied skill, all of this procedure takes place in background attention, while the additional technology at first all remains decomposed, conscious, and foregrounded. Fig 1.2 shows a thoroughly decomposed list made for the first performance of onstage operation as part of this programme of research (Perf. 2)\(^5\), emphasising the level of foreground attention required to manage the additional technical elements.

\(^5\) See Appendix B.
A summary of conscious procedure designed for Perf. 2 (April 2014, see Appendix B). Technical lists became an ingrained habit during this research, as a strategy to manage the cognitive diversity of background and foreground attention inherent to hybrid expert and fledgling skill levels.

Fig. 1.3: A summary of conscious procedure designed for Perf. 2 (April 2014, see Appendix B). Technical lists became an ingrained habit during this research, as a strategy to manage the cognitive diversity of background and foreground attention inherent to hybrid expert and fledgling skill levels.

### Rehearsal/soundcheck

- Start pick-up cable to coupler, taped through seat loops under skirt
- If using Fireface USB / HR:
  - Go to "Details"
    - Either load workspace ML:
    - ON set up input/output channels levels as required

- If using Fireface 800/800:
  - Go to "Fireface Mixer"
  - Import workspace or set up input/output channels & levels as required
- Or another soundcard:
  - Set up input/output channels as required

### 1 greatCount remote controller

- Open Softpatch editor from desk
- Set to "presets" mode and leave open
- Double-click 3 preset (see 4) alias
  - Top middle select ‘read’
  - Find and double-click on:...
    - /Users/acek/Documents/Softpatch/302-settings/302-remotecontrols.json
  - Check/configure switching controls and MIDI expression pedal
  - Adjust control curve and MIDI range as required
  - Close "Run window and minimize"

### 2 greatCount

- Double-click 2 greatCount alias (opens standalone app: greatCount)
  - Work done ALL of the settings:
    - Version: select ‘pentatones-march2014’
    - Select ‘read’
    - Find and double-click on:...
      - /Users/acek/Documents/Softpatch/302-settings/302-remotecontrols.json
    - Select ‘6spacecon’
    - Check audio settings, sampling rate (48kHz), I/O vector size (64 32), signal vector size (32 32)
    - Check mic settings and levels (lower compression as)
    - Set threshold (eq. >.15 <.25)
    - Set number of gams, depending on duration/intensity (eq. >.5 <1.0)
    - Check MIDI expression master output control

### 3 Dudas Prelude 1

- Set Softpatch Editor to "presets" mode and leave open
- Double-click 2 preset alias (opens in Mac)
  - Check and DSP settings /Options/Audio status (256/64/44100)
  - Check i/o routing from bottom left object (input3-output3 feeds sync follower)
  - Work done settings try to listen
  - Set to 102 and check MIDI expression pedal output control
  - (Adjust to 108 or manual level setting as required)
  - Calibrate sync follower (44100)

- In Ksphinx CURS hit ‘off’ then ‘beg’ to return/soundcheck
- When finished soundcheck/soundcheck:
  - Either set to ‘off’, switch off and save as minemic
  - Disconnect pick-up mini-jack

### 4 Rigged Up Megas

- Open 1 RUN alias
  - Check (or set) MIDI controls:
    - Softpatch sample pedal(1) a MIDI expression pedal
    - Save (if changed)
    - Hit sample pedal(1) to return/soundcheck

- When finished rehearsal/soundcheck:
  - Class sample if required
  - Either select (as NOTE and leave open)
  - OH Close patch and leave has open

- Go to "Details" (or other soundcard virtual mixer if used):
  - Either bring down master faders
  - OH sound engineer does not @ desk

- Remove pick-up cable from coupler and place safely on stage floor
Musical expediency and struggle

A practice model developed according to whether chance discoveries or deliberate choices were able to take hold of and sustain motivation. This depended a great deal on early difficulties, and pragmatic issues such as time and equipment availability. Resistance became a factor in terms of motivation, with the path of least resistance tending to dominate, unless sufficient capital was to be gained by sustaining the effort. Generally this meant I relied on getting to gratifying musical interaction early in the process—which I term musical expediency. If the advantage-challenge ratio was high, or at least worth it in musical terms, I stuck with the difficulty, and moved through the skill levels.

Barriers to learning new skill are in part emotional (Kaufman 2013) and it would be disingenuous not to mention here periods of struggle⁶, in which a juxtaposition of experience, expertise and novice status led to emotional distress, self-doubt and failure to sustain motivation. With normalised high levels of expectation, getting quickly into familiar practical work repeatedly proved beneficial, forming a clear idea of what needed to be known (ibid.), and establishing appropriate differentiations—between basic skill and expertise, usefulness and mastery, and achieving a realistic, dispassionate assessment of plausible outcomes.

There are difficulties encountered throughout mixed music: multiple software platforms to negotiate, inconsistency of materials provided, and data archaeology—obsolescence, version conflicts, redundancy, missing drivers, and licensing issues (Berweck 2012). There were indeed times when I knew “neither how it works nor how to work with it.” (ibid., p190).

Hybrid learning

A multimodal approach to learning new technical skills combined trial and error, expert advice, built-in Help files, reference manuals, and online resources, such as video tutorials, articles and blog posts. While there is on the one hand a lack of established and structured methodology for the augmented musician, this largely Connectivist approach (Downes 2008) affords a self-directed path according to the learner’s motivation, curiosity, and taste, and correlates with the Humanist educational approach that emphasises holistic, personally invested learning. Overall, a degree of self-reliance and an emphasis on expediency and motivation served to produce unique outcomes and privileged a sense of individuality and personal voice.

In moving towards self-implemented approaches to augmenting the clarinet (7.2), a further layer of instrumental hybridity was revealed. Thor Magnusson (2009) highlights the

⁶ Candidness is part of the value of practice-based research accounts (Smith & Dean 2009).
duality of *system design* and *performative* factors in the forming of digital and acoustic instrumentality. While acknowledging that in practice these understandings lie on a continuum, he observes (p171) that:

> the former creates the instrument from a conceptual understanding of the domain encapsulated by it, whereas the latter gains operational knowledge that emerges through use (or habituation) and not from abstract understanding of the internal functionality.

While initial experiences with the instrument at user level are performative, as soon as we begin to make changes to parameters, or invent them anew, we enter into a system design approach that requires an ongoing oscillation between an *embodied* and *conceptual* engagement.

### 1.3 Humanising

Dictionary definitions and etymology can be useful to elucidate the meaning of words that may be open to subjective or ambiguous interpretation, or whose usage may be somewhat diverse and unclear (Paine 2002, p295). The Chambers Dictionary (1994) definition of *humanise* is “to render human or humane; to soften; to impart human qualities to; to make like that which is human or of mankind” and (without object) “to become humane or civilised”. *Humane* is defined firstly as “having feelings proper to man,” (I take “proper” to be synonymous with “civilising”), continuing with “kind; tender; merciful”, and finally (somewhat unhelpfully here) “humanizing.” The definition of *human*, includes “having the qualities of a person or the limitations of people… not invidiously superior” [my emphasis].

What call would there be then to *humanise* the augmented practice of a traditional instrument? Firstly, my instinct was to attend to the easing of certain of these inherent difficulties and constraints in my experience of mixed music. Limited rehearsal time with the technical materials prior to the concert day and overly long technical rehearsals on the day itself, with little or no time for general rehearsal, are problems acknowledged by most performers in the field (McNutt 2003, p297; Puckette & Settel 1993, p136; Penny 2009, p54; Nicholls 2010, p50; Berweck 2012, p125). Difficulties of access and rehearsability with regard to software are still common in the field, alongside the issues of technical maintenance, and adaptation to purpose or personal preference (Berweck 2012, p14; Furniss & Dudas 2014, p459).
Sound concept

One of my central concerns as an instrumentalist is the issue of sound concept and personal sound. This study necessitates a distinction between sound as either physical property or as personal identifier. For the sake of clarity, I refer throughout this thesis to a performer’s dynamic set of influences, preferences, and personal interpretation of the instrument’s affordances as sound concept, which contributes to a wider, externally perceived, identity or personal sound.

Flautist Elizabeth McNutt (2003, p298) claims that “the player’s physical and sonic identity is significantly altered by the prosthesis of amplification,” and this is something all instrumentalists are confronted with. A knowledge of microphone and loudspeaker types, positioning, set up, and microphone technique, are now an important part of the contemporary musician’s practice, although this is not generally prioritised as part of the training of classical music performers. Humanising in this sense becomes a question of taking time to develop relationships with particular audio technology, and being able to combine self-efficiency with successful communication. MacNutt again concurs:

A strong and trusting relationship between performer and sound engineer is vital.
During the sound check, the first task should be getting the performer’s sound to have proper tonal balance and projection. (ibid., 298)

It has not been part of my agenda to simulate what might be termed “human-like interaction”, although this is an area of ongoing research in Musical Metacreation7 (MUME), or computational creativity in music. Simon Emmerson (1994) has described attempts to establish human-like musical AI agents as “misplaced”, and the debates and definitions over what constitutes human-like interaction lie beyond the scope of this study. However, the consideration of human embodied relationships to technologies8 and technique, and the notion of a performer’s unique personal sound, or voice, are both central to my approach and may thereby warrant further research into metacreation.

Embedded operation

In practical terms my aim was to move towards a substantial degree of self-reliance in terms of onstage operation of the electronic elements, as part of a move away from the duet paradigm and towards the instrumental. Such an approach to the widened technical

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7 A stated aim of MUME is the creation of software that “exhibits behaviours that would be considered creative if performed by humans.” See http://musicalmetacreation.org/ [accessed 1.7.2017]
assemblage afforded me control of important elements, such as microphone type and positioning, control parameters, and the balancing and blending of acoustic and electroacoustic sound. Even in situations where the presence of a sound engineer and/or technical co-performer was still required, working in this way I became an active participant in the totality of each performance, and not merely a passive element.

Preparation for a performances often involves a considerable amount of time spent negotiating the materials of score, instrument, coordination, physical energy and stamina, and interpretation. Being able to rehearse thoroughly and efficiently with technical materials is an important factor, highlighted by other performers (Pestova 2008; Penny 2009; Nicolls 2010; Berweck 2012). Being embedded in this way with the whole, a sense of anticipation and anxiety is removed about “meeting the accompanist” on the day of the concert.

A humanised practice

Where modern Humanism places the human moral agent at the centre of its worldview—with full consideration given to others, including the environment and non-human and non-living affective actants—a humanised augmented practice places the performer(s) at its centre, not in dominion over other people and elements, but as essential decision-makers in the act of presenting musical material, appropriately empowered within a community of interconnected influences.

Inhuman aspects of mixed music could range from threats to the safety of performers by excessive sound levels or unfit electrical equipment, to a placing of undue stress by excessive physical or mental demands. Denying or obscuring a musician’s voice and embodied expertise by the use of poor sound reinforcement or rigid interaction with timing and triggering devices may also be considered inhumane.

Humanism as a theory of learning emerged in the 1960s, following the work Carl Rogers and Abraham Maslow, in response to the emerging behaviourist approach of Skinner and others, and places an emphasis on a holistic and personalised approach that privileges motivation, autonomy and self-actualisation (DeCarvalho 1991; Huitt 2009). While not explicitly a structure for this research, its principles are in tune with my own approach to learning, whereby the most important value and goal (DeCarvalho 1991, p95):

... is to facilitate the students’ discovery and actualization of their nature, vocation, what they are good for, and what they enjoy doing. The learning resulting from this need has subjective meaning and results in expressive and creative behavior that is personally satisfying. In this sense, the goal of education is to make an alliance with the student’s natural wonder and to facilitate the process of learning.

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9 The International Humanist and Ethical Union’s 2002 Amsterdam Declaration summarises the principles of the modern Humanist movement. See http://iheu.org/about/about-iheu/ [accessed 2.7.17]
We might define these “personally satisfying expressive and creative behavior[s]” as gratifying musical interaction, while “actualisation of human potential” corresponds to the idea of developing and articulating a personal sound concept, interpretation (in the case of composed works) and artistic voice. This approach fosters a sense of personal investment in the acquisition of knowledge and skill, motivated by intellectual curiosity and positive experience.

A Humanist analysis of musical practice would resist any mythical *deus ex machina*, or blind faith in anecdotal evasions that extol talent, genius, evocations of the “soul” or similarly unhelpful terms that pervade much of the journalism and hagiographies around musical performance, and instead draw on a rich literature of performer-led phenomenological description, on contemporary concepts in anthropology, cognitive and social science, and on a multitude of philosophical frameworks that support the flourishing of individuals and communities. This study does not aim to be a definitive work of such broad analytical scholarship, but its motivating agenda has produced musical works, observations, and recommendations for practice, that contribute to ongoing and future research that will illuminate the complexities of the performer’s art, and potentially facilitate and enable entry into this particular field for others.

This research, therefore, proposed a humanised augmentation of an already expert instrumental practice, by means of a performer-led and embedded probing of mixed music, and by the privileging of embodied relationships and processes within a dynamic social, technical and temporal ecology. A first-person, practice-based account of solo performance cannot hope to be objective—a struggle that has been acknowledged within phenomenology and autoethnography, where reflexivity has already been widely debated. Placing myself as performer at the centre of both the research and its driving agenda is not inherently solipsistic, however, but rather centres the enquiry on relationships that emanate from a pivotal focal point of performance practice, a position acknowledged by Christopher Small (1999, p16):

> the act of musicking will bring into existence a complex web of relationships for the duration of the performance. At the centre of that web are the relationships that the performers create between the sounds. Radiating out from these, and feeding back to them, are the relationships among the performers, between the performers and the listeners should there be any apart from the performers, and with the composer, should there be one apart from the performer, and with anyone else who may be present.
A research framework

In summary, the sense I brought into this research of wanting to humanise the experience of mixed music was at first rather vague, but in retrospect had much to do with a search for the professionally familiar—feeling in control on stage. Where difficulties were encountered, these have been addressed by attending to established and contingent priorities of sound concept (making the work sound as I envisage it) and liveness (maintaining an engaging narrative dramaturgy), directed within an interdependent and situated ecology of materials, bodies and cultures—and ultimately, by seeking a requisite and dynamic level of presence by attending to these three broad areas of musicking. The remaining chapters in Part 1 will address each in turn.

Finally, all of this shifting of doing and humanising continues to evolve. The practice as described here jointly by submitted musical works and this thesis no longer exists at the time of their listening or reading. The Final Performance, for example, is necessarily retrospective, yet presents intrinsic changes and developments to those accounted for in this text.

Fig. 1.4 The humanising framework emerged from a desire to place performers’ embodied processes and priorities relating to sound, liveness and control at the centre of the work. An optimal performing presence, it will later be argued, combines personal and pragmatic negotiations of these three areas.
1.4 An errant methodology

In common with a wealth of recent practice-based doctoral projects (Bell 2016, p19), this research represents a discovery-led account of practice, and is not:

... predominantly concerned with general methodological precepts or conclusions, or with divining law-like regularities in artist’s behaviour, nor with arriving at binding judgements of taste in the aesthetic sphere [...] Research in the creative arts is not so much about producing well defined and empirically answerable research questions, but about being open to various possibilities of discovery and insight that arise in and through the processes of art making, and which, as a result, may be based as much on intuition, professional insight and skill, and on the capacity to intelligently respond to contingency. Arts research in this sense is ‘discovery led’ rather than ‘hypothesis led’. It is less about the production of propositionally based knowledge than about the production of meaning and insight gained through the process of making art.

Both Small (1999) and Daniel Leech-Wilkinson (2015) have called for more attention to be paid to the contribution of performers in the literature. This reflects an overall shifting of performers from objects of discussion, or intermediaries in the flow of musical interaction, to active participants in the intellectual, conceptual and cultural debates, characterised by the performative and practice turns in late twentieth century thinking. Small (1999, p10) notes that:

performers and performance are hardly ever mentioned in writings on the meaning of music. It seems as if a performer and his performance are thought of simply as the medium through which the musical work has to pass before it reaches its goal—the listener—and the more transparent the medium the better for the musical work.

The intervening years have seen a rise in performer accounts of practice, which is consistent with the establishment of practice-based doctorates in academic institutions (Smith & Dean 2009; Bell 2016; Impett 2017). Contemporary performers are benefitting from a research lineage within the field of electroacoustic music that stretches as far back as the earliest experiments in recording and synthesis, as well as a growing body of practice-based accounts by performers, composers, and system designers in a field that has contributed to a blurring of those distinctions (Impett 2000, p30). Attending to performers’ accounts of practice both in terms of their outcomes, processes and motivations is essential to a global understanding of music performance (Gabrielsson 2003, p258):

Music performance should be studied as much as possible: (a) in musically relevant contexts to ensure ecological validity; (b) in relation to performers’ intentions, and listeners’ experiences and reactions; (c) both as process and product; and (d) considering that performances are (should be) aesthetic objects. We are still far from understanding the aesthetic aspects of music performance and experience.

In this research I intend to contribute to a growing body of performer perspectives in what is still a technician- and composer-dominated field. The primary outcomes of a practice-as-research (PaR) programme in the Arts remain the works themselves (Bell 2016).
Here they constitute a body of practical and supplementary material, representing both process and product, that relate specifically to musical performances, whether in the physical presence of an audience or in the recording studio. Appendix B provides a list of relevant performances undertaken during the course of this research, with recordings of some also included in the Practical Elements. This accompanying thesis comprises a short introduction, documentation of the research narrative, from an initial humanising framework to emerging research questions, detailed and discursive case studies from the Practical Elements, and theoretical reflections on interagency and presence, drawn from research avenues that sprung from the practical work.

Practice-based research requires, and indeed celebrates, flexible approaches to methodology (Bell 2016). This study took a notional idea of humanising, based in an embodied understanding within my nascent practice of mixed electronic music that elements of sound concept, liveness and control were problematic. Forming research questions at the outset was cumbersome. Instead, I went about the business of learning to pilot pieces from onstage, in the process revealing an unfolding methodology that drew on expediency and motivation, from which a set of practical recommendations arose from successes, mistakes, and occasional happenstance (Medbøe 2013, p8).

This necessarily individual approach nevertheless falls within a now well established tradition of reflective, practice-based and -led accounts—phenomenological and autoethnographic—in the Arts in general (Bell 2016; Smith & Dean 2009), and in mixed electronic music in particular (Wetzel 2004; Pestova 2008; Penny 2009; Nicolls 2010; Berweck 2012; Hayes 2014; Woods 2016). Nor are the entirety of the outputs emergent and without predetermined goals. The recordings on CD1 are driven by a sense of how these pieces could be implemented via the humanising agenda, including both interpretive realisations (how I want the pieces to sound), adaptations in light of embedded operation, and considerations of the difference between performances before an audience and recording sessions. CD2 explores the blurring of interpretive and compositional approaches, foregrounding creative autonomy on the part of the performer.

Insights were gained on reflection following a methodology rooted in responsiveness and the accessibility of gratifying musical interaction, and a playfulness in the open-ended, responsive and relatively unstructured approach taken that is echoed in some of the work. Some technical problems encountered could certainly have been eased by more structure. However, the benefit of a wandering, motivation-led practice is individuality. The work has proved creatively enabling, and the works themselves have a unique, personally invested sound concept. Learning by doing, and engaging, animated interaction, drove this research, during which layers of technology and a good deal of valuable scientific, technical and theoretical knowledge have been acquired that enhanced the practice. But at the heart of the process lies a desire not specifically to innovate, or invent new systems for interaction, but to sustain and develop liveness in augmented performance.
Emergent questions

Unpacking the elements of this humanising proposition to form a practice-based research agenda has been a gradual unfolding, enacted by a process that combines elements of various research methods. Action Research entails cycles of action, reflection, and re-doing are intrinsic to the preparation and multiple performances of the same (or related) works, while Grounded Theory has guided other performers to emergent questions and answers (Roche 2011).

The questions I came to ask could be framed as:

- What does a contemporary performer of mixed music gain from onstage control?
- How does a digital augmentation of the clarinet affect personal sound concept?
- What do experienced performers require of interactive technology?

Self-reflexivity

Expert performers balance the monitoring and micro-management of technical precision and detailed, rehearsed shaping, while leaving space for the intuition, emotion and the self. Naomi Cumming (2000, p35) compares Richard Schechner’s description of the actor’s divided ‘I’—the idea of two selves in performance: the acting and the self-observing. This is broadly comparable to Timothy Gallwey’s identification of conflicting intuitive and conscious selves (Green & Gallwey 1987; from Gallwey 1972). Cumming cautions that Schechner is not advocating a “philosophy of consciousness”, rather “a pragmatic set of observations about […] different kinds of awareness,” which accords well with my purpose here. We continue to encounter affective presences, identities and assumptions to be managed, with the aim of establishing a contextually informed approach.

Recounting details of equipment, experience and process serves to ground the work amid the self-reflexive questioning of the practice-based hall of mirrors, and may afford others the opportunity to recreate scenarios for themselves, or use them as starting points for similar endeavours. Owen Green (2014) suggests that such errant methodologies draw on the improvisatory nature and approach of his work, which similarly emphasises agility and playfulness (2011) as both process and purpose. For Green (2014, p4):

the endpoint was not something established in advance of commencing work, but emerged through the process of making, and remains somewhat contingent insofar as the systems are liable to further modification and development if that seems attractive. In this sense they depart somewhat with the notion of design being geared towards the implementation of a set of known, pre-existing requirements and have more in common with what Tim Ingold calls ‘wayfinding’, whereby a terrain is explored intuitively and attentively.
Boundaries of the study

1. The study comprises the preparation and public performance of composed and improvised works for solo clarinet and bass clarinet with live electronics. The software materials were either supplied by the composers themselves, or by third parties, or developed as part of the research. Some materials were adapted (in accordance with the research agenda).

2. Operation of the live electronics, both in rehearsal and performance was undertaken, wherever plausible, by the performer in situ.

3. The Practical Elements were recorded, edited and mixed by the performer to a level consistent with public release. Multichannel works are presented in 5.0 audio files, with additional stereo mixes provided (CD1 1-3; CD2 5-7).

4. A public performance consisting of works from the Practical Elements is included as part of the conclusion of the study.

Thesis structure

I have swiftly set the background against which my various augmentations of the clarinet were undertaken during this research, and identified some established and contingent priorities brought into it. These were primarily concerned with improving working conditions, having more say on matters of sound, and being able to rehearse sufficiently and efficiently. The research narrative centred on ways of adapting and learning—of developing a hybridity of technique and technologies in changing electroacoustic and digital environments. Moving towards self-efficient, embedded technical operation afforded advantages in terms of efficiency and engagement, leading eventually to a new sense of instrumentality, and a means to develop new creative work. A growing understanding of instruments emerged as inherently situated and evolving assemblages that employ technologies of the time to facilitate and enhance a highly personal musical expression.

Sound, liveness, control (in any order)

In Chapter 2 the practical and personal issues of sound concept are explored. The multiple affordances of an augmented practice of the clarinet are considered in terms of forming a personal take on the curation of instrumental sound, and the forming of holistic gestalts—in other words, a specific electro-instrumental sound concept for each context. As well as this dealing with the clarinet, microphones, loudspeakers, and space as artefacts of sound management, a three-stage way of working is revealed as being inherent to my performer’s instincts—namely, the preparation of an optimal performance.
Firstly, simplifying the initial working environment is shown to provide the opportunity to find engaging interaction and musical threads. This I define as musical *expediency*, which is shown to be both practical and motivating. A second stage of rehearsal identified is again pragmatic, in that it set out to more or less simulate the technical conditions of the performance space. Here is where most of the work happens, both technical and musical. The third stage takes place within the performance space itself: set up, sound check and technical rehearsals. This three-stage process threads into discussions of *liveness* and *control* in the remainder of Part 1.

Chapter 3 draws on the working method in terms of its anticipation of the live event itself. I propose that engaging interaction is both motivating, and inherent to an *inner liveness* that I seek out—a probing of viability in the piece, its technology, and my ability to bring this *outward* into the presence of a community in performance. There has been a good deal written on liveness, rooting the discussion in a performer-centred account of method and negotiation. Developing sufficient trust in the augmented instrument to negotiate a flux of different valences of liveness is shown as a central purpose, and not merely a pragmatic endeavour. In accounting for this sense of both *inner* and *outward* liveness, both process (rehearsal) and performance are seen as enacting a narrative trajectory encompassing both practice and research.

Negotiating liveness and curating sound are inherently tied to the idea of control, which forms the focus of Chapter 4. The move to onstage operation of the electronics accentuated choices in relation to control parameters. While exploring a variety of physical control setups, interfacing at the level of sound was found to be immediately engaging and practical, in that it obviates the need for any gestures that might upset embodied processes. Wanting to be in control at the outset, turned out, in technical terms, to be much more about wanting to *feel* in control, in order to get to liveness. At its most fluent, the human-instrument relationship suggested a cognitive state of *presence within* both the clarinet and the additional technology.

While attending to the immediately practical, this chapter also considers a far wider ecology of influence, reflecting a growing awareness of the interagency of materials and culture, which may be generalised. Engaging negotiations with machines, and broadening, disparate assemblages of technology, imposed a gradual shift on my hitherto normalised and dialectic relationship to control, reframing the idea of instrumental mastery as a *balancing* of *interagency*. A spectrum of interaction from the dialectic to the embedded also suggested a reframing of musical instruments as filters and resonators of physical energy, identity, and culture.
Accounts, commentaries, conclusions

Part 2 consists of extended and discursive case studies of each work in the Practical elements in Chapters 5–7, illustrating the enactment of the research framework in rehearsal, performance and recording, and divided according to the three creative roles defined earlier: *executant interpreter, enabled interpreter,* and *enactive composer.* It is shown that, while the open-ended, self-determined and enabling world of enactive composition privileged a personal, immersive and at time elusive working process, the tightness of the more executant role conversely turned out to be highly collaborative.

It is worth noting that the habit of recording, as a research anchor (Nicolls 2010), and familiarity with the practicalities of recording, proved to be of significant benefit to the augmented performer. The studies were realised by an iterative process of recording and listening—and of filtering, compressing, balancing of signal from instrument, computer, and room—as part of their preparation, performance and final documentation. They each emerge as affording distinctive augmentations of both clarinet and clarinettist in sonic, spatial and creative terms. Each has a defined electro-instrumental sound concept that represents a contemporary interpretation of the clarinet as an instrument.

Finally, in Chapter 8, I draw on these studies from the other side, and notice a reoccurrence of the idea of *presence* in the way that this research has played out. Attendant to the performer-oriented values of the research agenda, the work became increasingly concerned with negotiations of sound, identity, and liveness, and with a growing embodied control. The notion of *optimal performing presence* is proposed as combining pragmatic sound considerations, personal sound and interpretation (identity), liveness—both physically in the sound space and in the performance narrative—cognitive presence in the instrument (embodiment), and the overall establishment of an interdisciplinary practice of the clarinet that holds to its values, while remaining open to a spirit of enquiry into the contemporary.

### 1.5 Practical elements

The recordings presented here represent a spectrum of work in terms of the performing roles identified earlier, and reflect a journey on the author’s part towards the creation of new work, which was among the major affordances of moving to a more embedded practice. Several of the works employ multichannel diffusions in their live performances, and his is reflected here by 5.0 mixes. Multichannel formats for consumer audio have not been as successful as its video counterparts, for various reasons that lie outside the scope of this study. However, the stereo mixed on CD should be treated as for convenience only, while the multichannel format sound files provided present an altogether more considered realisation, in terms of clarity, balance, fidelity to an immersive sound concept, and presence. They offer opportunities for subsequent public release.
Clarinet, live electronics
Recorded at the Reid Concert Hall, University of Edinburgh, 2016-17.
Edited and mixed by Pete Furniss. Engineered and mastered by Owen Green.

<table>
<thead>
<tr>
<th>CD 1</th>
<th>stereo mixes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Richard Dudas</td>
<td>Prelude No.1 for clarinet and computer (2004/2014)</td>
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</table>

<table>
<thead>
<tr>
<th>CD 2</th>
<th>stereo mixes</th>
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<tbody>
<tr>
<td>1. Martin Parker/Pete Furniss</td>
<td>worksAsAFastOne (2014) * Live at the Objects of Sound Research Festival, University of Edinburgh</td>
</tr>
<tr>
<td>2. Martin Parker/Pete Furniss</td>
<td>Improvised solo set (2014) * Live at the Edinburgh Jazz and Blues Festival</td>
</tr>
<tr>
<td>3. Martin Parker/Pete Furniss</td>
<td>thisOneHasRests/PAusesInIt (2014) * Live at INTER-FACE, Lisbon</td>
</tr>
<tr>
<td>4. Martin Parker/Pete Furniss/Ane La Berge</td>
<td>worksAsAFastOne (2014) * with Anne La Berge (flute)</td>
</tr>
<tr>
<td>7. Pete Furniss</td>
<td>Fragmentology (Blues for Rod) (2017) *</td>
</tr>
</tbody>
</table>

Clarinet, bass clarinet*, live electronics
Track 1 recorded at Edinburgh College of Art, May 2014; track 2 at the Festival Theatre Studio, Edinburgh, July 2014; track 3 at Zé Dos Bois, Lisbon, Portugal, November 2014; track 4 at Studio 4, Alison House, Edinburgh College of Art, April 2015; tracks 5-8 at the Reid Concert Hall, University of Edinburgh, July 2016 (8) and May 2017 (5-7). Engineered, edited and mixed by Pete Furniss. Mastered by Owen Green.
Final Performance

12th January 2018, 1.10pm
Reid Concert Hall, University of Edinburgh.

Pete Furniss *Fragmentations* * (2017)
Pete Furniss / Martin Parker *fastWorkIfYouCanGetIt* * (2017) première
Pete Furniss *An Errant Soothing* (2016)

Clarinet, bass clarinet*, live electronics

1.6 Appendices, supplementary materials & terms

Appendices

A Scores of the case studies in Part 2 and an annotated performing score for *Fluence*

B A list of performances related to this research, dating from December 2013 to May 2017.

C Published works authored during the research period (with full permission of co-authors).

Supplementary materials

A selection of relevant technical materials, with additional audio and video examples of process, are supplied in the accompanying data storage.

Definition of terms

performance

*Performance* and *performativity* have been used by Performance, Cultural, and Social Studies to describe aspects of human behaviour. For the purposes of this study, the term could be clarified using Schechner’s distinction between *as-performance* and *is-performance* (Schechner 2007). The first addresses wider concerns of human behaviour which lie for the most part beyond the specifics of this study. I therefore here refer to performance and to performative acts in the more literal sense of *is-performance*. 
Describing a creative practice, in my case extending from playing the instrument in rehearsal and performance, selection and maintenance of instruments, sourcing and adapting materials, choice of genres, administration, and communication—in short, a curation of the instrument on professional and personal terms. To be distinguished from *practising* as musical term implying work undertaken alone with the instrument. For clarity, I generally use the term *private rehearsal* where there is a need to disambiguate one from the other.
2 Sounding the assemblage

To do music in any capacity is to integrate a set of habits and proclivities into the texture of one’s various activities and relationships.

Owen Green (2014, p.5)

In this chapter I deal with issues of sound as part of a humanising framework that looks to my embodied action and working priorities as a performer. My approach throughout this research has been one of working towards an embedded private rehearsal methodology that prepares me for the practical considerations of the concert space: how to prepare musically and technically, what equipment to choose, and whether to provide or specify it on the concert day, and how to make optimal use of the sound check. In an augmented practice, the embedded performer’s role is close to that of soloist/director or leader of a chamber music ensemble (Pestova 2008, p.66). My focus has centred on pragmatic and personal issues of sound in order to achieve the requisite balance, and blending the overall output with a sense of a personally curated electro-instrumental sound concept.

The process entailed a combination of developing self-sufficiency—trying different technical equipment, experimenting, adapting, and simulating performance conditions—and external advice from technical experts and experienced performers. Each of the stages provided means to experience, document (by recording), evaluate and reiterate the work in a research cycle that also includes performances themselves. The learning process continues,
but while there are always problems to be overcome, it was useful to start out from a positive assumption that performers, composers, sound engineers, and audiences share an aim of wanting the performance to sound as good as possible.

2.1 Signals

In terms of sound, the twin functions of signal analysis and processing lie at the core of the work. The sound of the clarinet is transduced from sound wave to analogue signal, and on into binary code, which can subsequently be used for the purposes of monitoring and/or sampling for later use (Roads 1996; Cipriani & Giri 2010). Monitoring of the incoming signal may serve one or both of two functions:

- following a piece’s progress (tracking the signal according to preset parameters)
- influencing predetermined events (triggering samples and/or processing)

Sampling for immediate use by the real-time transformation, multiplication, attenuation or other of timbre and pitch, produces what could generally be termed effects. These include equalisation (EQ), harmonisation, distortion, ring modulation, short delays and reverb tails. Over a longer timescale, deferred sample playback, looping, or more complex combinatory processes such as granular synthesis and long convolution reverb, create a dislocation from the performer that sets up the possibility of a response (Emmerson 2007), and implied dialogue. Simon Emmerson’s suggestion (1994a, p100) that the composer’s role be one of “tracking and following the existing human performance and […] intelligently modifying, controlling and projecting the electronic processing and production of materials” has become widely followed in the growing field of interactive music during the intervening two decades.

From the perspective of the onstage performer, my approach to sound concerns the managing of “control oriented variables which prima facie concern themselves with the expressive detail of timbral nuance and development” (ibid., original emphasis). I came into the practice with a set of pragmatic and personal values concerning the sound of the clarinet in the performance space, in terms of quality and a variegated palette of timbre and dynamics, and had considerable experience in the acoustic arena of managing different venue sizes and acoustics. These values were now subject to a further layer of sound mediation, from microphones to loudspeakers, via the conversions, transformations, and reconversions of the digital and analogue assemblage. Reaching a viable public performance standard under onstage operation entailed integrating each of these elements into a working rehearsal methodology that privileged efficiency, practice and experience.
There are three stages to this process of preparation:

- **STAGE 1** rehearsal with only clarinet, laptop and headphones
- **STAGE 2** rehearsal with microphones, audio interface and loudspeakers
- **STAGE 3** sound check and dress rehearsal

Early in the research process, I defined the base requirements for the purpose of satisfying both monitoring and sampling, according to the priority of each stage in the process, from the initial setting up, trialling and learning of Stage 1, to the simulation of concert conditions during Stage 2, and finally to establishing performance readiness at Stage 3. This meant, in terms of monitoring, establishing sufficient clarity of the signal, based on the parameters being detected by the software, and in terms of processing, aiming for a sound quality of input and output that met with my practical and aesthetic needs at each stage.

The following sections describe various decisions I made at each stage regarding these twin concerns of clarity and quality. While it is inconsistent with a performer’s ongoing audible-tactile feedback loop (di Scipio 2003; Leman 2008; Hayes 2014) to completely delineate sound input and output, I will nevertheless, for the sake of convenience, begin with a focus on the implications of getting sound into the apparatus, followed by the business of attending to balance and blend in the loudspeakers and performance space. These pragmatic considerations will also take into account issues of personal preference and individual sound concept, with a view to working towards a personally invested and holistic practice.

### 2.2 Expediency

A way in

For Stage 1 rehearsals, the built-in functionality of my laptop\(^{10}\) was satisfactory in terms of clear signal recognition and quality. Tracking input amplitude in Parker’s *gruntCount*, and pitch in Dudas’ *Preludes*, for example, worked easily with simple adjustments of the input level in the Mac OS System Preferences to avoid clipping. A USB microphone could be employed at this stage to improve sound quality slightly, but on the whole I found the built-in equipment to be satisfactory enough. Use of headphones at this stage kept the output

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\(^{10}\) MacBook Pro (late 2013), 2.3 GHz Intel Core i7 with 16GB RAM. Mac OS X Version 10.9.5.
isolated from the input, avoiding issues we will encounter later in this section. Playing with headphones is not ideal in terms of monitoring one’s own sound, but this is tolerable at an early stage, and the cups can be partly removed to accommodate a blend of sound from the rehearsal space, as I had already discovered working in recording environments, to provide a rough and ready working environment.

As corroborated elsewhere, I found motivation to be a significant factor in dealing with fledgling technical skill. Working in this way was simple to set up, efficient, portable, and allowed me to anchor my workflow on my expertise rather than ignorance. I was able to get to work immediately, for example, with gruntCount and Costanzo’s C-C-Combine patch, adjusting the various parameter settings and nuancing interaction, and to integrate my early practising of sections of Boulez’s Dialogue de l’ombre double with both its recorded sections and simulated piano reverb processing.

The motivational value of the (familiar) experience of an engaging, at times immersive, interaction with sound, was important in terms of building trust in the viability of a project, which was encouraged in the face of developing new knowledge and skill, and overcoming difficulties encountered along the way. Overall, for the purposes of learning the sound of the electronics, and getting a feel for the balance and blend of the diverse elements, the built-in solution satisfied base requirements in terms of clarity and quality, and most importantly, in line with suggestions from previous performance research, proved to be both expedient and motivating (Gabriellson 2003, p242):

Practice results in opportunities to demonstrate one’s competence, thus contributing to strengthening the self-concept and sense of identity, which in turn generates further motivation to practise.

Ways out

Having worked to a point of trust in Stage 1, the next stage was to get the sound of the computer out into the room. Unplugging the headphones at this stage would quickly reveal one of the essential problems of mixed music—feedback. Two issues are raised: firstly, in terms of clarity, the sound from the loudspeakers is now feeding into the input signal, and secondly, in terms of quality—and not least, audio safety—acoustic feedback (the Larsen Effect) may be disturbing or even disastrous. Extending use of the laptop’s built-in audio provided a temporary solution, but at Stage 2 I felt it was useful to begin to work in an environment as close to that of the performance as possible. Unbalanced connections, with an attendant risk of buzz or hum in the output, proved adequate for small rehearsals,

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11 This is not the case when acoustic feedback is employed as a feature of the piece. For example, there is a degree of play in the low-mid frequency range (80-120 Hz) in gruntCount. For An Errant Soothing I used an isolated feedback simulator, which produces the sounds of feedback, with an inherent liveness of danger, but without any actual risk. Contrast this with flautist Richard Craig, whose use of controlled feedback using analogue systems offers an example of an alternative approach: https://vimeo.com/91839597 [accessed 10.7.2017]
informal run-throughs, and lecture-performances, with a USB microphone useful in terms of more focussed directionality than that of the laptop. However, public performances usually employ balanced connections at professional audio levels, providing the requisite robustness and reliability for concert performance, and so gaining familiarity with this environment was an important step towards a viable embedded practice. As such, Stage 2 was the most significant in terms of rehearsal time, equipment choices, and gaining technical knowledge.

2.3 Microphones

Contacts and pickups

A clear input signal from the clarinet (without interference from the output) can be obtained with a contact microphone on either the mouthpiece or instrument body. While unsuitable in terms of conveying a richness of sound quality, they are affordable, readily available, and proved effective for tracking both amplitude and pitch for Dudas’ Prelude 1 (Furniss & Dudas 2014), and again with IRCAM’s OMax improvisation system12 (Lévy et al. 2012). Alternatively, an in-bore (pickup) microphone may be fitted to an additional hole in either clarinet barrel or bass clarinet neck, with the piezo or condenser sensor isolated from the outside world by around a centimetre of dense wood, or the thinner, but nonetheless effective metal alloy of the bass clarinet neck. Pickup microphones are widely used in Turkey and Eastern Europe, where the clarinet maintains a strong presence as a folk instrument played in contemporary amplified settings. Quality assurance and availability seem inconsistent13, although further research in this area would clarify this.

The build quality of Rumberger’s K1X Advanced Piezo Technology microphone is impressive, with an evenness of response over the full range of both the clarinet and bass clarinet. Its small condenser capsule is sensitive and water resistant, bass levels are configurable, and the unit is easily transferred between instruments. It proved to be a highly reliable and influential piece of equipment during the course of this research. While drilling into the bore of the clarinet barrel or bass clarinet neck and fitting the sleeve is invasive, this proved to be (a) relatively inexpensive as professional players usually have interchangeable spares, (b) negligible in terms of impact on the resonance of the instrument, and (c) worth the effort in terms of usefulness. Most importantly, the signal is rich, dry and free of

12 Improvisation with OMax residency, IRCAM, Paris, January 2015 (Perf. 8).
13 My initial purchase, the Pasoana Mk 2.1, proved to be of variable quality and reliability, and rather difficult to obtain. The manufacturer’s website is no longer available, but the product can be found here: https://www.worthpoint.com/worthopedia/pasoana-mk-0-bb-clarinet-transducer-478945443 [accessed 5.9.17]
feedback, fully satisfying clarity criteria for monitoring. There is some unavoidable noise from the clarinet’s keywork at high volume levels, and the amplified sound of the inside of the resonating chamber of the instrument is inherently unnatural in terms of perspective. Piezo pickups have a tendency towards uneven response and harshness. However, mediating the signal via a high impedance unit (the 10MΩ Radial PZ-DI\(^{14}\)), with a configurable high-pass filter, was found to significantly reduce the harshness of the signal, rendering it usable as a second microphone (replacing the lower) in situations that call for a lightweight, portable set-up. I found, particularly in my early experiments with Ableton Live, that developing familiarity with the pickup microphone, contributed to new avenues of sound concept, influenced by both the very close proximity of the in-bore perspective, and the tonal qualities of players using them\(^{15}\).

Overall then, while satisfying the required level of clarity for signal monitoring purposes, and offering options in terms of quality, even the high quality of the Rumberger K1X would not completely fulfil my requirements regarding sound quality. It is also a rare, expensive and highly specialist piece of equipment that would be difficult to replace if lost or faulty, and too rare to specify in a technical rider. In order to properly and reliably prepare for performances, I therefore needed to turn to a range of standard condenser, ribbon and dynamic microphones. As a performer-researcher I was fortunate in this respect, with a wide variety of high-quality microphone options available, and a wealth of experience and wisdom to hand among staff and other users.

**How many, and where?**

Clarity with regard to signal represented the central determining factor with regard to the type and number of microphones used, for both monitoring and sampling purposes. Omnidirectional capsules, clipped onto the shirt front, have been widely used (Yoder 2010, p30) and proved to both practical and portable. However, they registered the output signal significantly, leading to missed cues in pitch-tracking, and to an indistinct, distant quality in the computer output (Perfs. 1, 15). Closer, cardioid or hyper-cardioid pattern condenser microphones provided a more tightly focused sound, richer in overtones, and with more isolation from ambient noise.

The long, straight, cylindrical body of the clarinet is rather complex with regard to microphone placement in comparison to the focused sound source of brass instruments, and to curved saxophones where the positioning of the bell lies fortuitously close to the central

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\(^{14}\) I am indebted to Kevin Hay for introducing me to this approach, and to Marij van Gorkom for discussions and comparisons relating to use of high impedance boxes. In this video, Peter Janis of Radial Engineering introduces the PZ-DI, emphasising this feature [3:16]: https://www.youtube.com/watch?v=xC7iKZBMH4B [accessed 15.8.2017]

\(^{15}\) For example, clarinettists Ivo Papasov (Bulgaria) and Hüsnü Şenlendirici (Turkey).
body of tone holes carrying much of the projection. Placing a microphone at the bell reduces the fullness of the main range, and particularly the \textit{throat notes} (G-B\textsubscript{b} in the stave), while exaggerating the proximity of the lowest notes, and their harmonics, where all or most of the tone holes are covered. These \textit{bell notes} will conversely drop off considerably with a single placement towards the middle of the body of the instrument, where most of the range is strongest. While a compromise positioning is plausible, it requires some judicious movement from the player to ensure the whole range is covered in the amplified or recorded sound. Therefore, on the whole, two microphones are preferred.

![Diagram of Meyer's principal radiation directions for the clarinet](image)

\textbf{Fig. 2.1} Meyer's principal radiation directions for the clarinet (1978, p200, Fig 7.20, my annotations). These observations aided and reinforced practical decisions regarding the placement of one or more microphones to adequately represent a full range of pitch, dynamics, and timbral shading.

Meyer's analysis of directional variations (1978, p296) provides a further indication of implications with regard to microphone choice and placement, particularly at close range (Fig. 2.1). In the chalumeau register (146-415Hz), and slightly above (to 800Hz), the clarinet sound is more or less omnidirectional, but above this “not only the overall sound strength changes with direction, but also the spectrum \textit{and thus the tone colour}” [my emphasis]. Higher pitches radiate from the first and subsequent open tone holes of a given fingering, with a group radiator effect determined by the combination of depressed tone holes. A drop off of up to 20dB is found in sound radiated from the front in the lower range, and of just over 10dB for higher pitches (p146). The sound is diverted by \(\pm 60^\circ\) away from the line of the bore until around 5000Hz. This is compensated for slightly by the effect of the bell, which
seems to privilege sounds in the 1200-2500Hz range forwards. For very high frequencies (mostly partials), radiation is predominantly from the bell (p144). As a result, a microphone placed above and forward of the middle will pick up mostly overtones & “attack noise” (p299) in the extreme upper range (and partials), which may explain difficulties in pitch-tracking in comparison to the flute, for example (see 3.2).

To summarise these twin considerations of sound source and directionality:

- two microphones are required to adequately represent a full range of pitch and dynamics
- the upper registers project strongly upwards from the middle of the instrument (from E in the stave upwards), with a considerable drop off towards the front
- the upper (altissimo) range and extremes of volume (carrying strong upper partials) project strongly from the bell and upwards

Unfortunately, Meyer does not include the bass clarinet in his survey. However, some of the above points may be generalised, taking into due consideration the longer instrument body, extended lower range, and vertical playing angle. Since I often play both instruments in the same programme or piece, a compromise is generally made to accommodate both instruments. The influence of the performance space is also significant in respect of both input and output, and the fact that I perform in a standing position is also to be considered with regard to floor reflections.

Mounting

Next, to the question of mounting—on the body of the instrument, or on stands? With an on-body mounting, the purchase (or build) of a specialist\textsuperscript{16} solution would result in greater freedom of movement, and a consistently close contact with the instrument for efficient isolation. However, I play both clarinet and bass clarinet, and changing the whole apparatus would be impractical in a short time frame. The cost of two such systems was prohibitive. Stand microphones restrict movement to a slightly narrower field, but afford a degree of control over proximity, which is useful. The further practicality of specification, both for rehearsal (my university’s stock) and performance (on the technical rider) persuaded me to opt for stand mounting. Non-specialist equipment is also more easily replaced in the event of loss, technical faults or absent-mindedness (I have a tendency to forget things).

Dynamic range and proximity thus became integral to the way I interact with the computer output, in a way I find suits my playing style and aesthetic. Whether nuancing the timbre of the vocoder-based output of Dudas’ Prelude No.1, negotiating the edges of a booming 80Hz or high-pitched howling feedback in \textit{gruntCount}, or cosying up to a

\textsuperscript{16} For example, the AMT WS for clarinet: \url{http://www.appliedmicrophone.com/hardwired}. Also the SD Systems LCM82B: \url{https://www.sdsystems.com/products/#lcm82b} [both accessed 5.8.17]
microphone at a distance of 1-2cm to play at the edge of audibility into fierce distortion in the manner of an electric guitar, I now find it advantageous to use fixed position microphones that privilege proximity as an expressive tool over any freedom that might otherwise gained by on-body microphones.

Types and models

A complete survey of microphone types and positioning in relation to the clarinet is both impractical and beyond the scope of this study. Eargle (2012) has a comprehensive account of microphone types, as well as amplification and recording techniques, and a good deal of information is available online from expert technicians (Robjohns 2005, 2006), performers (Alder 2014), and via online forums17.

I briefly emphasise again here that my knowledge of technical equipment and audio technology was that of a more or less complete novice. I had plenty of professional playing experience in the recording studio and amplified performance environments, but—and I stress, this is an observation regarding the culture of classical music practice and training, not of mitigation in terms of my research—up to this point, in a twenty-five year performing career, had never purchased, chosen, connected, researched, mounted, or adjusted a microphone, never coiled a cable, or attached a clip. That this is the case is testament to a tendency in classical music towards an oppositional performer/technician paradigm that is both anachronistic and unhelpful. Later, in conclusion of this thesis, reflecting on the impact of this research on my practice as an educator, I recommend this kind of knowledge—a thorough consideration of instrument-specific practical need and personal preference—to be part of every performance course at higher education level, regardless of genre.

A Connectivist approach was taken, comprising experimentation, research, advice from sound engineers and fellow performers, and a good deal of online video tutorials. As noted elsewhere, in the online community, there seems to be an article, forum or, more commonly, a video channel for every conceivable technical issue. The number of available microphones is daunting, therefore choices were restricted to widely available models that could be specified in an external technical rider. Condenser, ribbon and dynamic microphones were used in performances and recordings, as well as the Rumberger pickup.

Condenser microphones were preferred in general, for reasons of quality and relative robustness. The AKG C414 and KM140 emerged as favourite options, for reasons of sound fidelity. Both were enjoyed, in pairs or combination, as upper or lower options. The former is industry standard, and configurable with both high pass and pad to accommodate stage clarity and the harsher dynamics of the clarinet’s wide dynamic range. The KM140 is very portable, proved to be well isolated in terms of feedback, and warm in comparison to the

17 For example: https://recording.org/threads/recording-clarinet.24237/ [accessed 5.8.17]
perhaps more commonly provided KM184. Standard practice in many popular music and theatre venues is to assign the Shure SM57 to orchestral instruments, which is at least very robust and well isolated. It was in fact rather too isolating for the clarinet’s long sound source, discussed above, but in conjunction with the K1X pickup, for example, or as a second-tier choice lower microphone, it is usable, and at least widely available. The Røde NTR ribbon microphone throughout as the upper microphone in the concert hall recordings (CD1, CD2:5-8) offered a rich and highly detailed, natural-sounding response, but is rather too heavy, sensitive and costly (to replace) for travelling purposes.

Although dynamic microphones are generally preferred for close coverage of loud and low-end attacks, such as the kick drum and guitar amplifier, they were useful, particularly as the lower of a pair on the bass clarinet, in highly amplified and/or crowded stage environments. Both the Electro-Voice RE-20 and AKG D-12E handled the harmonically rich slap tonguing of gruntCount (CD2:1, 3) and the heavy electric guitar spill of Bitter Together (Perf. 10, 11) respectively.

Finally, concluding this very brief foray into microphone usage and placement, it is important to note that an inherent messiness in performance—its multiple considerations of space, set-up, contingency and diversity of aesthetics—precludes ideal solutions. The recording studio is a more exact environment, but my prime concern in all such considerations was one of pragmatism in the face of venue conditions, finding a variety of options that related to personal preference and playing style. Alongside the sound engineer, the best that can be done is to work towards optimal solutions, developing coping strategies around the inherent and ubiquitous compromises.

2.4 Internal mixing

Preparation as makeshift experience

Sound checks and setting up time at venues are often tight and subject to delays and alterations. In order to keep a cool head in the augmented performance environment, being thoroughly prepared was essential. From experience I already knew the peace of mind gained from being meticulously prepared with regard to musical material, visual materials and reed selection, for example, amid the stresses of the concert day. “Learning involves consistency. The same action must produce the same result. In the world of physically produced sound this enables increasing nuance to be learnt” (Emmerson 2000, p199). During Stage 2, therefore, I prepared with the same equipment (or as similar as is practical) used in the performance. The requisite number of loudspeakers (usually tow or four) were placed in the rehearsal space in a way that reflected the likely layout in the hall, with
additional monitoring connected accordingly for larger venues. This way, although rehearsal rooms are generally smaller, a feel for the sound in the space can begin to develop.

Having selected and positioned the combination of microphones, their input must be routed into, through, and out of, the digital assembly, via the audio interface. Alongside my laptop, the RME Fireface models were a constant presence throughout the study. It was important to have consistent, high quality and configurable equipment at the heart of the set-up. Balancing and blending the clarinet sound with the computer output generally required a small amount of the microphone signal to be routed directly to the outputs and into the sound field of the loudspeaker array. Even in a small and reverberant venue, a little instrumental sound in the mix serves to bind the local and field sources (Emmerson 1994b, 2007) into the same overall spatial frame (Smalley 1996).

Routing and mixing of the clarinet signal, software output, and overall output levels was operable from within the audio interface—its TotalMix FX software enabled the preparation of pre-mixing in rehearsal, with the identical input and output channel routings, and levels—a best-guess mix to take into the sound check. The overall workspace, with up to eight preset mixes, may be saved to a database and recalled accordingly. On the UCX and UFX models, this internal mixer also offers EQ and compression settings. I thereby kept an internal mixer preset of every performance to recall or use as the basis for new settings, and dedicated a significant amount of rehearsal time in the days before a performance to this process of preparation, arriving at the sound check with a quickly accessed, preset mix of microphone and software output that (a) put me in overall charge of output level, balance and blend, (b) allowed the sound engineer to attend immediately to the diffusion in the room, and (c) established a bank of precedents on which to base further performances.

In rehearsal, becoming accustomed to playing with both a loudspeaker and a headphone mix provided alternative or combined means of monitoring balance, blend and detail. This dual approach served to connect a growing feel for the overall sound in Stages 1 and 2, and provided a precise and configurable alternative perspective to the sound in the room. It is difficult to maintain an objectivity towards the clarinet sound with headphones, since the cup (or plug) exaggerates in-body hearing through flesh, teeth and bone. Over time, however, I developed a useful headphone rehearsal technique, with a combination of:

- levels, EQ, compression, and reverb within the audio interface software
- noise-cancelling (inhibits external sound)
- double-lip embouchure\(^{19}\) (insulates sound transference via the teeth)

\(^{18}\)When performing without a sound engineer, or for reasons of executive control over audio safety, signals were sent through either a small onstage mixing desk, analogue volume pedal or volume control potentiometer.

\(^{19}\)A single-lip embouchure is predominant in contemporary clarinet playing, whereby the upper teeth are in direct contact with the body of the mouthpiece. Double-lip embouchure is less common, although preferred
Presence and viability

In practical terms, balancing the clarinet with the computer output was primarily a question of making sure that foreground elements in the music are not unduly pushed into the background. In this sense, I began to think more in terms achieving *presence*, rather than mere volume—“is the clarinet loud enough?” became “is the clarinet duly present” in the context of the loudspeaker field and performance space. Once the essential gain levels were set to avoid distortion (clipping), avoid acoustic feedback, and optimise clarity and quality of signal, rehearsals became an immersive process of orchestrating foreground and background within each piece.

Taking time in private rehearsal to develop fluency and embodied understanding with a variety of set-ups formed the major part of this research process, as the electronics became embedded in my private rehearsal. Flautist Jean Penny also describes these long experimental periods as immersive and motivating (2009, p164):

> A luxurious immersion is the most valuable time: a whole week thinking about and trying alternative approaches to a single sound, adding electronics and discovering new nuances and meaning; taking it away again to distil the tone and search about its source; adding it back to explore the changes that have occurred. These are learning processes to treasure in this work.

This period involved both an ongoing tweaking (and saving) of input and output levels in both the performance and interface software, and ultimately by judicious inflection of the clarinet sound as part of the musical interaction—a process that runs through all three stages of preparation, and which anticipates the performance itself. Individual preferences and discoveries emerged from experimentation that accumulate, contributing to a personal negotiation of the sounding assemblage—an instrumental voice. Growing trust in the *viability* of an engaging and sonically balanced performance was my primary motivation throughout the process.

Reverb

Prior to this research I had often felt isolated and impoverished in the electro-instrumental performance space and recording studio, where dry acoustics are generally preferred for the sake of detail, exaggerating the physical and psychoacoustic disjuncts (Emmerson 1994, 2007) between acoustic and electroacoustic elements, whereby the onstage

by some players for its perceived mellifluousness of tone, and tendency to discourage over-biting (Stein 1958, p46). For these last reasons I have moved towards a partial use of double-lip in recent years, and it has proved valuable in removing some of the perceived harshness of tone borne of the teeth that characterises headphone use while playing. It is possible that this may be contributory to the suggestion that double-lip produces a sweeter tone (ibid.). Regardless, the use of double-lip embouchure has facilitated a more supported, less tight, embouchure in my playing, and in this sense, my augmented practice has fed back into an improvement of my overall technique and tone quality.
performer “sometimes has the uneasy feel of a persistently real and recognisable intruder into a dream” (Emmerson 2000, p207). Taking control of the mix allowed me to make judgements based on personal preference and contingent environmental factors in setting appropriate, supportive levels of reverb for each performance or piece, binding the electro-instrumental sound concept and empowering me as a performer.

Reverb affects our sense of identity (Rothenberg 2006), of being heard in, or amplified by, a real or imaginary space. By using artificial reverb as a tool, “we can begin to play with the very notion of authenticity” (ibid.). Harker and Dudas both built reverb systems into their software output, while in Dialogue de l’ombre double, Boulez juxtaposes different levels of natural and artificial resonance in both the live and recorded parts, creating a dialogic play of space and proximity. In gruntCount and my early Ableton Live set-ups, employing a very long reverb tail deliberately offset an imagined space, enlarging the sonic field, while pragmatically affording a degree of flexibility and room for breathing and brief moments of physical rest. Dry acoustics create intimacy in the sound field (Penny 2009, p172), while reverb provides an empowering, spatial augmentation around the performer: “the player gains greater flexibility, and can relax, almost allowing the sound to self-project, depending on the level of intensity desired” (ibid., p163).

Reverb therefore forms part of the fabric of the instrument, the fading tail providing spatial information that fulfils a sense of drawing optimal resonance from the body-instrument and surrounding architecture. While excess reverberation compromises clarity of detail (hence the ‘deadened’ acoustics of theatres), in a dry space, I feel a sense of resonance being sucked away—an essential part of my sound diminished, or denied. Small, dry, rehearsal rooms certainly aid detailed listening, and may serve to encourage the development of a full, warm sound in an impoverished acoustic space, after which the reward of the concert space can be a much fuller—and heartening—sonic bloom. During this period of study, however, I preferred to play into a little reverb while working in the dry environment of the practice studio, and thereby formed a habit of including reverb in the adjustment of my sound within the whole.

2.5 Personal sound and sound concept

My situated, embodied relationship with technology, culture and identity over time has undoubtedly fashioned a personal sound. While I am unable to perceive it objectively, its individuality is rooted in experience and myriad influences, tempered and heightened by constraints, and subject to the adoption of various personae. From my perspective, this individual set of influences and choices represents a sound concept, and centres around areas of tonal consideration as priorities—dynamic range, focus, presence, timbral (harmonic) richness, warmth, mellifluousness—alongside priorities relating to conscious action, in particular attending to a dramaturgical thread with agility and an openness to play.
Notions of ideal tone are still common in classical training (Cumming 2000; Leech-Wilkinson 2016), often with a view to conforming to acknowledged standards within traditional contexts. Yet the distinctive voice in instrumental music is highly prized. As a professional clarinettist I have spent the requisite years developing a fluid and athletic instrumental facility, a resonant and richly shaded projection of tone quality, and have become more individually motivated, based on experiences, personal ideas, influences and chance discoveries. While performers are widely understood to interpret scores and other sets of instructions in a manner that balances authorial and performative agency, this interpretation of the instrument is also at play in the way that musicians develop a unique Sound, using more or less similar equipment.

Sound concept is continually unfolding, changing as I develop familiarity with equipment and systems for performance, revealed through a process of learning by doing. It would be unwise to enter into a technologically mediated practice with a fixed personal sound aesthetic, without first understanding the equipment and processes involved and subsequently working in amongst them to develop a feel for the types of responses each system provides. For example, finding ourselves in a new environment, it is not unreasonable to expect that adjustments to the type of sound(s) will be appropriate, in order to bring about a richer whole. Marco Stroppa has suggested that a “natural” way of playing an instrument may produce a processed result that leaves the listener with a deformed sense of the whole, rather than “a new sound family” (1999, p48). It may require “a different approach to instrumental playing” (ibid.) that privileges the compositional purpose, in order to achieve a unified sound concept. This study has to some extent centred on an extended investigation into this nuancing of approach, finding adjustments of timbre and dynamic that complement the assemblage of computer output and its associated hardware as an unfamiliar ensemble partner—one whose responses require time to become acquainted with.

Unify and multiply

If you’re using a mic on a clarinet, you’re already sacrificing a ‘true’ sound.

Jason Alder (2014)

On one level, Alder is right: that we will sound different when amplified, recorded and processed is a truism. Here, while the humanising research framework attended to practical needs and personal values, there was an inevitable re-negotiation of terms in regard to sound concept in the light of additional technology, played out during the three stages of rehearsal. Becoming familiar with the augmented instrument required a similar approach to that

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20 Jonathan Impett’s suggestion that the score be considered a technology serves to illustrate this connection. Symposium on Notations for New Instruments and Musical Expression, IRCAM, Paris, September 2016. https://medias.ircam.fr/x437e31 [accessed 20.7.17]
practised over years on the clarinet: preparation (rehearsal, research, technical adjustments),
performance (including recordings), and fitness (routine, consistency, time). Working in this
manner ensures an embedded approach to the personal understanding of both instrument
and pieces, in a manner that Xenia Pestova has described as consistent with acoustic
ensemble practice (2008, p14):

the performer should view electronic sound as being equal in importance to
instrumental sound, and approach learning the electronic part in the same way as
learning the orchestral part of a concerto or the parts of his or her chamber music
partners.

The affordance of multiple variant sound concepts is one of the most enabling aspects of
the genre, extending and distorting the sonic capabilities of the instrument. More
significantly, the element of interactive dialogue creates an ensemble aesthetic, requiring a
requisite sound concept. In this sense, the onstage instrumentalist becomes director of an
ensemble of physically and virtually present forces—not quite a conductor, but more
accurately, a concerto soloist/director (ibid., p66). A hybrid sound aesthetic emerges from a
sustained, informed and reflective practice: an electro-instrumental sound concept that may
over time develop into an identifiable part of a performer’s personal sound.

An augmented practice “reveals performance aspects that include musical structures,
spaces in sounds, spaces in performance and illusions” Penny (2009, p252). The
instrumentalist thereby becomes a “re-shaped, re-located, renewed and re-invented
musician in a field of shifting emphases, new processes and expanded symbiosis. New sonic
goals and identities emerge as the performer’s world attains an expanded meaning and
refreshed understanding.” (ibid.) But because of the multiple affordances of the genre, this
holistic and augmented personal sound is multifarious—a cast of diverse musical personae
that enlarges the expressive scope of the performer.

The entire sound world is conceived as an extension of the soloist – not as a
dichotomy, but as a new kind of instrument. (Machover 1995; quoted in Pestova
2008, p9)

A period of discovering, imagining, testing, stretching and breaking instrumental
thresholds of dynamic, timbre establishes a unique musical identity, which is blurred and
multiplied by dialogic affordances—we may speak of voice in instrumental terms, because
an accomplished musician seeks not only to optimise their technical and expressive skill, but
in some way to transcend their instrument in the shared musical experience of performance.
We talk of a musician’s personal sound as a projection of their personality, and sometimes
recognise instrumental performers in the same way as we identify the voice of a singer or
actor—even a family member or friend.

Manifold decisions, from instrument maker and model, set-up, to the foregrounding of
tonal elements and negotiations with the space—venue size, reverberation, equipment
specification and placement—are all carried strongly into a process of collaboration with
technical co-performers towards an integrated and personally invested sonic experience in the venue.

The contemporary performer is furthermore armed with a wide variety of extended techniques that brought timbral expansion, multiphonics, systems of microtonal tuning, and a multitude of articulations to the instrumental palette during the latter part of the 20th century. Augmentation affords not only a broader palette of expression, but an enhanced ability to inhabit multiple incarnations of sound concept.

**An agency of identity**

I pause here to briefly consider the issue of pre-recorded samples and tape parts in relation to this idea of personal sound as a projected identity. It is generally optimal for performers to record their own fixed media where a sense of virtual dialogue is inherent to the piece (see 3.1). This may, however, not be practical. Nicolls (2010, p17) attests to feeling a tacit connection to her own recorded samples that improves a sense of interaction and liveness. A parity of sound concept also enhances liveness, as I shall discuss in the following chapter.

Where fixed media works employ recordings of another clarinettist, there will be a difference in the personal sound of each player. The significance of this disjunct will depend on performer and composer preference, with performance viability also contingent upon mitigating factors of limited preparation time, available personnel, facilities or materials. For example, performing Andrew May’s *Chant/Songe* (2004) in 2008, ultimately the stylistic and timbral divergence between the recorded clarinet parts (by F. Gerard Errante) and my own sound concept left me feeling constrained. The recordings imposed an imbalance of agency in terms of identity to an untenable degree: to me, *Chant/Songe* simply belonged too much to Errante and May’s collaboration for comfort. We discussed re-recording, but decided instead that the time and effort required would be more fruitfully spent on a new piece. By contrast, in Harker’s *Fluence*, where over a thousand samples were recorded by Jonathan Sage, there turned out to be no such conflict, due to both a predominance of liminal sounds, and to the shaping of each sample in the electronics, which serves to obfuscate any sense of personal identity (see 6.1).

**2.6 Communication**

The ears were my guide throughout this research, but augmentation of the acoustic instrument is facilitated by a basic understanding of the properties and behaviour of sound waves, as well as the terminology used by technicians. At Stage 3, the immersive personal practice of equipment choice, setting balance and blend, and immersive rehearsal give way to a negotiation of space, limited time and social interaction with venue staff and any
technical co-performers (assuming there is a sound engineer). Having the confidence to explain and insist on a lower overall volume level, for example, and when to defer to the sound engineer’s expertise on diffusion and delays became easier with the makeshift experience of Stage 2 rehearsal and test recordings. We are usually separated from the sound in the hall for reasons of clarity in diffusion and the avoidance of audio feedback. Pestova (2008, p48) points out that musicians are generally experienced and adept at second-guessing their levels in differing spaces. While a headphone mix and tests in rehearsal can prepare the performer to an extent, experience of listening from the audience perspective is useful, either by playing a sound file or processing loop, or even by having a colleague stand in while stepping out into the diffusion space (ibid.)—as a conductor might in a dress rehearsal, to gauge balance and response in the concert hall.

Overall, at this stage efficiency and collaboration in the performance space were enhanced by the humanising approach to sound taken in this chapter. Communication with the venue staff and sound engineer represented the final step in the process towards viable performances. This was achieved by:

• communicating clearly beforehand what equipment I will bring, and what I will require (the technical rider)
• confirming that the electronics will be performer-operated onstage
• specifying the required stage area
• providing considered, tested mix presets as outputs to the mixing desk
• stepping out and listening to a sound file recording, loop or ongoing processing state
• clearly articulating pertinent practical details to the sound engineer, combining descriptive and technical terminology
• mutual discussion of the diffusion

2.7 Summary

In the above section I articulated a performer-centred approach to concerns of sound in the augmented environment, as part of the humanising framework outlined in Chapter 1. It was noted that, in terms of sound, analysis and processing lie at the core of the work presented here. Signal from the acoustic instrument is monitored and/or sampled, affording the output of a manifold real-time manipulations, as well as forms of response, or dialogue. In preparation for a performance, I worked in three stages towards optimally balancing and blending the presence of both clarinet and electronics in the output and within the acoustics of the performance space:
• **STAGE 1** rehearsal with only clarinet, laptop and headphones
• **STAGE 2** rehearsal with additional microphones, audio interface and loudspeakers
• **STAGE 3** sound check and dress rehearsal

In practical terms, it was found that:

• more than one microphone is required to adequately capture the sound of the clarinet
• two condenser microphones, upper and lower, in a cardioid pattern, and mounted on stands, offer optimal flexibility
• the optional use of an in-bore pickup microphone facilitates clarity of input signal and provides an alternative to the lower microphone
• preparing preset mixes in the audio interface software during rehearsal saves time during sound check
• dislocations of space and time between acoustic and electroacoustic sound sources are influential in terms of blend and reverberation
• shared responsibility for sound in the concert space entails clear communication with the sound engineer, both before and during the sound check

Personal preferences, experience, and chance discoveries in the curation of instrumental sound contribute to the ongoing development of a personal sound concept. An embedded, onstage practice established a diversity of electro-instrumental sound concepts, differing from one assemblage to another. This personally invested and holistic approach to sound concept was found to be motivating, while liable to compromise by the additional technology, including the use of pre-recorded samples by other performers. A primary focus was established based on the notion of *performance viability*—building sufficient trust in the overall sound to satisfy practical and personal considerations in anticipation of the liveness of performance.
3 Chasing liveness

The perception of liveness in music is the perception of that which reminds us of music’s basis in performance. Thus the value of liveness is not located in what is actually happening but in what we perceive as happening.

Paul Sanden (2013, p109)

3.1 Purposeful threads

While the sounds of a piece are thus very much determined through acts of intuiting, projecting, shaping, responding, and interpreting, there is more to a humanised practice than curating sound. Coping with shifting hierarchies of influence as they impact the performer requires an ongoing management of shifting states of attention (Gabrielsson 2003, p239; McCaleb 2011; Furniss & Parker 2014). Action and reaction, both conscious and intuitive, operate within a constantly shifting flux of factors relating to time (present, future, and past), sonic forms, and a personally negotiated dramatic thread, all in the service of a wider, socially oriented narrative. The temporality of this managing of sound, and of the socially situated act of music performance, highlight a transcendent purpose: shaping the moment-to-moment unfolding of events (planned or otherwise) into a directed, animated and engaging thread of attention, with the goal of curating a communal experience that has
its own unique drama. Attending to this ongoing dramaturgy brings into focus the central issue of liveness. Sarah Nicolls aims to create:

real-time connectivity between the live interpreter and the progress of the music (allowing the performer to create the most convincing and fluid performance they can). (2010, p11, my emphasis)

In the following chapter I describe liveness firstly as a personal, inner phenomenon, which connects via rehearsal to a publicly engaged, outward experience of liveness among others. Connecting these inner and outward experiences emerged as integral to both methodology and motivation. Finding simple technical solutions to get quickly to gratifying musical interaction provided viable means to realise engaging, animated performances. This expediency allowed me to focus energy immediately on preparing for performances—leaning on professional experience and expertise, rather than insisting too much on the furthering of my fledgling technical knowledge.

Performance has its own energy, and our relationship with pieces often only fully emerges once they are publicly aired (Schroeder & Rebelo 2009; Nicolls 2010). Both the performance and its preparation happen in their own timespan, or thread. On the one hand, the duration of the piece is more or less fixed, and mutually agreed within the context of its programming within a communal event. On the other, the preparation of this thread forms its own thread in the practice of the performer—a timespan unfolds as the performance approaches, taken up with the processes of learning, rehearsing, negotiating, shaping, reworking, and embodying, and including simulations of the anticipated goal in the form of run-throughs and recordings. The thread of the performance is, in this sense, already underway the moment a performer begins to prepare it. Drawing on Tim Ingold’s distinction between objects and things (2010, p3), the piece exists not as an object to be prepared for exhibition, but rather a gathering together of threads of activity, attention, relationships, and authorship:

this is to read creativity ‘forwards’, as an improvisatory joining in with formative processes, rather than ‘backwards’, as an abduction from a finished object to an intention in the mind of an agent [...] the pathways or trajectories along which improvisatory practice unfolds are not connections, nor do they describe relations between one thing and another. They are rather lines along which things continually come into being, (ibid.)

Subsequent performances become enfolded in the process as lines in a piece’s existence as an ongoing and manifold thing, and as performers we step into its river anew at each reiteration21.

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21 The metaphor is borrowed directly from a lecture given by Ingold at the University of Edinburgh in 2015, relating to his own playing of Bach’s Suites.
What I here term *inner liveness* is in this way connected to the idea of a *performative layer*, which serves to connect preparation to performance by way of a trajectory towards the socially situated *outward liveness* of the event (Schroeder & Rebelo 2009, p138):

Whereas the habitual and the present body play a role in the development of skill, the performative layer assumes these skills and frames the positioning of the body, beyond the habitual, in the context of an environment with elements beyond the control of the performer. This environment or performance context can include elements such as the performer, the instrument, the work, the audience, the dramaturgy. It is through the performative layer that a performer deals with the complexity of the performance environment with its unexpected events, dynamics and breakdowns.

3.2 Musical expediency

Whether interpreting compositions or improvising new works, early in the rehearsal process I need to feel confident that an engaging performance will be possible, and to feel motivated in Stage 1 rehearsal by a sense of engagement with the instrument and the musical material. This *expediency* represents a personally negotiated inner liveness between player and instrument, interpreter and score, and as an experienced performer I rely on this to motivate my preparation, to growing a sense of trust that a performance will be both practically achievable and engaging. While I cannot predict or speak for the subjective engagement of the audience, I feel that my task in the performances discussed here is best served by remaining authentic to this insistence on building an inner liveness that prepares me to deal with the forthcoming performance—or at least, those aspects within my sphere of influence.

Engaging, animated interaction

While liveness is rather a moot topic, to which we will return later in this chapter, I will bypass debate for a moment and focus on my practical priorities in relation to the term, namely the maintenance of an engaged and animated thread of attention from the beginning of a performance to its conclusion. Finding and nurturing a requisite level of interaction, and probing its performance viability in terms of liveness, represents the second layer of the humanising agenda that similarly began with musical expediency in relation to sound. What, then, might stand in the way of engagement in the augmented performance environment?

Faulty, out of date or simply non-functioning software and hardware will create interruption to workflow and frustration, and here the composer and/or software designer
share responsibility for the update and accessibility of materials. The rigidity of overly controlling tape parts may or may not have a detrimental effect, especially the cognitive dissonance of conflicting tempi inherent to stopwatch use. Predictable or disproportionate responses in an improvisation system may also present difficulties. Puckette and Settel (1993), Kimura (2003), McNutt (2003), Pestova (2008), and especially Berweck (2012), have lists of complaints that raise stress levels or impinge on a performer’s ability to engage fluently in music making at an appropriate level of expertise.

The cost may be high at this early stage, as pieces or systems that prove difficult in terms of expediency may fall by the wayside, abandoned or postponed either out of frustration, or more pertinently, out of a need to find personally viable alternative solutions. These rejections may simply amount to personal taste, rather than any inherent fault in the system.

Engaging and animated interaction across each of the roles in this research was found to come from a combination of pragmatic and personal factors:

- readily accessed and up-to-date materials
- plug-and-play functionality (user experience)
- a ready sense of what the software is designed to do
- clear, minimal, base level instruction
- richness and variegation in the sonic response
- proportional, synchronous and traceable responses
- lively or engrossing responses
- mappable control parameters that connect to embodied processes
- scalable control levels
- both responsiveness and resistance to input
- thresholds to set and test within the software interface
- a sense of something to be explored

Furthermore, for the purposes of engaging and animated improvisation, the following also provided pathways to inner liveness:

- a stimulus, provocation, or call to action, whether designed or not
- some fluidity of tempo and pacing
- simple ways to begin and end an improvisation
- a degree of unpredictability and otherness to negotiate

When engaged in a viable musical interaction, the result is a feeling of immersion, and the work stimulates both a thread of attention on a moment-to-moment basis, and a growing

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22 Work on Dudas’ Preludes, for example, was held up by legacy issues in moving from Max 4 to versions 6 and 7 (see 5.2), and a general shift over the period to 64-bit processing (Dudas & Furniss 2016), as was the case with Harker’s Fluence (see 6.1).
instrumental fluency. From Eastern philosophy to sports psychology, the phrase “in the present moment” is used to describe this kind of focus, agility and resilience against distraction. Such negentropic or flow states have been described as carrying a sense of non-mediation, of losing the self (Leman 2008; Riva 2008), which may be a feature of inner liveness in rehearsal. However, I argue that, even in fully fluent engagement, any such sense is rendered illusory by a blurring of body and tool, and by the realisation of the performative layer (see also 8.2). I remain very much present, and temporally distributed in attention, during the liveness of performance.

Performers’ thought processes are multimodal, combining musical thinking as a discrete mode (McCaleb 2011), with an embodied, enactive instrumental thinking through the structural coupling of tool, environment and musician (Varela et al. 1991; Leman 2008; Hayes 2014, 2015). While pianist David Sudnow (2001) describes this in terms of his hands acting, in my case the oral cavity and mouthpiece assemblage also act as a focal area in the embodied process of making sound. I am very much thinking with the tongue, the jaw, the position of the lower teeth in relation to the reed.

The clarinet mouthpiece, for example, as an essential control interface between external apparatus and human airflow and physique, affects the feel and performance of the reed and instrument as a whole. Variables of design define the level of flexibility, dynamic range, timbral range, tonal focus and general levels of effort. Mouthpiece setup, alongside reed resistance, is therefore an essential audio-haptic element in my embodied, enactive mode of thinking, or feel. While the structural coupling is intuitive, the present moment of doing is highly focused in the body in a way that is both specific and conscious—I am at some level conscious of the context (playing the instrument, performing) all of the time, not lost in a timeless, disembodied and unmediated reverie.

Elasticity of interaction

Interaction between performers and computer has been widely described as situated on a spectrum of viscosity from solid, rigid and inflexible (karaoke-like), through to fluid and mercurial (Winkler 1998; Kimura 2003; MacNutt 2003; Pestova 2008), which is not unrelated to the idea that instruments are founded on affordance and resistance (Waters, 2013). I feel these viscosities as embodied, enacted experience, and actively seek out and explore elasticity in both written and improvised works. Todd Winkler’s classification of interactive computer music system models (1998, p292) is useful in furthering this metaphor of viscosity:
A less analytical and more enactive reading of this viscosity might be understood by borrowing from the theatre, where the Michael Chekhov acting method posits a progression of resistance in movement qualities (Petit 2009, pp115-126):

- **moulding** (thick, viscose, syrupy)
- **flowing**, or **floating** (light, watery, undulating/eddied, whimsical)
- **flying** (airy, immediate)
- **radiating** (powerful, still, bright)

*Moulding* here suggests the precise, locked-in coordination of tempo-based musics, or the collective feel and underlying pulse of a free improvisation. *Flowing* might characterise the ongoing management of spontaneous creative impulses, while *flying* implies remaining open to mercurial adjustments of timbre and intonation. Radiating might suit the emanation of real-time timbral effects, or the trailing granular synthesis of the final bars of Dudas’ *Prelude 2*, for example. Especially in the early stages of research, while my technical proficiency was still nascent, the important growing of trust in my ability to achieve a viable and sustained thread in performance was facilitated when musical interaction in Stage 1 and early Stage 2 rehearsal fulfilled a combination of these qualities, or demonstrated potential to do so.

### Dialogue, exchange and virtual personae

A general tendency to impart living qualities to inanimate objects and phenomena may be understood as a way to make sense of a messy and perplexing world that allows our minds to make decisions based on what is known, and animate (Guthrie, 1993, p41). This animism extends to a *systematic anthropomorphism* in humans (ibid., p6), which “stems, as does animism, from Pascal’s strategy: faced by uncertainty, we bet on the most significant possibility. If we are mistaken, we lose little, while if we are right, we gain much.” Marc Leman’s view of embodiment as *action-oriented ontology* (2008) suggests that this strategy is based on empathy—understanding external phenomena in relation to a familiar movement, a view close to the enactive philosophy of mind. Cumming likewise links gesture (2000,
p163) to the possibility of perceiving a virtual identity—the motion inherent to the forming of a melodic phrase “captures the propensity of listeners [participants/actors/subjects] to hear in short, directed motions the evidence of a sometimes expressive agency in movement.” Ingold’s view (2011) differs from (and directly scoffs at) Guthrie’s, in favour of “lines of continuous birth” (2011, p69, citing Merleau-Ponty 1964)—again, his view is “not of things in a world, but of things becoming things, and of the world becoming a world”.

I found myself often referring to the creatureliness of the electronic output during this research (Furniss & Parker 2014, p193), and at times addressed the software out loud in rehearsal and recording sessions. This is perhaps part of my personal negotiation of interactive music, and is surely in response to the virtual ensemble paradigm inherent to my repertoire and approach. I may also carry a performer’s embedded, habitual tendency to project personae (Cumming 2000, p162, citing Cone 1974). Nicolls feels she is “improvising with another human”23 (2010, p24), and George Lewis (2000, p37) speaks of “a kind of technology-mediated animism” in relation to Voyager (1993), and improvising systems in general.

3.3 Motivation

Professional musicians learn by experience to develop appropriate strategies for both the performance and its preparation (Gabrielsson 2003, p240), including the use of mental representations of the projected performance, the current performance, and produc
tional aspects of the music (p241). While a necessary focus on technical issues inevitably features strongly in early rehearsal, performance dimensions have been shown to affect preparation at all stages (p239).

Driven by the motivation of encountering a sense of flow, I was often stimulated by a ‘hook’ sound or process, such as the distortion of gruntCount (6.2), or the accidental affordance of a drone-like buzz in the stereo comb filtering of An Errant Soothing (7.2). Any initial technical or musical difficulties were lightened by an immersive focus and engagement, the inner liveness engendering sufficient determination to persevere (Fig 3.1).

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23 In reference to Pierre-Alexandre Tremblay’s piece Un clou, son marteau et le béton (2009)
Fig 3.1 Expediency (getting quickly to a gratifying interaction) and sound concept feed liveness and stimulate motivation.

3.4 Outward trajectories

Moving from the inner liveness of musical expediency, and motivated engagement in early rehearsal, and on into the unfolding public performance, entails a shift from the instinctive sense of the piece feeling live to the subjective perception of liveness on the part of an audience, which has been much discussed, and which may be distinguished as outward liveness. My intention here is not a survey of an already crowded field of debate surrounding liveness (Auslander 1998, 2011; Stroppa 1999; Croft 2007; Dixon 2007; Sanden 2013; Aguilar 2014), but rather to illustrate that dynamic, engaging and animated public performances sit at the heart of my purpose and working process as a performer.

Philip Auslander observed (1998) that it is no longer adequate to define live performance as ontologically opposed to that which involves the use of reproductive media, since the perception of liveness alters with the development of technology. The oppositional view of live as distinct from recorded or broadcast music was a reaction to what Simon Emmerson (1994, p95) identifies as three dislocations in electroacoustic music—time, space and mechanical causality—arising from the technologies of telecommunication, recording and electronic synthesis. The disjunct between potentially dehumanising electroacoustic soundscapes and physically present performers, with their humanly excited sounding bodies and objects, highlights:

... the basic problem of ‘mixed’ music: the root ambiguity between the liberated objects free to fly of their own accord and the fixed and real entity of the instrument, forever rooted in its physical structure. (ibid., p99)
Paul Sanden argues that any definition of liveness should reflect its “versatile and dynamic” nature (2013, p159), and has undertaken the most thorough survey of the topic to date. He sees liveness in “mediatized music” (his term encompasses, amplification, recording, sampling, live electronics and mixed music) as emerging in various ways from inherent dialectical tensions presented by the disjuncts noted above, and from a synthesis of apparent threats to conventional constituents of live performance, as understood and accepted at the time, brought about by technology (p160).

John Croft (2007) usefully distinguishes between procedural (functionally real-time) and aesthetic (causally and proportionally responsive) liveness in live electronic music, which is supported by Emmerson’s distinction (2007) between real-time and the idea of living presence (see 8.2). Emmerson has proposed that “what we perceive when we perceive ‘interactivity’ becomes a measure (but not the measure) of liveness” (Emmerson 2012, p15; his emphasis), with Sanden going even further in the quote at the head of this chapter (2013, p109). Both views tally with my description of a performer’s inner liveness. For Auslander (2011), the more outward, subjective, historically contingent, and culturally dynamic perception of the listener ultimately defines liveness: a claim is made by the performer, and the measure of liveness depends on the degree of its acceptance. This seems rather too transactional, but the notion of offers to be accepted in a communally negotiated narrative—borrowing a term from theatrical improvisation (Johnstone 1979)—is certainly familiar.

For Marco Stroppa (1999), an important contribution to addressing dislocation is made by the performer, whose physical and visible “presence and attitude can do wonders and is often necessary and sufficient to infuse life into a piece.” Musical considerations are more important than any methodology or format, and liveness brought about by the artfulness of both interpretation and composition:

Life in music sprouts suddenly, when some kind of communication is going on between the performer and the surrounding electronic material, between both of them and the audience and [...] when the piece is worth it. (Stroppa 1999, p52)

Unpacking liveness

Sanden proposes a typology of liveness that offers a framework for negotiation in terms of pragmatism, personal values and ongoing levels of attention, which include fidelities to acquired notions of authenticity (2013, p79), traces of human effort, a perceived sense of interaction and, in the digital era, virtual presences (p159) or personae (p121). His full list comprises:

• spatial liveness
• temporal liveness
• corporeal (causal) liveness
• spontaneous liveness
• trace corporeal liveness (traces of will)
• authentic liveness (fidelity to certain values)
• interactive liveness
• virtual liveness

Suggestions for the further identification of liveness types (p161) are made, including livenesses of individuality or virtuosity. Based on this research, I suggest livenesses of illusion (or deception) and danger in mixed music, and a liveness of discovery, or searching to be a feature of some improvisation24.

Narrative liveness

Liveness is therefore a manifold, nebulous, shifting set of qualities that relate fundamentally to human bodies, brains, technologies, and to a dramaturgy of tension between expectation and surprise. “Different valences of liveness exist as fluid perceptions, sometimes giving way to one another, sometimes acting in complex relationships with one another” (Sanden 2013, p160). I propose that these various types of liveness, or livenesses, contribute to an overarching narrative liveness.

The negotiation of an engaged and dynamic trajectory through this “entanglement of things” (Ingold 2010, p3), armed with a set of defined practical and personal priorities and an openness to surprise, sits at the heart of my humanising ethos and embedded working practice. The shifting tension of expectation and surprise producing a sense of abstract narrative, however abstract or unplanned—a more or less taut thread of attention drawn between musician-instrument and audience. Perhaps an early background in the theatre draws me to see this focus on managing a flux of livenesses as attending to a dramatic thread. Jerome Bruner25 has proposed that “storytelling performs the dual cultural functions of making the strange familiar and ourselves private and distinctive.” The performing musician is thus engaged in the spinning of a kind of private tale in their own distinctive voice.

3.5 Visual interfaces: attention and habit

Experienced performers develop embedded, habitual strategies for the management of attention, upon which narrative liveness is dependent. A notable example of this is our use

24 As exemplified in jazz by musicians such as John Coltrane, Miles Davis, or Eric Dolphy.
25 From an interview with John Crace in The Guardian, 27.3.07 [accessed 22.5.17]:
https://www.theguardian.com/education/2007/mar/27/academicexperts.highereducationprofile I am grateful to Professor Colwyn Trevarthen for bringing this article to my attention.
and personalisation of visual materials, which in this research included both paper scores and the software’s user interface (UI). While Emmerson notes that “the need for human-computer interfaces more sensitive to the needs of performers is emerging as the most important new field of research” (2000, p209), the design of user-oriented visual materials for mixed music does not seem to have played a major part in this emerging field, which is surely in part due to the relative rarity of onstage operation by performers. From the composer’s perspective:

significantly lower priority may be given to creating a user-friendly interface […] Even when the piece has been performed multiple times, and the GUI has been revised and streamlined, what is presented on-screen may still be tailored for a technically proficient sound engineer or computer musician. (Furniss & Dudas 2014, p458)

Berweck (2012) has also observed that graphical user interfaces in compositions for mixed music have tended, on the whole, to be designed for use by either the composer or a technical specialist. From the outset of this research, I was presented with several such user interfaces, which until that point were usually operated by the composer. While the visual interface is often, for the composer at least, a self-made, already lived object, observed and operated from a typical distance of a few centimetres, for the onstage performer it represents an additional score, with the laptop to be placed at an angle and distance that does not interfere with the playing of the instrument.

Deadlines are often tight for first performances of works, and where the composer is present for the premiere, preparing the score adequately and managing technical rehearsal and sound check take a great deal of time. Richard Dudas acknowledges that finessing the software may move down among the priorities of the composer or technical operator, especially where other pieces are also programmed with which they may be less familiar. While in the case of Fluence the UI is sufficiently clear and operable, and published score contains exemplary instructions, Alex Harker confirmed that he hadn’t prioritised the design of the visual interface, since he had himself operated the electronics in all of the performances to date before this research (see 6.1, Figs. 6.3-4).

In a parallel approach to the twin-threaded process I adopted here, Winkler (1998) recommends refining interfaces at regular intervals during the composition process, with a view to bringing them towards performance readiness. The answer to his question “how will the interface reflect the activity of the user?” (ibid., p111) rests pertinently on the identity of the user. With the rise of embedded, onstage practices of performance, there is now an urgent need for a more nuanced and flexible approach in interface design towards “expressive, higher-order music notations” (Stowell & McLean 2013), which reflect an

26Private email communication: “this one [Prelude 2] is kind of painful to go through cause I feel I’ve had to revisit it so much to fix things […] [the patch, as I recall, was originally very hastily cobbled together before the concert].” [private email communication 24.2.17; my emphasis]
emphasis on user experience. A genuinely performer-friendly Max patch, for example, should be user-ready, or plug-and-play, with clear, logically ordered instructions, and optional performance settings which are grouped together in one region of the interface.

Annotation

Performing complex musical material, the details of material notation tend to keep my visual attention highly occupied in the notated score. I therefore began to adapt user interfaces where plausible to provide only the specific information needed in performance. In doing so I explicitly treated the interface as a secondary score, ensuring that visual feedback is provided in sufficient clarity to be registered in peripheral vision. There is a dynamic interaction between a performer and score—“not just a storage device for musical content, but a persistent external representation, functionally tied to cognitive processes in music performance” (Kaastra 2011, p677). More experienced performers tend also to annotate increasingly according to complexity (ibid.; cites Winget 2008). Linda Kaastra divides annotations into three classes: firstly, those relating to visual salience, such as enlarging, translating, or circling, and secondly to corrections of errors, or re-notations (for the sake of clarity). A third class of performance anchors includes beat marks, shorthand symbols, and arrows, that “hold and link internal and external performance processes” (ibid., p678).

I certainly make a great deal of pencil markings on the score, and may even cut it up and rearrange, re-size, re-orient or completely re-notate it, for ease of reading or page turns. Similarly, I found myself wanting to annotate the user interfaces I first encountered in Max in terms of both visual salience and “holding and linking,” and this was relatively straightforward to learn and implement in Presentation Mode27 (see also Chapter 5 and 6.1). For example, I need only, register change in a number box in peripheral vision to understand that a cue has been triggered, and tend only occasionally to check the actual cue number. Number boxes were therefore enlarged and coloured to stand out against the background. Similar adjustments were made to toggle and bang objects that responded to pedal movements (Figs. 3.2-3).

27 Available from Max 5 onwards.
Fig. 3.2 Andrew May’s original interface for *Ripped Up Maps* (2011), an interactive work for improviser in Max/MSP. May, as composer-performer, has a history and authorial familiarity with the design of the GUI. Text windows are used during familiarisation with the piece. Information such as number boxes was found to be distracting and the numbered toggle boxes rather small. Functions related to set-up were not included, beyond rehearsal expediency.

Fig. 3.3 The author-adapted interface in Max 6 Presentation Mode. Note the revised spatial layout, the resizing and use of colour in the principal interactive elements is designed to register strongly in peripheral vision. A calmer feel is engendered, with a darkened anti-glare background for use with stage lighting.
Berweck (2012, p107) mentions the usefulness of enlarged visual clues, particularly with regard to “the forgotten pedal,” where an accidental missed cue by the performer may go unnoticed\(^28\), but my experience does not accord with his view that it is “an unmusical task to check if the printed number in the score is the same as the one that is displayed on the computer screen.” (ibid.) This may partly be due to differences between the physical interface of the pianist—the wide keyboard and positioning of its music stand (and here the laptop)—in contrast to the free-standing clarinettist, or is perhaps simply personal taste. On the whole I prioritised a building of trust in each system—its viability in performance—and enlarged visual display cues proved efficient in this capacity (Dudas & Furniss 2014).

**Design and attention**

The appeal of a UI’s visual design has been shown to have an effect on performance (Reppa & McDougall 2015), particularly in tasks that demand high levels of attention or difficulty. Their findings are “potentially relevant to different types of stimuli and user experience, where optimising performance could have considerable costs,” adding that “people can be sensitive to performance costs as small as 150ms (Gray & Boehm-Davis 2000). Such costs can add up during multi-step interactions with interfaces, which can lead to employing strategies to avoid interfaces in favour of those that maximise efficient performance.” Adaptation of Max interfaces exemplified one such strategy, employing a need-to-see policy that took account of visual clarity and appeal. This was both practical, and served to put me at ease within an assemblage of visual, tactile and sonic materials.

With an emphasis on interaction design that privileges engagement rather than function, the readiness-at-hand of everyday computational artefacts “drives a shift from efficient use to meaningful presence of information technology” (Hallnäs & Redström 2002, p107). This relates to the notion of *focal things*, which “are not designed to disappear; rather, they act as engaging centres in human practices” (ibid., p114; citing Borgmann 1992)—inviting not merely passive consumption, but active attention.

Grouping and symmetry in spatial organisation have been shown to have a strong impact on user experience, as does clear contrast between visual elements, including the size and colour of fonts, and their contrast with background colour (Silvennoinen 2014). While many interfaces feature plain white backgrounds, for example, I prefer darker backgrounds to the pronounced glare of white in the context of stage lighting that has an effect on both the player’s vision and stage presence (Fig. 3.4).

Annotation of interfaces thus seems to be a valuable contribution to fluency and comfort within the technical process of learning and performing. Where a performer is able to tweak

\(^{28}\) The phrase originates from a private communication between Berweck and Hans Tutschku: “The forgotten pedal seems to be in the nature of things and always happens from time to time...” (Berweck 2012, 103; my translation)
not only parameters and implement control settings, but to alter the appearance of the interface itself, an optimal relationship with the visual and interactive material is achieved in terms of attention to the ongoing thread. Notably, this is not usually plausible to implement within standalone software, and should be considered as a further implementation in their design. Personalised interfaces may be radically simplified or only subtly re-organised, according to preference.

Finally, there is some evidence that orderliness may to encourage conservative behaviour patterns, with disorder possibly a motivating factor for creative or exploratory enterprises (Abrahamson & Freedman 2007; Silvennoinen 2014). This might explain my preference for clear and orderly interfaces in the composed works, especially the Boulez and Harker, where the technical demands of complex notated material are exacting. So where control is paramount, stress levels may be facilitated and concentration freed up by a tidiness in the source area of the anxiety (the computer). By contrast, Rodrigo Costanzo’s C-C-Combine (see 7.1, Fig.7.2) is already very neat and clear, and there is no requirement to coordinate precise triggering. Similarly, there were no problems with the gruntCount interface (6.2, Fig 6.6)—everything I needed to see was there, allowing focus to be directed towards material creativity and an agile engagement with the response.

Working in this way on visual interfaces was part of a leaning on embedded behaviour in the preparation of performances. Attending to thought process, attention and my visual map of the piece fluently, without undue distraction, left me free to engage with sound as the primary instrumental interface—to develop a fluency and concentrate on musical interaction, and on shaping a narrative.

3.6 Summary

In this section I identified creating an engaging and animated thread of attention in both preparation and performance as a central priority. Attending to liveness was seen to be both pragmatic and personal, multifaceted, and to have both inner and outward aspects. A variety of scalable livenesses are thereby constantly in flux with one another during performance. Spatial, temporal, corporeal, trace corporeal, interactive, and virtual livenesses are at play in mixed music, as well as livenesses relating to virtuosity, discovery, danger, and to notions of authenticity. While there has been much discussion of liveness, it has generally been oriented towards performance itself, or “theatre, drama, ritual and spectacle” (Aguilar 2014, p253), which I characterise from the performer’s perspective as outward liveness, which is anticipated in rehearsal, coming fully into play with the listening attention of others.

The more personal inner liveness, and its outward trajectory, contribute to performance viability—a building of trust in the technical assemblage, and its capacity to engage—and to an over-arching dramaturgy of communal experience, or narrative liveness. I proposed that inner liveness was aided by a musical expediency that privileged doing over designing, and
inner liveness was aided by a musical expediency that privileged doing over designing, and initiated the trajectory towards of outward, socially situated liveness in the concert space (the performative layer). This was motivating in terms of working process and overcoming technical difficulties encountered in the early stages. As a practical example, attention and flow were seen to be affected by visual software interfaces, some of which were adapted to provide clear, salient, performance-related information, without undue distractions. Annotation to the visual interface was seen as stemming from a normalised behaviour of score adaptation that anticipates a managing of attention in performance.

Musical expediency and the development of electro-instrumental sound concepts have so far been shown to be motivating, with performances serving as anchors in the quest to develop a fluency of embedded practice. This motivation was key in contributing to further learning and engagement with the additional technology, particularly where difficulties were encountered. Bringing these elements of the humanising framework to bear in performance called for more pragmatism and personal choice in terms of how—and how much—the instrumental assemblage was to be controlled. In the following chapter, this negotiating of control is examined in terms of practicalities, equipment, personal preference, and emergent discoveries.
4 Negotiating control

While a satisfying interactive performance naturally includes a certain amount of give and take and changing relationships with the electronic sound, the musician has to feel in charge of their performance. This can be achieved regardless of whether the musician is in an accompanying or soloistic role, and is not different from any chamber music interaction.

Xenia Pestova (2008, p68)

Pestova’s emphasis on the solo performer’s need to feel in control—as executive director, or leader of a virtual or hybrid human-machine ensemble—represents a central negotiation of augmented instrumental practice. As is the case in acoustic ensembles, this authority is most effectively exercised with due consideration to the presence of other human and non-human factors in the performance environment, and is scalable according to ensemble and role, both between and within performances.

We saw in Chapters 3 how a symbiotic relationship between liveness and interaction emerges from the complexity and fluidity of skilled performance. I interact with the clarinet in physical terms by means of developing an aural–haptic feedback loop, and a growing sense of both trust and ongoing discovery in its affordances (Hayes 2013; cites Leman 2008; Rebelo 2006; Schroeder & Rebelo 2009). The previous chapters showed how a humanising framework for augmented performance attended to the managing of valences and contingencies in regard to sound and liveness, and my aim in moving towards onstage
control was to integrate this approach with the operation of a variety of technical parameters, with the possibility in the long term of establishing a hybrid instrumental entity or gestalt (Rebelo 2006; Croft 2007; Furniss & Parker 2014, p193-4). In the short term, I found again that the more quickly a sense of gratifying interaction could be reached, the more motivated I became to explore it further—solving or easing technical problems, testing thresholds, and adjusting my approach, in order to serve the development of a diversity of electro-instrumental sound concept, and ultimately chasing the anticipated liveness of the public performance.

Ecological considerations of the various influences of technology, the body, the space, and other people, acknowledge that each performance is situated within a culture of embedded influences, expectations, behaviours, and institutions, and that these happen in relation to time in a way that is distributed both locally and historically (Impett 2001; Bowers 2002; di Scipio 2003, 2015; Waters 2007; Magnusson 2009; Davis 2011; Green 2011, 2013). With a background in classical performance, however, the issue of control was very much at the forefront of the humanising agenda during the early stages of research. This entailed gaining an understanding how my actions influenced each assemblage of clarinet and additional technology, and what elements lay outside my influence.

On or off, more or less

Factors requiring control, with or without the clarinet, could be summarised as either on/off or gradation functions. On/off functions cover initiation of the piece, the activation or deactivation of sound files and/or signal processing (in isolation or preset determinations), and perhaps termination of the piece. These controls are required to either switch between states or hold them, either by a single or continuous action, and in the computer-based augmented environment of this research are usually digitally operated via MIDI or OSC messages. Gradation functions control the degree of processing, scaled from maximum to zero, or within desired parameters, and would usefully including a mechanism for controlling the overall output volume, which may be handled digitally or by analogue means.

Control parameters therefore dominated much of this period of work, particularly at the outset, which once more focused on pragmatic solutions to mounting viable public performances under onstage operation. Experience as a performer of contemporary and improvised musics was instructional in this respect, in that I had already come to a performing relationship with the instrument in which indeterminacy, liminality, the agency of the instrument, and in situ discovery were already embraced as creatively enabling.

Embarking on this trajectory with only a nascent technical knowledge and competence in regard to the significant (and in this case, defining) new portion of the assemblage, at first presented the question of the interface at which my control was to be negotiated, falling into
two categories. Firstly, interfacing at a level of sound would privilege my already existing musical skill and agility, leaving the relatively straightforward task of learning to set up and initiate the electronic assembly as my primary extra-musical concern. Secondly, bodily gesture would provide simple, mappable solutions. Due to inherent constraints of playing the clarinet, and particularly the larger and more physically imposing bass clarinet, this would on the whole be, where plausible, and for now at least, via the feet. Getting quickly and regularly to a requisite level of musical interaction has already been seen as a driving priority. In control terms, this was at the expense of trying out many of the innovative sensors and controllers that continue to emerge in interactive music (Miranda & Wanderley 2006; Tanaka 2000). While the use of sophisticated sensor technology is undoubtedly musically engaging, I considered getting to a basic level of independence in terms of onstage practice to be the best use of my time, and (regrettably) to restrict my technological arsenal to simple, and widely available, pedal and manual controllers.

4.1 Sound as the interface

Employing sound as the primary interface in a system between performer and computer has a number of advantages that can be broken down into several factors. Firstly, it removes the requirement on the performer's part to develop parallel physical skills in terms of manual and (predominantly still in the field) pedal movement, and obviates any disturbance of habitual and embodied balance in the performer's physical relationship with the instrument (Kimura 2003, p289), which may also cause strain (Nicolls 2010, p24). Secondly, it privileges the already expert interface, and thereby encourages an integrated, instrumental approach to the overall apparatus. Finally, in practical terms, it simplifies the physical set-up in terms of hardware, allowing for the kind of expediency espoused throughout this thesis as motivating and productive in terms of embedded practice and engaged performance. Kimura (ibid.) and others (Emmerson 1994a; Croft 2007) have also expressed a dislike for the obviousness of the visual connection between pedal action and resultant—in other words, a reliance on sound encourages an aural rather than tactile or visual perception of corporeal liveness, drawing performer and audience towards the musical drama at the expense of spectacle. There is a balance to be worked out here, according to pragmatism and taste.

From a performer's perspective, the cumulative sound from both instrument and loudspeakers as it is dispersed in the space is already very much the interface in a human-instrument-computer assemblage (di Scipio 2003, p270), reflecting a recursiveness in the ongoing feedback loop:

the agent determines the computer's changes of internal state, and the latter, as heard by the agent, may affect his or her next action (which in turn may affect the computer internal state in some way, etc.)
This deliberately simplistic and linear reading serves as a starting point for understanding my relationship to the overall sound, as discussed in Chapter 2. Firstly, from the enactive point of view, sound is inextricably linked to physicality and the environment, in terms of the performer’s “perceptually guided action” (Hayes 2015; cites Varela et al. 1991):

An enactive understanding focuses on the idea of structural coupling between agent and environment through repeated sensorimotor interactions. Both the perceptive capacities of various organisms as well as the environment itself emerge through reciprocal coordination and coevolution.

I perceive sound from the instrument through the body, partly as physically transduced energy passing through tooth and bone, and through the sensations of the mouth and head—in a sense I listen partly through the interaction of tongue, reed, oral cavity, sinuses, throat and chest. Secondly, both the clarinet and the loudspeakers disperse complex and diverse sound wave reflections within the space. The latter may be bypassed through headphones, as at Stage 1, although in performance I tend to prefer external monitoring, or a half-on headphone approach, to monitor the balance of sources.

![Fig 4.1](image)  
**Fig 4.1** A linear reading of the implicit aural feedback loop in interactive system design by Agostino Di Scipio (2003, p270). The situation is clouded by the dispersion of different sound sources through both body and space.

Interfacing with sound in compositional terms relies on recognition of, and responses to, the amplitude, timbre, and pitch of the instrumental source, and on score following techniques where there is to be any predetermined structure. This recognition and the subsequent responses may be either predetermined or configurable.

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29 di Scipio goes on to mainly discuss the interface of sound in systems without acoustic instruments.

30 Illustrated most clearly when performing with insufficient monitoring in highly amplified environments. I rely on the knowledge of how given sounds feel in terms of this body-reed-mouthpiece interface.
Rodrigo Costanzo’s C-C-Combine (in Max), for example, eschews structural constraints, focusing on the improvisatory exploration of a single nexus of responsiveness and connection between two sets of sounds: an interchangeable, preset sample bank, and the input of the performer (see 7.1). My early instinct here was to control the output via expression pedal, and to hold onto familiar interaction settings by installing a preset management system to engender a highly controlled stage environment in performance. I found it useful as a compositional device, and as a way into flow (Csikszentmihaly 1990) that adhered to the familiar, while exploring the new. But by fading out or cutting the output created pockets of contrast, and configuring very determined parameters within the settings, I imposed a received emphasis on control that rather went against the mercurial spirit of the system.

Moving into a second phase of work, it became more interesting to play with indeterminacy. Ongoing discovery and in situ parameter adjustment became essential to the preparation of the piece, right up to the last minute before a performance, making each performance unique. I began to rely less on the output veto pedal and find a delicate balance of determinacy by negotiating with sounds—looking for consistent reactions, and responding to surprise in a way that formed an animated threads of tension between expectation and surprise (CD2:5-7).

In Dudas’ pieces (see 5.2), and in gruntCount (6.2), over time I similarly either lost the volume pedal altogether, or drastically cut down my use of it, preferring to elicit responses by timbral variance, dynamics, and timing. Teasing out the timing of a pitch-tracked response by repeated testing and adjusting of dynamic in Prelude 1, for example, is a far more instrumental—I would argue humanised—process than finding the right moment to press a pedal. It privileges an already mature and embodied multimodal level of thought and skill, and serves to promote a unified, non-linear, egalitarian approach to the augmentation of the instrument. Similarly, the emphasis on physical effort at the heart of gruntCount is part of a design that explicitly espouses sound as the interface. Responses are triggered by a configurable amplitude threshold with regard to the incoming signal, which provides a single point of physical interfacing—essentially, I was asking “will I play or not?” or “can I play without it noticing?” This simple, ludic device afforded multiple possibilities for musical engagement within the structure of each piece, and perhaps the ultimate test of the environment’s musical viability lay in simply leaving space for computer solos—letting a nested dynamism in the system interface with my sound from the other bank (see 6.2 for a more detailed discussion).
4.2 Feet and hands

Foot pedals have been widely used by performers in mixed music for triggering events or processing elements. The extra pedal movements require significant time in private rehearsal to develop familiarity and become accustomed to the requisite adjusting of body weight distribution and coordination. Distribution of weight may disturb (Kimura 2003), and when a lot of pedalling is required, it may feel like playing two instruments at once (Pestova 2008, p62; Nicolls 2010, p23). Learning pieces, either fresh or anew, as was the case here with the Harker and Boulez, developing embodied muscle memory requires time in rehearsal to include the extra pedal movements. Different foot pedal types may present a diversity of further issues, such as height and size, floor stability, ease of view from a standing position, connectivity, configurability, reliability, and financial cost. There is also the question of how many parameters one can cognitively handle at once while playing a complex instrument and negotiating the musical interactions of a performance.

All pedals require a certain level of patience and understanding when working in Max, as there is no standard for connecting foot pedal types. This forms a part of the augmented musicians essential technique (Berweck 2012): tracing or setting MIDI messages, for example, and ‘debouncing’ with the `thresh`, `onebang` or `change` objects in Max. Small adaptations were implemented in the Dudas, Harker, Boulez and Costanzo patches. In contrast, Ableton Live’s straightforwardness in this regard stands out as exemplary.

A recurrent issue in both mixed music and DMI use generally is the lack of satisfactory sensory information returned to the performer from pedals and other controllers, in comparison to ongoing tactile feedback that underpins instrumental performance, whether by implementing tactile feedback (Hayes 2013; Michaelidis & Berweck 2011), or eliminating the use of pedals altogether (Kimura 2003). I worked with several pedal types and combinations over the course of this research, and aimed to implement a sufficiency of visual feedback via the available hardware and software interfaces. The IK iRig Blueboard, for example, features visual feedback via a backlight for each of its four buttons, which is reassuring during both setup and performance (although the foot needs to pull backwards to check the light). On depressing the button there is also a slight click—felt, but importantly, not heard—which again engenders trust. Placing strips of white tape to foot pedals and controllers improves visual location in direct or peripheral vision, which becomes rather important in venues with the stage lighting that may be rather dark.

31 Avoiding unwanted multiple instances of MIDI (or similar) messages.
33 For this reason it is useful to enquire about any lighting for the performance beforehand, and preferably to experience the lighting state during sound check.
Expression pedals were used to provide overall volume output control, initially as a pragmatic rehearsal tool and additional nuancing device for the Dudas pieces (levels are usually tweaked slightly from the desk in duo performances). This ability to ‘kill’ the output proved to have powerful consequences for interagency, as I shall discuss later in relation to grunt\textit{Count} and the C-C-Combine pieces. Piano-type sustain pedals have limited resolution and control for managing levels and therefore proved impractical.

I settled eventually on a setup comprising the Blueboard and two expression pedals that has proved robust, reliable, and easily portable, with an alternative USB controller packed as a relatively easy to configure backup. Bespoke solutions such as an Arduino-based unit with global control patch in Max\textsuperscript{34}, or further familiarisation with the SoftStep could improve connectivity and efficiency in changing from piece to piece, presenting opportunities for further research.

Re: the manual

While a clarinettist’s hands are usually, though not always, both in use, strategies for freeing the hands can become part of technique (simply turning a page with one hand, for example). Such an approach emerged while developing my first improvisation system in Ableton Live, with implementation of both pedal and manual control for an improvised theatre piece (Perfs. 20-21). Since I would be off-stage, providing only occasional support to the actors, significantly more control than I had been exercising for free improvisations was required, and a manual MIDI controller was used to provide quick on/off capability. This subsequently became part of the system, and was increasingly loaded with new effects parameters (see 7.2). Time away from the instrument was afforded by a combination of delay and looper devices, long convolution reverb tails and suspended granular synthesis, during which I was free to manipulate the controls. This proved useful in terms of stamina, and offered a means to manually structure spectromorphological interludes with the ongoing electronics.

It was certainly motivating to have these multiple options. Enthusiastic overloading of the controller, however, ultimately left me too little cognitive space to focus on a musical thread, especially when stressed or rushed for time, and it became increasingly clear that a focus on simple, or more internally nuanced, gestural mappings would be beneficial.

\footnote{Anne La Berge and I used her Arduino-based system during research on the ensemble version of \textit{gruntCount} in May 2016 (Perf. 27).}
4.3 Towards instrumentality

Todd Machover emphasises his design of hyper-instruments as “[extending] the soloist – not as a dichotomy, but as a new kind of instrument” (2005; quoted in Pestova 2008, p9). However, Pedro Rebelo (2006, p28) has framed the performer-instrument relationship as “a multimodal participatory space (and not one of control),” and argues, with Franziska Schroeder, against the objectification of instruments as extensions of the body, where the relationship with the performer is seen as “a transfer from the body to the world”, preferring a back-and-forth interdependence that is revealed over time by an exploration of physicality and resistances (Schroeder & Rebelo 2007, p88):

... the performer only becomes acquainted with the ‘thing’ at hand by being able to test boundaries, negotiate subtleties and uncover threshold conditions.

In terms of augmenting the clarinet, beyond the initial stages it was not the acoustic/electroacoustic opposition as such that concerned me, but whether my relationship with the assemblage of technologies as an instrument would be inherently integral or dialectic. Was I playing two instruments at once, or one new hybrid? Somewhat inevitably, the answer seems to shift along a continuum.

I have spoken elsewhere about instrumentality in the context of gruntCount (Furniss & Parker 2014, p188). A similarly embedded approach was taken to preparing Dudas’ Preludes, involving private rehearsal with the computer as intently and intensely as that undertaken in ensemble rehearsal (Furniss & Dudas 2014, p458). After two years of performing the pieces under embedded operation, both reached a stage where I felt at once at the interface of an instrument, and in the midst of a virtual and self-emanating ensemble. Negotiating, developing a feel for the virtual chorus’ reactions to my dynamic shading, timings (including any latency) and overall pacing, the works became not merely interactive, but instrumental; the acoustic instrument and digital processing forming a gestalt in which each element is augmented.

By contrast, Boulez’s work is inherently dialectical, and, for the time being at least, Harker’s Fluence remains at a stage of interactive negotiation (particularly with such an active role for the right foot). Interaction itself is not an obstacle to instrumentality—I wrestle with the clarinet on a regular basis, not least in the more strenuous Strophes of the Boulez, and the physicality of my improvisations with gruntCount—screeching, grasping at indeterminate high notes, looking for a pitch to grab onto, seeking a balance of tones in soft multiphonics.

Riva & Mantovani (2012) suggest that in first-order mediated action (acquiring fluency in the use of a tool) our perception of our bodily selves moves outward (p206). Our sense of

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*Rivach & Man	otavani (2012)*


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35 reminiscent of Ingold (2010, p3)
space and what we can do in it operates by integrating two “reference frames”: the *peripersonal* (immediately reachable with the body) and the *extrapersonal* (how we remember and learn to relate to the space beyond our reach, and to objects in it) that “our peripersonal space is extended by the proximal tool: we are present in it” (p207, my emphasis). This implied presence is exemplified by my feeling of concurrence with the clarinet, of thinking with the tongue, lips, and breath, of fingers-on-holes as mellifluous sound makers, or of the little-finger/key-surface assemblage as a resonator of throat notes. This deepening “relationship of reciprocal affordances” (Nijs et al. 2009, p124) developed over a forty year co-trajectory with the clarinet that is ongoing.

More pertinently to my focus in this research, second-order mediated action (the skilled operation of a secondary, *distal* tool) “shifts the extrapersonal space to the one surrounding the distal tool: we are present in the distal tool and in the space surrounding it” (Riva & Mantovani 2012, p208). The shift to second-order mediation (or *telepresence*) is described as “moving from a paradigm of oppositional forces to one of integration.”

Jean Penny describes a similar journey towards an embedded practice (Fig. 4.2) that at times achieves an instrumental quality, while at others remaining dialectical (2009, p29-130):

> The basis of flute playing is already accomplished and incorporated as part of my identity. Acquaintance with the new interior and exterior physical gestures began with a struggle of assimilation and familiarity. Immersion led to the gradual materialization of ease and enfold, as the flute took on these extensions and they became part of my performing self. Although this amalgamation was revealed as imperfect, with the extensions essentially remaining part of the digital other, this seeming aloofness was frequently minimized and an impression of oneness was discerned.

![Fig. 4.2](http://example.com)  
**Fig. 4.2** Flautist Jean Penny’s diagram showing augmentation as potentially “a process towards an engagement commensurate with the performer-instrument relationship” (2009, p130)

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36 A more analytical description would frame this as physical properties of the bore becoming altered by the concomitant pad covering a tone hole beyond my reach.
In terms of presence in the instrument, there was certainly a growing feeling of this instrumentality in Ajkad Csúpa Vér and the Dudas pieces, and in particular with gruntCount. But perhaps it is simplistic to even theoretically propose the same kind of embodiment for the clarinet and the disparately assembled electronic technology. Riva and Mantovani distinguish between the incorporation of first-order mediation, and the incarnation of a space around the distal tool (in this case the microphone-controller-laptop-loudspeaker assemblage). The issue is further clouded by the space, which is already in a manner of speaking the distal tool of the performer.

4.4 Ecologies and interagency

A broad threading and knotting of influences forms an ecology inherent to all performance in which the developing of a dynamic augmented practice of the clarinet reveals layers of agency and embedded stories within its multitudinous elements. Lucy Suchman (2006, p284) notes that these hybrid encounters “invariably take place in settings incorporating multiple other persons, artifacts, and ongoing activities, all of which variously infuse and inform their course.”

Consider this illustrative list of potential influences on one of my performances:

- the clarinet, its make, model, my history of lived practice with it
- multiple reeds—their preparation, variation and reaction to atmospheric conditions
- the mechanical condition of the instrument
- the state of my instrumental technique, level of bodily fitness, tiredness, preparedness
- temperature, humidity, light, time of day
- the laptop, power supply, operating system, software
- microphones, audio interface, cables, connections
- pedal controllers, connections, mixing desk or volume controller
- the positioning of instrument, microphone and music stands
- scores, visual interfaces, and visibility
- the number of pieces to be played, my familiarity, experience
- distraction, errors, anxieties
- the venue, performance space, facilities
- the sound engineer, PA, monitoring, technical set-up of the space
- set up time and sound check, stage sharing
- collaborators, audience, staff, local community
- event type, audience expectation

37 Or the “quality of listening” (Frith 1998) of the occasion.
Unpacking every layer of a given ecology is impractical, and beyond the scope of this study. Making a cut in this sequence of embedded relational networks is both necessary and arbitrary, with spillages and overlaps that in dealing with the messiness of music performance practice, are inevitable (ibid., p284; quoted in Green 2013, p68):

How far our analysis extends in its historical specificity and reach, or in following out lines of connection from a particular object or site to others, is invariably a practical matter. That is, it is a matter of cutting the network, of drawing a line that is in every case enacted rather than given. The relatively arbitrary or principled character of the cut is a matter not of its alignment with some independently existing ontology but of our ability to articulate its basis and its implications.

The frame of central importance in this study connected to paradigms of ensemble direction as leader or soloist, and instrumentality rather than any antiphonal stance towards the electronic technology—in short, my aim was to feel in control of the elements of movement, sound and interaction within each piece, and attend to the practicalities and liveness of the concerts.

A focus on curating sound and narrative within an evolving flux of liveness, and on accepting the shifting, relational nature of things (Impett 2001, p108; Ingold 2011, p69; Green, 2013, p157), provides an approach to augmented practice that can be generalised to music performance as a whole. Moving to an overview that resists the binary oppositions of performer/composer, human/instrument, performer/listener, human and non-human, acoustic/electroacoustic music technology, in favour of a fluid, scalable approach, reflects a contemporary interdisciplinary turn in arts practice and research (Magnusson 2009; Born 2010; Green 2013; Bell 2016) that draws on technological, interpersonal, cultural and historical ecologies (Gibson 1979; Deleuze & Guattari 1988; Small 1998; Impett 2000, 2001; Bowers 2002; Waters 2007; Swift 2012; di Scipio 2015). These lateral spectra are counterpointed with the inherently temporal nature of music and musicking—by present narrative threads within each piece in performance, and temporally distributed in the duration, timing and structuring of different pieces within the event, and by the three-stage trajectory of preparation. Over a longer timespan, these threads will permeate outward into repeat performances, curated series, career and historicity.

Reframings

Developing an approach to the composite acoustic-electroacoustic environment has afforded a wider understanding of the acoustic arena (Smalley 1996), and provided a broader framework for understanding the clarinet, and musical instruments in general. Performer-composer Simon Waters (2007, p5) has observed that:

faced with the conundrum of adding the virtuality of the digital domain to the physical reality of the performer/instrument/environment triumvirate, we become peculiarly aware that there are virtualities to take account of even within more historically-situated versions of these concepts.
The research framework of attending to sound, liveness and interagency led me towards a holistic and generalised reframing of instruments as filters and resonators of physical energy, identity, and culture.

This generalised view is useful as a guiding approach to curating a performance practice that affords sufficient presence to each element. Rather than implying disturbances to the habitual apparatus and behaviour of the clarinet, it raises questions as to how the additional technical elements are to contribute to an overall purpose, in which the role of the solo performer becomes the temporal orchestration of these presences in a communal thread of liveness. A notion of optimal performing presence as a guiding principal of practice emerged as a result of the work presented here, and will be elaborated further in the final chapter. The approach is scalable to the collaborative musicking of ensembles.

Cumulating acoustic, electronic and digital materials also encouraged an addressing of identities of self and other, and redefined partnerships of human and non-human. The machine ‘behaves’ in unfamiliar ways that have the potential to both liberate and oppress us. On the one hand it can set ‘inhuman’ constraints, such as rigid interaction, and the missing empathy that exists between human co-performers, or a liability to break down completely, without the human performer’s propensity for coping strategies. On the other, computers are enabling new types of interaction and broadening modes of expression—the compositions on CD2 (see Chapter 7) stand as testament to this stimulation of creativity. Issues of voice and identity warrant further performer-led and collaborative research (Riikonen 2004; Penny 2011) to clarify the management of voice, role, personae and interconnectedness amid the influence of humans and things that make up the performing environment (Cumming 2000, p60):

Musical selfhood [...] is not, then, surrounded by irremediable boundaries, isolating the individual “self” as the origin of insight, but is formed of shared activities, which ensure modes of connection with others.

Finally, the humanising framework extends this empowering and alleviating to other humans too, with the aim of a clarity and integrity that impacts composers, performers, technical collaborators, audiences and promoters alike. Developing a diverse and augmented practice of the clarinet entailed a reframing of every aspect of its constituent parts as socially situated, ecologically and historically distributed, and replete with received assumptions about technology, repertoire, collaborators, acts of performance and preparation, venues, creative industry, and the wider culture.

4.5 Summary

Feeling in control and actually controlling the requisite elements of the additional technology were found to be related but different phenomena. The former came from time and experience—developing simplicity and efficiency through familiarity with the set-up,
and working through the stages of skill acquisition from novice to a requisite level of proficiency. Particularly important here was the disjunct in my procedural thought between the immediacy of a holistic intuition with regard to the clarinet, and an initially slow and decomposed negotiation of the onstage electronics. Control of the latter was seen to be enacted either by the sound of the acoustic instrument, or by bodily gesture, which was restricted to pedal and manual function.

Control parameters beyond those of the clarinet can be summarised as:

- **on/off functions**
  - initiation of the piece
  - activating and deactivating sound files and processing (in isolation or preset determinations)
  - termination of the piece

- **gradation**
  - the degree of processing, scaled from maximum to zero, or within desired parameters, including a mechanism for overall output volume

Due the timescale of the study, and the necessity to engage in public performances and recordings, *performance viability* was again prioritised as a measure of the control required. This viability depended (as in the previous chapter) on growing a sense of trust, here in the coordination of given physical interactions to satisfy a practical negotiation of the piece, sound concept issues, and ultimately to engender sufficient liveness in the performance. Over time, performance viability in terms of sound, liveness and control contributed in some cases to a growing sense of a holistic instrumental entity (Rebelo 2006). With this *instrumentality*, the performer may cognitively extend into both the acoustic instrument and the secondary apparatus. This widening of cognitive presence in the assemblage is nascent, due to the relatively short timescale of the study, but highly motivating, and will be discussed further in Chapter 8.

The process of integrating new technology and skills reinvigorated and re-evaluated my relationship to the acoustic instruments. Drawing on the previous two chapters, I came to a reframed understanding of musical instruments as filters and resonators of physical energy (sound and effort), identity (sound concept, human agencies, virtual personae), and culture (ecologies of influence). My desire to feel more at ease and in control onstage, as part of a humanising agenda, led me from a familiar, culturally embedded paradigm of mastery over technology, to a more relational and interagentic view of performance practice, in which making gratifying music with technology entails sometimes allowing machines to be machines, with their own creative and epistemic dimensions. Over time spent working with the various interactive systems, in different performing contexts, my role as performer emerged as one of curation, or leadership, rather than control—a sense of becoming empowered within a community of forces, rather than exercising dominion.
In Part 2, the Practical Elements are presented as case studies, revealing ways in which the research framework played out within differently emphasised performance ecologies. They are organised according to the three creative roles of *executant interpreter*, *enabled interpreter*, and *enactive composer*, which at times blur into one another—performance is inherently messy and subject to contingency, error and coping strategies. Each role, however, entailed a different approach to the distribution of practical and creative influence between onstage performer, co-performers, composer, technology (including the space), audience, and venue type.
Part 2

Case studies
5 Role A: executant interpreter

5.1 Case Study 1

Pierre Boulez

*Dialogue de l’ombre double* for solo clarinet and tape (1985)

*Dialogue de l’ombre double* was dedicated to Luciano Berio on the occasion of his 60th birthday, and premiered in Florence by clarinettist Alain Damiens, with members of IRCAM’s staff diffusing the electronics under the supervision of Andrew Gerzso and Boulez himself. It has now achieved the status of a classic work of mixed music and has been transcribed for bass clarinet, bassoon, saxophone, alto flute and recorder. Musically distinct live sections (*Strophes*) alternate during the course of the piece with pre-recorded material (*Transitions*). As in *Domaines* (1969), there are two alternate orderings of the sections: one with sections numbered in Arabic numerals, the other using Roman numerals. The latter has become the default version and is used and referred to throughout here.

The recorded material (*clarinette double*) frames the piece (*Sigle initial, Sigle final*) and is processed and spatialised via six or more loudspeakers surrounding the audience. At the
close of the *Sigle final*, the live clarinettist re-emerges to extend a single sustained pitch for approximately ninety seconds while the frenetic recording fades to silence. A further loudspeaker, placed at one of the extremities of the space, carries the fading tape part. The dialogic effect is enhanced by lighting, which places an emphasis on the contrast between a spotlighted performing soloist and the blacked out stage for pre-recorded sections, enhancing the listener’s focus on the dialogue, the “succession of one part in relation to the next […] which amounts to a sort of textual development” (Toro Pérez et al. 2016). While optional, the simple, stark changes of lighting—from spotlighted performer in the Strophes to an otherwise dark steady state—serve to heighten the spatial and corporeal liveness of the unfolding dialogue.

The publisher’s website insists that: “prior to the performance, the clarinettist will have to record the part written for tape”, insisting that “to use a tape recorded by another soloist is inadmissible.” [my emphasis] This firm line is softened in the printed score, where it is suggested that “as a last resort”, a recording licensed by the publisher may be used. In practice, the recording is labour-intensive and potentially expensive. I was fortunate to receive funding to record the materials at the Forum Neuesmusiktheater in Stuttgart, where
I first performed the piece in 2006. While I was motivated to record the part, the financial cost alone may otherwise have inhibited a project which entails a major commitment of time and resources.

The work is listed (rather incompletely) by Universal Edition as being “for clarinet and tape”. While the anachronistic usage of “tape” (Fr. bande) has in the last few decades become a widely adopted shorthand for fixed sound media, the description makes no reference to the live resonance in Strophes II, III and V, where the soloist’s sound is to be diffused to a speaker underneath an offstage piano, whose sustain pedal is continually depressed. The resultant resonances are relayed to the hall and diffused either via two speakers above the soloist, or mixed into the frontmost speakers of the main ring. An alternative digital implementation of this process was later developed (with Boulez’s approval) and is integrated into the software used for this study.

One of my aims throughout this research has been to probe the limits of onstage control for the executant performer. The use of several score-acquainted manual operators for spatialisation of the sound files and cueing of the lighting technician has been largely automated in various software migrations. Performances today typically involve one or perhaps two technical co-performers. My specific aims here were to test the plausibility of embedded operation at a performance in Edinburgh, and to make a high quality recording of the piece in a surround format that would reflect the piece’s liveness of proximity, space and movement. Taking responsibility for both solo clarinet part and its electroacoustic double would, I hoped, reclaim the piece from its institutional origins and place it within the realm of viable solo repertoire. The journey from a work that in the 1980s could only be performed with a large team of specialist IRCAM-based technicians, attending to a vast array of computer and sound equipment, to one that might require little more than a laptop and loudspeakers under the control of the performer, would represent a dramatic emancipation of the work.

Preparations

I had last performed the piece in 2008, and therefore a period of seven weeks was set aside to relearn the notes, build up the requisite stamina, acquaint myself with the technical materials, and make any updates and adjustments. The first consideration was which platform to employ for the electronics. For my performances before this research, an implementation in Max was used, obtained privately from IRCAM and updated by Magali Deschamps, Richard Dudas and Gilbert Nouno (Akkermann 2016, p58). The alternatives

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38 The original software was created at IRCAM by Andrew Gerzso for Max/FTS 0.25 running on the ISPW on a NeXT computer (date unknown). In 1998 this was ported, under the supervision of IRCAM’s Franck Rossi, to Max 3.5 (Opcode Inc.) and the first version of MSP, which at the time was sold separately by Cycling ‘74. My copy is marked “Version MSP October 1998” (Fig 5.1).
were to create a set of pre-configured multichannel sound files to trigger, with the piano resonance facilitated traditionally in the venue, or to use another platform—realisations seemed to exist in either Integra Live\(^\text{39}\) (Rudi & Bullock 2011) and Pure Data (Pd)\(^\text{40}\). Since I had already gained some familiarity with Max, and knew that the system worked, it was a clear choice (Fig 5.1).

![Max patch figure](image)

**Fig. 5.1** The Max patch used for both performance and recording, with enlarged section identifier box (upper right), resonance cue system implementation, and historical adjustment of output levels in dB over several performances.

**Onstage operation**

Taking onstage control means assuming some or all responsibility for a unifying of the sound concept for the whole, matching the level of the live clarinet, piano reverb and recordings, and ensuring each has the appropriate presence. The score suggests some amplification of the clarinet in either the main front pair, or in a separate pair of monitors onstage. In a wide hall this reinforcement is ideally supported by small channel delays in

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\(^{39}\) The Integra Live implemention turned out to be incomplete.

order to maintain a perceived predominance of the clarinettist as sound source in the
*Strophes*, and may thereby be extended to the whole array. A balance levels is largely
achieved by the sound engineer on the day of performance, but here (as elsewhere in the
research) I adopted a principle of being well prepared for the typically short technical and
dress rehearsals on the day. Output levels from the patch in past performances would
typically have been adjusted by technicians who knew the piece well and had a score to
hand. This is not mentioned in the materials, illustrating part of a significant oral tradition
(Dudas 2015, p35) in mixed music which also revealed itself in the layout and operation of
the software throughout the rehearsal and recording process. In rehearsal levels in each of
the recordings were tested in a stereo mix, and reset in an ongoing process of bringing
cohesion to the whole. Five of the seven original sound files were adjusted for levels in
Reaper, with the previously manual operation of the volume envelope in *Transition II–III*
replaced by automation. This eliminated any need for an expression pedal, which would
require too much attention and be difficult to monitor from an onstage position.

An additional mechanism to trigger the built-in piano resonance was implemented by
Martin Parker, displaying current state and cue number (Fig. 5.2). In *Strophes III* and *V*,
where the timing of each rise and fall in resonance is indicated in the score, the gradations
were automated with an envelope to occur within an estimated timeframe. Live operation
by expression pedal control was deemed to be too challenging *in situ*, particularly in the case
of *Strophe V*, where precise timings were adjusted several times as the performance
approached, to fit my gradual increase in tempo.

![Fig. 5.2](image)

*Fig. 5.2* The cue system implemented by Martin Parker (2017) for triggering piano
resonance from stage, shown here in Max 7 Presentation Mode. The large cue
number (centre), flashing bang object (circle, left) and blue resonance output fader
(top right) are easily visible in peripheral vision.

The digital resonance is highly practical and of a very high quality, but was not used for the recording, given
the availability of a Steinway D piano, and the elimination of feedback concerns in post-production.
Overall, an embedded operation facilitated integration between the voices of the dialogue, foregrounding the central drama of spatial, timbral and kinetic elements that represent the most significant affordances of a spatialised mixed work with fixed media. A level of interaction with the tape is gained in the process in a work whose sections only very briefly overlap, and in which there is otherwise little interaction in terms of performer experience. In attending to the resonance triggering and level management, the piece moves from being a large effort of collaboration towards that of a solo repertoire piece for augmented clarinet, in which the soloist is personally invested as an active curator in the overall sound of the piece in the hall. This also facilitates a mutuality of respect in the working relationship with technical co-performers.

**Legacy software**

Interfacing with the software presented few difficulties regarding the updating of the software. The operation of the Max patch, however, was not entirely straightforward. Instructions for setup are in French, with comments throughout the patch in both English and French. There were inconsistencies in the layout of the nine channels, which presumably had been changed for a previous performance, and no information at all regarding the operation of the rotation control in Transition IV–V or the piano resonance.

This is an example of a software interface that was designed to be used sitting in front of the computer screen by an expert and informed co-performer (see 3.5), whereas Parker’s addition envisaged an embedded user. I was fortunate in being able to draw on the experience of previous users with regard to the intricacies of the patch, drawing again on an oral tradition that has been passed down over two decades, without which I would have found it extremely difficult to proceed. However, while the UI itself is rather cluttered and took time to get used to, *in situ* the clarinettist only requires an awareness of the six level meters, and perhaps (for reassurance) the section identifier, which I enlarged accordingly.

**Viable solutions**

Once rehearsal with the software was underway, appropriate pedals were chosen, not so high as to impede balance or induce strain in the foot. Rehearsal of the additional physical movements was essential, in order for movements of the feet not to disturb the flow of the fingers. This was acutely apparent in Strophe V, where I found that the operation of the second (resonance) pedal caused cognitive load problems in the execution of the written notes both before and after depressing the pedal (notably at b66). Re-learning the passage slowly and deliberately enabled a greater embodied unity of manual-pedal action.

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42 The only requirement here was to replace the bundled CNMAT Max external objects to run in the latest 64-bit version (Max 7).
Previous performances were rehearsed in the venue for several days, a luxury not afforded by Edinburgh’s Assembly Rooms in the Festival month of August, where we had only an hour on the day to sound check and rehearse. Implementing the lighting via cues in the patch was abandoned, due to time and compatibility constraints, with Martin Parker taking responsibility for lighting cues. A significant amount of time was spent setting levels with the sound engineer, and while this is standard practice, it could here could have been reduced with a more precisely oriented setup in rehearsal. My simple pre-mixed stereo panning method for private rehearsal had only partially prepared me for contingencies in the large hall—in future, I will be sure organise a period of Stage 2 rehearsal with the requisite number of speakers to be more prepared at the final stage.

Overall, in the performance there was a sense of engagement exceeding that of previous experiences of the piece. I felt more prepared, more familiar with and connected to the electronic output and equipment, more authoritative in terms of interpretation, and more attuned to the ongoing flux of livenesses—the virtuality and trace corporeality of the double shadow, its spatial and kinetic liveness, the physicality and virtuosity of the solo part, and the long, interconnected narrative of the drama.

Summary

This first experience of the piece with embedded operation balanced a desire to exercise a personal interpretation of the piece, with managing the best use of resources to optimise energy levels and concentration. I had support from trusted co-performers and advisers, and shared or deferred responsibilities where it was beneficial. Running the piece alone in rehearsal allowed me to manage decisions on a contingent basis and prepare for both performance and the recording process. A ten year process was vindicated, beginning with the double recording and completed by the forming of a relationship with the operation and output of the electronics. Developing an understanding of the piece from the inside out contributed to a sense of performing the whole piece, and not merely half of it.

Under the right circumstances I see no reason why full embedded operation may not be taken from stage, finally liberating the piece from its once institutional shackles. My point is not that this would be ideal, but that this research empowered me to make decisions about when, where and how I might programme the piece.

Recording a live play of proximity and space

Making the recording, the acousmatic nature of both parts potentially threatens the inherent tension of physical and virtual presence. Accentuating the presence of the Strophes without suppressing the double that carries so much of the spatial drama required careful
balance in both the 5.0 and stereo mixes. It is surprising that there has been only one commercial recording in surround format (Toro Pérez et al. 2016), despite the relative obscurity of spatial audio. While a stereo mix is necessary for wider dissemination, such recordings represent only a fraction of the drama of the work, where the eponymous dialogue is as much one between inhabitations of space as it is between a live and virtual clarinettist. A stereo mix, therefore, has an inherent and significant reduction in spatial, interactive and authentic livenesses.

The patch was used to generate multichannel audio files for the editing, retaining a sense of fidelity to the original process, and to the piece’s legacy in the IRCAM tradition. As with all the recordings, I operated the electronics during the sessions, in order to feel sufficiently invested in the interaction. While precise timings were adjusted in editing, the Max output from the session was used to anchor the initial editing process in live performance, before replacing it with clean takes of the double part in the final edit.

Another affordance of the recording is the possibility to use the multichannel sound files themselves in future performances. In practical terms, there seem to be benefits in the simplicity of this operation, with the patch used for the digital piano resonance. A future period of research could also realise the alternative version with Arabic numerals, which has not to the best of my knowledge been thus far recorded for commercially.

5.2 Case Study 2

Richard Dudas

Preludes Nos. 1 & 2 for clarinet and computer

for amplified clarinet and real-time processing44 (2005, transcribed 2014; 2006)

These were the first in Dudas’ ongoing series of short pieces for solo instrument with real-time electronics. The electronic cues may be triggered by manual/pedal means, or with the use of the in-built score-following system, based on pitch- and tempo-tracking (Dudas 2011). Diffusion of both pieces is ideally in quadrophonic, or otherwise stereo diffusion. Originally scored for flute, Prelude 1 was composed in 2005, with Prelude 2 added the following year45. There followed pieces46 for alto flute (2010) and percussion (2014), and transcriptions of Prelude 1 for viola (2014) and violin (2015). The clarinet transcription was first put together hastily in 2008, and more thoughtfully completed in 2014. This involved transposition of the solo part, re-voicing of the electronics, and a kind of parallel transcription, adapting the software interface for embedded operation—a process already described in detail (Furniss & Dudas 2014).

My aims were to collaborate with the composer in bringing both pieces to onstage operation, using pitch-tracking to minimise the pedalling of cues, and to record the pieces for future release on disc in both surround and stereo formats. I was also keen to establish the pieces in an educational capacity. Being short, relatively straightforward to play, and flexible in set up, they represent ideal entry-level pieces for performance students.

The two pieces share a great deal in common in terms of effecting a kind of hybrid physical-virtual ensemble, with the live clarinettist in a director/soloist role (Pestova 2008). A focus of the long-term collaborative research connecting to this study has been to establish a unified (electro-instrumental) sound concept and plausible ensemble aesthetic in these pieces (Dudas & Furniss 2016). The approach was “informed by both the physical properties of instruments and the needs and priorities of their players within a variety of performance environments” (ibid., p202). In co-coding the feel of the pieces we took a collaborative humanising approach that affords on the one hand the richness of a plausible sense of ensemble, and on the other sufficient difference to produce a gestalt of clarinettist and virtual

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44 The catalogue titles, and those in the printed scores have “for clarinet and computer,” while the instrumentation on the composer’s website is “for amplified clarinet and and real-time processing”, which I prefer, particularly as it makes explicit the amplification of the clarinet, which (although subtle) serves to place both the acoustic and electroacoustic in the same field (Emmerson 2007; Smalley 1992).
45 Supported again by the Forum Neuesmusiktheater (Stuttgart), where the first performance took place alongside Dialogue de l’ombre double and Steve Reich’s New York Counterpoint.
46 A full list of works is available at: http://www.richarddudas.com/compositions/ [accessed 2.8.17]
partner, in a way that neither a multi-tracked recording or physically present ensemble of clarinettists could achieve.

Throughout Prelude 1, it was my aim to achieve a blend with the sound of the live clarinet as closely as possible, which in rehearsal required a different approach to the way I may usually play (Stroppa 1999, p48). Taking into account the timbre and dynamics of the original conception for the flute, over time I softened some attacks and dynamics, as well as microphone input levels, and placed an emphasis on very soft dynamics and restraint in phrasing. This allowed for the swelling in the electronics at cue 14, for example, and established an optimal evenness and balance in the layered sections at cues 11 and 17 without breaking their quietude. This layering of transpositions created a thickening of the texture, requiring a slight further diminuendo to obtain the desired effect. Cue 11 is particularly delicate, since the throat E and G in the first half of the bar have a lighter timbre than the B and C, which as bell notes are usually very resonant. While this attending to tone density in phrasing is part of the clarinettist’s established technique, the shading was here exaggerated in order to keep the electronics from dominating. It also facilitated maximum tonal contrast with the brilliance of the \textit{risoluto} entry at cue 13, and the rich, warm cantabile at cue 19. Later in the piece (cue 26) the composer’s tongue-in-cheek marking \textit{trillo elettrico e rapido} is both a play on the word ‘electric’ and a very deliberate invitation to match the intensity of the trill to the effect produced in the output [2:18]. The smoothing of the two parts here relies on an unusually rapid trill, without too hard an attack, which has something of a machine-like quality.

In Prelude 2, the timbral blurring and distinction of parts is more developed. Multiphonics here serve as a reminder that the clarinet has its own inherent harmonisation technique, employed deftly throughout the composition to either contrast or blend with the computer transpositions. The pure dyad at cue 9 affords a blending of these harmonisations, while the final multiphonic of the piece is intended to leave listeners unsure as to whether they are hearing processing, the multiphonic, or both (Dudas 2011, p70).

While dyads fall on the whole into pure harmonic intonation, other multiphonics employed here are inherently compromised, even with long practice. Being able to rehearse with the electronics allowed me to more precisely hold and phrase the opening note of the piece, which serves to underpin the later passage. The outset of the coda [3:53] is now more connected (role-reversed) recapitulation of the opening, emphasising the impure, strained quality of the harmonised multiphonics from the earlier pure, smooth \textit{portamento} of the electronics.

\begin{footnotesize}
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\footnote{I sometimes also pull back from the microphones here, to avoid any exaggeration afforded by microphone proximity and the diverse sound sources of throat and bell notes.}
\footnote{Philip Rehfeltt (1994, pp41–56) has a full description of clarinet multiphonics.}
\end{footnotes}
\end{footnotesize}
The DSP in Prelude 2 nuances the purity of the earlier piece’s ensemble aesthetic with use of a technique whereby in some sections the even partials normally absent in the clarinet’s sound are blended into the processed signal to a varying degree, creating a response that shifts in timbre between the clarinet and something more akin to an alto saxophone or tárogató (Dudas 2011, p71). This is particularly apparent in the Poco agitato section from cue 10 [0:50], and in the build towards the climax of the canonic material from cues 88 [3:25]. This kind of hybrid sound concept provides a rationale for the real-time virtual ensemble paradigm, answering any accusations of solipsism or of de-humanising by the manufacturing of synthetic presences to replace human performers that could do the job more finely.49

**Practical considerations of onstage operation**

From a performer’s point of view, a two-player version of an interactive live-electronic piece (alongside a technical operator at the computer) may not feel very interactive. Rather it is weighted towards the reactive, which is quite unlike performing a duo with another human musician. A solo version of the same piece, with the computer controlled onstage by the performer, creates a more plastic relationship, leading to a more integral musical performance. (Furniss & Dudas 2014, p458)

The pitch-tracking, although exacting in terms of accuracy, eliminated the use of a cue pedal, affording engagement with the electronics as a virtual co-performer with which/whom to negotiate, rather than a technical element to be controlled. Microphone input was adapted to allow for up to three microphones. Two microphones were usually employed to adequately capture the sound of the clarinet, fed to the central processing module in the patch. A third microphone input was added, routed only to the pitch-tracking, from either a pickup or contact microphone, eliminating confusion of input and output signals in the room.50 (Furniss & Dudas 2014, p459)

**Working with the patches**

A significant part of this research has addressed the user experience of technical materials (see 3.5). The pieces were already several years old when work began, and had been only occasionally updated by the composer, who had supervised all previous performances. This is common in mixed music, and I was aware that technical work on both

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49 Following an audience member’s suggestion that the output be transcribed and either recorded as a fixed media accompaniment, or performed by a live clarinet ensemble. The changes in timbre and intonation, the liveness of interaction and the subtlety of its trace corporeal liveness and temporal play, are surely sufficiently engaging to negate this kind of criticism.

50 Dudas most recently introduced a set of faders to manage the input levels of all three inputs (Dudas & Furniss 2016, p201). This represents a highly practical tool for the travelling performer, who is now able to adjust levels in venues of diverse sizes and acoustics, and according to a variety of input types.
pieces had been completed under time pressure for the first performances, leaving the likelihood of unwritten personal shortcuts and adjustments. I encouraged the composer to revisit the works as part of a collaborative process of preparing them for wider dissemination as either a solo or duet for clarinettist and technical co-performer.

My central areas of concern were to update the patch to run efficiently in the latest version of Max, and to establish a performer-oriented UI. The updating process was exacerbated by the move to a 64-bit environment in Max 6, which required several external objects to be updated or recompiled (even when running in 32-bit mode). As a relative novice, I relied on the composer to undertake this work, which also obliged him to reconsider the score-following and pitch-tracking engines used (Furniss & Dudas 2014; Dudas & Furniss 2016). The process was therefore long and ongoing throughout the research period, with final plug-and-play versions available only during post-production of the recordings.

**Prelude No.1**

I began working alone on Prelude 1 in October 2013. On first using the software, it was useful to run the piece with the sound file input option provided, to become familiar with the computer response and check that all the cues were being recognised and implemented. For rehearsability, the keyboard-operated on/off mechanism for the pitch-tracker feed (useful to avoid false cueing) and a mechanism for jumping forward or back a cue, were both mapped to pedal controllers, as well as the initialiser and buffer clearer. Although only the initialising would be necessary in performance, having several operations available facilitated fluent Stage 1 and 2 rehearsal and a readiness for Stage 3 in the performance space. Knowing that output levels had been manually adjusted at the mixing desk in the performances to date, I also mapped a MIDI expression pedal to the overall output in order to be able to nuance the levels *in situ*.

As for the user interface, it was difficult to monitor salient information in quick glances or peripheral vision while reading the score\(^{51}\), particularly the changing cue numbers, which provide reassurance that the requisite pitches have been recognised. The original interfaces for both *Preludes* were again designed for close operation by the composer. I needed a logically ordered, visually clear, and rehearsable visual interface, as discussed in Chapter 3. I have described the processes of embedded rehearsal and annotation elsewhere with specific reference to *Prelude 1* (2014, p458), and will therefore focus here on work with the more substantial second piece, where this differs from the earlier work.

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\(^{51}\) Memorising would obviate these issues with visual interfaces. This is not always practical, however, nor is it a universally normalised practice in classical performance.
Prelude No.2

The downloaded folder received from the composer contained some advice, some of which applied already to the earlier piece:\footnote{See Supplementary Materials.}

1. This piece might not be quite as much a “plug and play” affair as the flute piece...

2. If the score follower jumps cues or gets stuck, the right and left arrows on the computer keyboard can be used to move from rehearsal mark to rehearsal mark.

3. From rehearsals [2] through [6] the clarinetist sets the tempo for the computer, so the notes should be played in strict rhythm.

4. Rehearsals [36] though [47] may require a fair amount of rehearsal - here, the clarinetist forces the computer to make an accelerando... the notated rhythms in the clarinet are just a point of reference.

5. From rehearsals [60] through [66] the clarinetist sets the tempo for the computer, so the notes should be played in strict rhythm.

6. Rehearsal [84] requires some manual control of the patch. The up and down arrows on the computer keyboard can be used to turn off the live input to the pitch tracker. Live input may need to be turned off until the clarinetist gets to rehearsal [85].

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fig53.png}
\caption{The original interface for Prelude 2, as supplied by the composer, shown here in Max 6.}
\end{figure}

The interface at this early stage was extremely difficult to decipher, and visually disorganised (Fig. 5.3). The cueing system for rehearsal was well ordered, but salient information was too scattered, with extraneous legacy material (right) taking up space and
attention. The pitch-tracking identifier was at concert pitch, requiring mental transposition, with the all-important cue status buried centre left in a small integer box. A Presentation Mode adaptation was made (Fig. 5.4) in accordance with the points mentioned in Chapter 3. Once a satisfactory UI had been implemented, I felt much more comfortable in the working process of preparing the piece, and the pitch-tracking proved robust, with all bar one of the cues (99) triggering successfully.

A significant development in Prelude 2 is the tracking not just of pitch, but of tempo. Cues 2–6, and more critically 60–66, are both marked *tempo giusto*, and require careful setting of an accurate and steady tempo, in order to regulate the following sections (Dudas 2011). Some tolerance was found in the first example to an intuitive flexibility in the way I was playing the quintuplet. However, the second example dictates the feel of the whole Scorrevole passage up to cue 99, and therefore needs to be rigidly metronomic. Here again, working in private rehearsal with the electronics allowed for a back and forth, gradual evolving of a tempo for the whole section. With the tempo subsequently locked in the computer part from cues 67–99, I found it necessary to work each phrase meticulously with a metronome, maintaining a strict rhythmic accuracy while imbuing the phrasing with a sense of fluidity. In this sense, tempo tracking is rather like an inaudible click track.

![Fig. 5.4](image)

**Fig. 5.4** The adapted performer-oriented interface for *Prelude 2* in Max 6 Presentation Mode. Objects relating to setup are aligned with clarified instructions, ordered on the left top to bottom. The pitch-tracking identifier is transposed to written pitch. Input and output signals are clearly visible, and the buffer waveform is displayed and enlarged, confirming that the system is recording. The cue box and ‘advance’ bang object (flashes green) are enlarged and coloured, in order for changes to be noticeable in peripheral vision.
Over time, interacting on a phrasing level, coordinating the interleaved canonic material, the above section has come to feel *instrumental*—moving towards second-order mediation, or *telepresence* (Riva & Mantovani 2012). This embodied fluency represents an *expert* level of skill according to the Dreyfus model, with contingent, situational reactiveness, holistic recognition of events, and intuitive, non-analytical responses, while maintaining a supervisory awareness of the whole assemblage in the context of managing the linearity of the performance. The sense of instrumentality is more readily achieved in real-time event-based processing, where (almost) in-the-moment transformations of the live sound become intuitively understood and absorbed as causal responses to the existing human-instrument entity. Where in this case *temporality* is the interface, the challenge for the performer is to be distributed across past and future events (Impett 2001), juggling a temporal liveness with inherent traces of corporeality and virtuality (Sanden 2008, 2013; Emmerson 2007). A richness of interaction comes from this multimodal transformational approach at the levels of timbre, pitch and phrasing (Stroppa 1999, p45).

**Recordings**

The recordings were co-produced with the composer, each of us taking responsibility for elements of the editing. I again operated the electronics during the sessions, even with the composer present. Later, the clarinet part was edited, using the computer part as a guide to fluidity and timing—finding the *feel* of the piece in the manipulation of the takes. A mix of the two close microphones was sent to the composer in order to compile a fresh computer part. Up to this point in time, there remained some errors in the behaviour of the software (due to the long updating process), which were finally fixed in order to complete a ‘live’ edit from Max. There is an immediacy in the recording that is difficult to achieve in performance, where a degree of latency is inherent, but here we decided to implement a slight delay on the input to the audio chain, adhering to the imagined effect the composer intended. This represents an example of recordings—electroacoustic works made from live samples—as alternative (rather than definitive) threads of a work’s life.

In addition, work that had begun on improvements to the plausibility of the transpositions was implemented, including formant filtering for the real-time transposition and adjustments to the harmonicisations to reflect the way musicians manage tuning according to just and expressive intonation\(^5\) (Dudas & Furniss 2016, p200; Kanno 2003). Choices are constantly being made while playing, at both a conscious and intuitive level, to match the output of pitches to that of the inner ear and other performers. This involves ongoing micro-adjustments to the surrounding context (here the responsive, but immovable, output of the computer processing). The result, according to the composer is “significantly different overall in details,” adding “I’m not convinced it ever sounded in tune in equal

\(^5\) Winkler (1998, p211) mentions this issue in connection to *humanising* techniques in interactive music.
temperament (see Kimura 2003, p295). While I cannot speak for the technical process, audible examples include the use of just intonation in the final chord of Prelude 1 [3:46], and micro-tunings at cues 54–56 in Prelude 2 [1:56–2:17]. Transpositions in the latter piece’s canonic Scorrevole section are now predominantly calibrated according to expressive intonation [2:41–3:51].

The epistemic dimension of the recording process has been prevalent throughout the course of this study. Here, further improvements to the software were made as a direct result of recording and post-production, affording up to date, ‘plug and play’ materials. Whereas in performance the pressing concerns are balancing sound in the hall and managing feedback, in the studio there is time for a more considered approach, in which the clarinet delivery or output may be nuanced, influencing subsequent performances.

All of the above changes were inspired by an aim to create pragmatic improvements that draw on embodied processes of learning and performing (Dudas & Furniss 2016, p199)—humanising, as defined in the Chapter 1. It is hoped that this will inform and feed future pieces in this series.

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54 Personal email from the composer, 2017
6 Role B: enabled interpreter

6.1 Case Study 3

Alexander J. Harker

*Fluence* for clarinet and Max/MSP (2010)

*Fluence* is described by Alex Harker (2012a) as “a kind of ‘real-time’ tape music,” and employs a bank of pre-recorded clarinet samples, which are matched to the live input in real-time using a set of audio descriptors and triggered in real-time according to a predetermined gestural shape (Harker 2012b). There is also a small section of subtly blended DSP in the coda (from 134). The use of a large catalogue of categorised samples (1677 in total) affords a consistent yet slightly variant outcome each time the piece is played.

The structure of the piece alternates between line sections (Fig 6.1) in which “time and pitch are articulated clearly and cleanly, as if on a grid,” and field sections (Fig 6.2) in which “things are blurred, unclear and constantly morphing." The former are precisely notated,

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55 Use of the terms *line* and *field* derives from conversations with the composer.
with a combination of rhythmic precision and tempo flexibility akin to *Strophes I* and *VI* of the Boulez, while the latter are sketched using a variety of indeterminate notations—graphic and textual indications, gestural cues, and approximate guide timings for each subsection, rather than bar lines—drawing on the freedom and extended techniques of free improvisation. Hybridity lies at the heart of the piece, in the juxtaposition of differing sound concepts, and in the use of real-time processing and prepared samples.

![Fig. 6.1](image)

*Fig. 6.1* Line sections in *Fluence* are formally notated, with a degree of flexibility in interpretation.

The aim was to record the piece for future public release, and to probe the viable limits of an onstage operation in performance. I had already performed *Fluence*, firstly with the composer triggering cues from a Wii remote in the audience[^56], and a second time with a score-reading technical co-performer[^57].

![Fig. 6.2](image)

*Fig. 6.2* Field sections use indeterminate graphic and text notation, with a degree of flexibility in interpretation and some material improvisation, within given parameters. Timings indicated are only a guide.

[^56]: March 2012. Reid Concert Hall, Edinburgh.

[^57]: June 2012. Hanyang University College of Music, Seoul.
Sound to sound

Negotiating an integrated sound concept was aided here by the composer’s skill in foregrounding the sound of the soloist in the rich and variegated interactive whole. Unlike the Boulez, there is no call in the score for the performer to record their own samples. I considered it appropriate to take on a piece with sample recordings by another clarinettist, and not merely because of any general similarity in personal sound between Sage and myself. Firstly, from a practical point of view, it would be a monumental task to re-record and organise over a thousand sound clips. More pertinently here, the type of samples used negates the need for such an undertaking, by virtue of their predominantly short duration and largely non-transient nature. Harker designed the sample bank such that there is very little dichotomy of performer voice. As discussed in Chapter 2, personal sound is connected to characteristic usage, expressive phrasing, and to sound concept, and therefore the relatively short duration of the samples, each destined to be concatenated into a broader gestural material, to a large extent inhibits any sense of voice.

The samples fall into four distinct categories, which Harker classifies as noise-based, pitch-based or transient-based types, and impulse responses. Disregarding the impulse responses, the noise-based sounds are variously organised as short breaths, tongue-constricted breath (with spit), continuous noise (longer examples) and “random swoosh” (further short, spit-infused sweeps). These carry a generic breathiness that infers a causal relationship with the a human agent, and perhaps a clarinet—they are first-order surrogates in Smalley’s terms (1992, cited in Emmerson 1994, p97). Still, the indicative link (ibid.) is generic, not specific. Meanwhile, the pitch-based samples in the Fluence bank use a good deal of teeth-on-reed squeaks, exaggerated bisbigliando, heavy vibrato, and multiphonics—which carry little sense of personal sound—and some single pitches, which often do. However, since the single pitched samples are short (under 12 seconds), softly attacked, soft in dynamic, and will be inevitably ramped at the outset to avoid clicking in the (generally soft) output, their identity will be dislocated by the lack of transients (Taylor 1992, p81; Risset 1978). Finally, the transient bank itself is comprised of a multitude of impersonal mechanical sounds derived from key clicks, taps, dismantling the instrument, and pops of varying length. Overall then, while Sage’s corporeal trace is detectable, and while his recorded sound permeates the piece, his presence as an authorial agent in another’s performance is only catalytic. He has become a kind of ‘enabled dedicatee.’

An example of the above undisturbed and unified sound concept is the suspended feel of the section from 32–38 (very fluid, free [2:11]), where the sustained single pitches in the electronics serve to ‘float’ the clarinet’s melodic line. Here, and in similar passages

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58 See Supplementary Materials.
59 As we hear, for example, a trace of dedicatee Richard Mühlfeld’s personal sound in Brahms’ clarinet works, (Roche 2011, p51–2). Sage’s permission was obtained for the purposes of this recording.
throughout the piece (e.g. 36–38, 69–70, 79–80), I was content with the blend of live clarinet and sample, and the very slight variance in timbre fits the veiled, ethereal overall character of Harker’s electronics that reflect the “mysterious, magical or hypnotic power” of the work’s title.\(^{60}\) The first use of multiphonics (in both parts) at 40–44 is equally seamless. The following section’s contrast of breathiness in the clarinet part with a sustained chord in the electronics is an example of the non-intrusion of the pitched samples.

**Detailed Software Guide**

The patch realises the electronic part from a large bank of samples, according to pre-defined cues. There is a small amount of tracking of the clarinet part in places, which necessitates the audio input, although much of the piece will function correctly without input. In performance it is only necessary to advance though the cues at the appropriate times.

Setup is minimal, but in order to avoid a lengthy patch load time, sample loading is instigated manually, as this process generally takes around a minute.

Revolve may be added to the live clarinet part in the patch if it is deemed necessary (a dedicated revolve processor may also be used if preferred). *\(^{[c: 5 \text{ sec } 2016]}\)*

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**Fig 6.3** Technical instructions in the *Fluence* score are clearly laid out (with optional reverb settings for different venue types). Boxed numbers refer to further schematic explanations in the score. My annotations and highlights can also be seen.

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Task switching

15th December 2016

Coming back to practise *Fluence*, I’m suddenly remembering the discomfort of entering those free sections after all the intense focus on the notes and intricate rhythmic subdivisions of the first two pages—how anxious I’d feel about those multiphonics, most of which weren’t familiar to me. I feel I need to get to a stage where I’m not thinking about the esoteric fingerings61, just going looking for a sound and feel for each. I want to feel very different in these sections, like I’m managing a flow and playing with the vulnerability of the sound, without sounding like I just can’t really play it, which is a danger here because the other sections sound so controlled. I know this is supposed to sound like a guided free improv, but it’s not the way I tend to free improv... I’m not using multiphonics all that much, and often end up finding things on-the-fly that break and crack and have a tipping point. I prefer being in the moment, not planning. Here it’s still very controlled and dictated, doesn’t feel improvised.

Coming out of the controlled sections I suddenly have to change embouchure every few seconds, for these wobbly multis, then move to breath and suddenly come back to a dyad, which needs a lot of concentration, then think about alternating these three notes in a free order. Then suddenly do the whole thing again and move to a louder, overblown section with teeth-on-reed slide (what, *AND diminuendo*?!?!) Getting the multiphonic at 52 is tough after that teeth-on-reed stuff—it takes a while to find a normal embouchure and it’s an overblow. 56 is kind of a relief and I’m starting to feel easier moving into the colour trill and pitch bending... it sort of allows me to re-find my embouchure and gather my thoughts for the coming melodic section. I feel calmer going into 60, like I can just get back to the business of playing the piece.

The *fields* are rooted in the sounds of free improvisers, and the above narrative attests to Butcher’s warning (2011) of being “pulled back and forth between different cognitive systems” (see 1.1). I have attested elsewhere (Whalley et al. 2015) that it is demanding to

61 In Watts’ (2015) classification, Type 1 multiphonics are based on a controlled overblowing of familiar, embodied fundamental fingerings, where “the perfect embouchure and the perfect sound have to be disregarded to some extent, as each multiphonic and each harmonic produced from a standard fingering require a versatile and flexible embouchure.” (ibid., p6). Type 2 multiphonics employ often counterintuitive fingerings to produce multiple frequencies and may be less predictable: “instrument set-up, acoustics, the individual performer, playing conditions and the pressure of performance can all have continually changing effects on the production of each multiphonic. What is easy and responsive during practice or in a rehearsal can suddenly become difficult and unreliable in concert.” (ibid., p110)
swing between musical modes of thought (MacCaleb 2014). There is evidence to suggest that such task switching can create high levels of cognitive dissonance (Wylie & Allport 2000). At the cusp of moving from precise notation to an improvisation, I experience a pronounced state of mental fogginess, accompanied physically by a dull pressure in the forehead, which lasts for several seconds before settling into the different mode of attention. Where these field sections involve physical extremes of energy (eg. 49–53), it takes time to readjust to a more measured delivery. Thus, moving from the oscillations and suspended multiphonics at 100–104, or the pitch-bends with colour trills at 56–59, towards a state of precise execution, requires a period of mental preparation, anticipating the pulse and physical feel of the upcoming passage, which in Fluence is generally rapid and fluid.

Relearning the piece, my focus was (as in the Boulez) on bringing an embodied fluency to the additional pedal movement, and on a more embedded engagement with the electronics. A period of intense private rehearsal was required before the multiphonics began to feel intuitive, particularly the switching of embouchure pressure and position. I developed strategies to learn the field sections—an alternative text notation, and my own categorisation of the multiphonics that analysed changes in fingering from one to the other—and came to lessen the discomfort between sections finding a more stable, less improvised, approach, with room for spontaneity in places (such as the outburst at 99).

Performing the piece as a duo with a technical co-performer may represent the ideal solution for a piece as intricate and demanding as Fluence. However, my aim here was to probe the limits of onstage operation, and show that an embedded approach to the assemblage could be worth the effort, in terms of musical interpretation, self-efficacy and a widening of the viability of the piece in my repertoire.

Interaction with the materials

The software is on the whole exemplary in its presentation, although the patch to date still only functions fully in Max 5, while Harker completes an update. The clearly organised interface has clear instructions for the non-specialist in the score (Fig. 6.3). A set of the composer’s own Max externals is supplied, or can be readily downloaded from his website,62 with guidance for installation in the materials folder. Having mapped the Advance, Panic (pause) and Reset functions to a foot controller, it was straightforward to begin rehearsing the piece. Since the output is sample-based, it is also possible to cue through the entire score hearing the type of response at each cue. I again implemented a performance-ready annotation of the patch with clear visibility of salient information only (Fig. 6.4).

62 http://alexanderjharker.co.uk/Software.html [accessed 5.8.17]
The main issue with the patch was its rehearsability. Particularly towards the latter sections, reliability of response could only be assured by cueing through from much earlier in the piece. After a few uses, Harker advised quitting and restarting the patch to avoid errors. Loading time could be up to 30 seconds \( (\text{much quicker in Max 6 or 7}) \), which caused breaks in workflow. A full update to the latest software version could alleviate this, and would certainly simplify the running of concert programmes that employ multiple patches and software platforms.

![Fluence interface](image)

**Fig 6.4** A Presentation Mode interface for *Fluence* (Max 5), designed for performer operation, showing cue advance (flashes) and cue number, enlarged for visibility from a distance. Input and output levels are also shown for reassurance, along with an emergency reset mechanism. This interface was eventually superseded by Harker’s remote patch (Fig 6.5).

Managing the cues in rehearsal involved always having the pedal at my feet, whether using the computer or not. Having the response to play off in rehearsal with the computer served to normalise the sections, and gave both context and a certain amount of cover for the vulnerability of some of the multiphonic writing, which was reassuring. The score helpfully indicates whether the precise coordination of a cue to its position in the score is critical or approximate. This facilitates both a managing of attention, and an understanding of the corporeal liveness relating the relevant musical gesture (eg. 5, 35). However, it soon emerged that there was a slight lag in the visual display during rapid sequences of cues (eg. 112–126), and at times it was impossible to ascertain whether cues had been activated. I would attempt to correct myself via the cue advance, but would then suddenly see the cues jump ahead to beyond my position in the score. I had to learn to trust my pedal action, until Harker provided a more viable remote control (Fig. 6.5).
There is a hybrid virtuosity to the piece that combines standard and extended techniques, delicate negotiation of liminal qualities in the production of sound and outbursts of extreme material. This engaging virtuosity extends to the instrumentality of the soloist’s liaison with the computer output: the visible action of activating rapid sequences of cues and the sonic interagency of the sounds of acoustic instrument, the breath of the human performer, the real-time immediacy of the richly variegated and variable concatenation of the samples, and the reverberation of the whole via space and software alike. These virtuosic, corporeal and trace livenesses are counterbalanced by the fields’ shift in expectation following the line sections, a relinquishing of traditional mastery to privilege a liveness of vulnerability, and of volatility.

The recording: revelations and affordances

Using the latest update of the patch for the recording sessions, I chose to pedal through the cues, despite having Harker present. This conformed to my now established practice of maintaining an authenticity to live interaction (Sanden 2013), and furthermore, while it might have been convenient to ask the composer to operate the cues in the hall, co-
producing from the recording studio was considered a more valuable use of his attendance.\footnote{I like to have several people in the studio when recording complex compositional material—an engineer, and two or three score-surveying co-producers are ideal. This may be part of my musical \textit{habitus} (Bourdieu 2004), from years as a recording and broadcasting orchestral and chamber musician, session player and soloist. It may also fulfil a sense of performing in the presence of an audience. The opposite was true of the improvised recordings, where a more solitary environment was preferred.}

In the line sections, Harker occasionally disregarded slight rhythmic inconsistencies where takes had a requisite fluid, malleable feel, and this afforded a sense of freedom in the editing process to trust my sense of flow within the precise rhythmic material. However, feel aside, these sections are exacting, and, as I had found in \textit{Strophe V} of the Boulez, pedal movements were liable to deflect from manual accuracy at times. This pressure was exacerbated by the above-mentioned latency in the visual display, and consequently the passage from 109–127 was retaken without the electronics for this reason. I was also becoming tired, and resolved to abandon the pedal until recording the \textit{fields} the following morning. However, on continuing to the second line section at 60–89 (organisation of the recording was not linear), the opposite problem was encountered. The passage didn’t feel right without the pedal movement, or the accompaniment of the electronics, so now not depressing the pedal led to confusion and attendant lapses of concentration. Here was an opportunity to reflexively observe my own developing expertise and embodiment \textit{in situ}—in Dreyfus’ terms, while certainly proficient, I was not yet expert. In this case, Harker hastily assembled a prototype of the remote control patch and the electronics were duly restored.

For the \textit{field} material, long takes were used as a basis for timing and overall ‘vibe’ (the composer’s favoured term). While the fragility of most of the multiphonics are, as mentioned, part of the liveness of the piece, here I decided to add more detailed gesture-by-gesture takes, in order to find sufficient variety and security in the multiphonics to create an edit that would withstand the repeated listening of a released recording. The resulting edit has a sense a sense of faithfulness to the score, while retaining a sense of vulnerability.

As was the case in the other three recordings of notated material, the initial edit’s guide electronics track was replaced with clean takes, here conveniently implemented by feeding the two close microphones as an input to the patch in Max 5, and directly recording the output in Reaper, via TotalMix FX’s loopback function in the RME Fireface audio interface. The computer part was recorded in sections, using a newly updated remote control provided by the composer, running concurrently in Max 7. Again, the Reid Concert Hall makes its presence felt in the final mix, both as integral to the particular sound concept choice I bring to my interpretation (the recording is more reverberant than Harker’s with Sage).
Further research

The collaborative nature of this research represents an example of a shared responsibility between performer and composer towards technical materials, and has pressed the composer into action by highlighting the need for work already timetabled to be done by the composer on updates to the software materials, including a section-by-section rehearsability that proved invaluable for both rehearsal and recording purposes, and will alleviate the need have multiple versions of Max to deal with during a concert programme. Moving towards the performance, lessons learned from the recording process, including timings of certain cues, duration and feel of the field sections, finding a degree of interpretive freedom within passages of line material, and the usefulness of the latency-free parallel remote control patch, will contribute to preparing the piece for operation from the stage. Some difficulties were identified in terms of coordinating and monitoring the cues in rapidly moving sections, and while this will no doubt be lessened with familiarity and further rehearsal, the implementation of a vibrotactile feedback device (Hayes 2013; 2014) could increase confidence and promote the development of ready contingent coping strategies in the volatility of a performance environment.

In field sections, while Harker materially enables the executant interpreter, particularly with regard to creating instrumental textures and miniature narratives within the semi-composed environment, this is still very much on his authorial terms. The performer is now rather like an actor improvising on a given scenario—free to bring into play a more personal take on the material and its ordering, to determine to a large degree of its pacing and flow, and to derive some appropriate original material. On the other hand, the sections remain tightly determined in terms of the precise multiphonics used, the coordination with the electronics, the precise pitches and their degree of variation (cues 57-59), engendering the spirit and sound of free improvisation, while determining much of its specificity and shaping the broader musical gesture. In Fluence, the executant performer is, for some of the time at least, afforded a longer leash on which to negotiate the geography of the piece, but remains throughout on a path that is still largely pre-determined. It remains nevertheless, a highly rewarding collaborative journey.
6.2 Case Study 4

Martin Parker / Pete Furniss / Anne La Berge

gruntCount for bass clarinet and computer (2011–present)

1 worksAsAFastOne Live at Edinburgh College of Art (2014)
2 Improvised solo set Live at the Festival Theatre Studio, Edinburgh (2014)
3 thisOneHasRests/PausesInIt Live at Zé Dos Bois, Lisbon (2014)
4 worksAsAFastOne Duet with Anne La Berge (flute) (2015)

In the case of interactive music, the blurring of the boundaries between composition and performance, work and environment, is an essential characteristic. It could even be considered […] the material itself.

Jonathan Impett (2001, p30)

Hybrid documentation of a piece-system-instrument

This case study is presented by means of an introduction, diagrammatic research narrative, and subsequent discussion. The use of a research timeline articulates both the process of gathering a performance-viable fluency in the use of this particular coalition of resources, and also its wider context as situated within a nascent augmented practice. In its upper section, phases of work are identified and briefly summarised, with versions, performances and collaborations listed underneath, and example recordings in the lower section that include the four tracks on CD2. Further recordings are available for reference via hyperlinks, which also connect to related research, online articles, blog posts and performance archives64.

Marking beginning and end points to research chronology was necessarily arbitrary, reflecting an ongoing relationship with Martin Parker and his gruntCount software that began before undertaking this research. Boundaries are drawn that frame the journey from the creation of a second version, through the process of acquiring self-efficacy of embedded operation, to a growing sense of expertise. Aspects of this work have already been documented (Furniss & Parker 2014, see Appendix C), including a summary of the system, its blurring of piece-system-instrument distinctions, performer and composer perspectives, and a consideration of its liveness.

64 A full list of links is also provided in (6.2.1)
While I will refer to the earlier writing where necessary for clarification, my aims in this study were twofold: firstly, to situate my journey from novice to expert within the context of a humanised practice, and secondly, to show how gruntCount, and the role of enabled interpreter, were pivotal in shaping my research and practice as a whole. A series of live recordings illustrate the process towards a unified instrumentality (see 4.3), and an emerging personal sound. Finally, in comparing practice with another member of gruntCount’s growing community of practice, the live recordings are supplemented by a short studio recording that stimulated an agenda for further research.

What exactly is gruntCount?

It’s important for me that this work sounds live. I want to hear the performer thinking through what’s going on. Playing with their own sense of anticipation, tension and release. For me, this is where music really starts to happen. I’ve often thought that a player on stage who is free enough to think about what’s going on in the room, they are perhaps not feeling oppressed, tense, or subject to demands that are beyond their control. A player who is thinking is a player who understands, is well informed and well practiced and for me when gruntCount works, it’s got the sound of spontaneity, a here and nowness that’s considered, not just bursts of energy.

Martin Parker (Furniss & Parker 2014, p191)

Parker’s aim in designing a flexible software environment for improvising musician and computer was to engender a rich and credible musical coaction that meaningfully addresses a compositional engagement with the liveness and spontaneity of improvised performance (Furniss & Parker 2014). Each version of gruntCount is essentially a unique set of DSP parameter presets, created and adapted in a real-time improvisation between performer and composer. These sessions had the feel of a jam, with considerably more playing than talking, communicating enjoyment and dislikes in the responsiveness through improvisatory, musical (non-verbal) communication. Other musicians have similarly initiated individual versions of the system65, and the sound and feel of each session remains present in the outcomes.

The system is later packaged as a standalone application designed for ready access and portability, replete with composed trajectories through the presets that act as pieces. These pieces are presented on a graph-like visual interface, which the performer uses like a score, negotiating an improvised musical thread through the piece’s sonic interactions. The piece will only progress when stimulated by sound at a given audible threshold, and over a

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65 At the time of writing, the following personalised versions exist: Anne La Berge (flute, 2011), Henrique Portovedo (saxophone, 2011), Karin Schistek (piano, 2011), Tom Arthurs (trumpet, 2011), Mark Summers and Liam Byrne (both viola da gamba, 2012), Christos Michalakos (drum kit, percussion, 2012), Emma Lloyd (violin, 2013) and Richard Worth (flute, 2017).
timescale set in advance by the user, drawing a focus on the level and intensity of effort (the number of ‘grunts’) required to complete the piece.

In answer to the above question, gruntCount is not exactly anything. Shifting and blurring distinctions of composer and performer, piece and system, it exists as both a set of pieces and as a configurable system for composition. Over time, its musical expediency, grounding in physical effort and resistances, and emphasis on performer agency also afford qualities of instrumentality (Furniss & Parker 2014, p194):

By making a piece with a system that plays like an instrument, we further blur the definition of each. Importantly, our individual roles are also smeared. The performer does much more composing and top-level piece design, taking greater overall responsibility for what is heard. Meanwhile, the composer is required to become a more expert systems designer, making fewer concrete decisions about what should happen on stage, instead defining a range of possibilities that afford what might happen. Given the numerous considerations involved in mixing and blending acoustic sound with electronics, both composer and performer also become instrument builders. The blurring of these roles, and the shifting of their emphasis in appropriate directions, leads to an environment where composer and performer are more able to focus on bringing liveness and spontaneity to musical ideas.
6.2.1 *gruntCount* interactive timeline

**beginnings**

Struggling to relate to some sounds (machine aesthetic)

**new version**

Lost something of the familiarity of the old system

**control**

Bringing to performance viability

**configuring**

More fluent, gaining in technical confidence

Making states

Finding a sound

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**bass clarinet edition v1**

Initial version created *(Parker 2012)*

**bass clarinet edition v2**

Updated with improvements to DSP and graphical interface

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**1st performance and CD recording**

University of Edinburgh Reid Concert Hall

Hanyang University, Seoul.

1st time running any electronics from stage.

March 2012

**study begins**

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**Addition of GC-remote**

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**objects of sound research festival**

Edinburgh College of Art

**Edinburgh Science Festival**

University of Edinburgh Informatics Forum

**Fabrikant Records**

Medbøe & Furniss *(2015)*

**Edinburgh Jazz Festival**

Festival Theatre Studio

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**Disc 2, track 2**

**Edinburgh Jazz Festival**

**Disc 2, track 1**

**ECA Objects of Sound**

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**performance**

**recording**

**version**
writing up
Rehearsals for a first performance on the road after time away and writing

instrumentality
Feels like an instrument, with free improvisations stretching towards 15-20 minutes

Further research
Exploring ways to open out beyond solos

GruntCount: blurring the piece / system instrument distinction (Furniss & Parker 2014)
See Appendix E

Demo edition
Special live version session with Martin Parker for conference presentation
International Conference on Live Interfaces (ICLI)
Zé dos Bois, Lisbon

V

Clarinet edition
Looking for a bespoke clarinet version
Metanast
Mantis Festival, University of Manchester
8-channel diffusion

P

Network communication and pause facility
1st multi-player version performance with Anne La Berge
University of Edinburgh
Reid Concert Hall

P

Further research
Duo set with Anne La Berge
Splendor, Amsterdam

P

Study ends
Disc 2, track 4
Duet with Anne La Berge

Disc 2, track 3
ZDB, Lisbon

Dec 2015
May 2016

Oct 2014
Apr 2015
Nov 2015

Apr 2015
Nov 2015

Metanast
Mantis Festival, University of Manchester
8-channel diffusion

P
List of timeline links

The following web links are arranged in chronological order as they appear from left to right (underlined) on the research timeline.

1  http://www.tinpark.com/2012/01/first-grunt-dump-for-bass-clarinet/
2  https://sumtone.bandcamp.com/track/many-boffins-died-to-give-us-this-information
3  https://sumtone.bandcamp.com/album/gruntcount-improvised-pieces-for-player-and-computer
5  https://open.spotify.com/album/5SCUScin1geNytymK7oVLw
7  http://ici.lurk.org/?page_id=558
8  http://ici.lurk.org/?page_id=224
9  http://ici.lurk.org/
10  https://metanast.wordpress.com/pete-furniss/
11  http://annelaberge.com/gruntcount-goes-ensemble/
13  http://annelaberge.com/2016/06/

[all accessed 10.9.17]
6.2.2 Discussion

The timeline shows a breadth of enabling affordances, from a growing situational expertise to an international dissemination of the work in performance and writing, and highlights its expedient, responsive and informative qualities. I propose this to be due to its inherent focus as a framework for spontaneity, liveness and co-creativity.

Onstage handling is inherent to Parker’s design, whereby “the player will start the piece off who then must leave the computer alone until the preset map is complete.” In the pre-research period I was at first privileged by having Parker to manage the coalition of computer (his), microphones and requisite audio equipment. Having the composer present in rehearsal was part of my normative modus operandi as a classical performer, and while I rehearsed in private with the built-in functionality of my own laptop and headphones, I valued at this early stage having someone with whom to discuss the outcomes.

Only in performance was I alone with the computer interface onstage—no pedals to press, levels to monitor, or cues to worry about. Beyond the anxious moment at the beginning of every performance with computers—will it behave as it did just before? (see Berweck 2012)—I was able to focus only on an unfolding negotiation between acoustic instrument, sonic response from the computer, the visual interface-as-score, the affordances of the concert space, and my will as performer to supervise the whole as a plausible concert item. Eventually, committed to this research’s preference for onstage operation of the assemblage, an embedded, individuated and mature relationship with gruntCount began to emerge.

Engaging with gruntCount

I have already discussed gruntCount’s heuristic role in the technical aspects of self-operated augmented practice (Furniss & Parker 2014, p189–190). A brief look through the visual interface (Fig. 6.6) illustrates this accessibility, and the instilling of procedure in the technical novice, affording a calm, orderly environment for setup, and facilitating optimal musical attention once rehearsal is underway.

Fig. 6.6 The gruntCount visual interface functions as an editable score, with a clear and logically ordered layout built around performer usability. On the left, from top to bottom are the settings: version and piece selection (here worksAsAFastOne), audio configuration, effort-related settings, and options for recording and diffusing the output in up to 16 channels. The vertical playhead is pushed from left to right as the piece progresses, while the horizontal beam indicates the current DSP preset (its number and name displayed above). At the top (left to right), the transport offers rehearsability which may be mapped to hands-free operation via the GC-Remote app (Fig. 6.7).

Rehearsal in Stage 1 with the new 2013 version (operating the computer manually via the keyboard), I quickly engaged richly with the pieces received from Parker, named in a colloquial and typographical vernacular: worksAsAFastOne (Fig 6.6), spacedOut, and thisHasRests/PausesInIt.67

As with the previous version, despite a relative technical naivety, I was able to begin rehearsing in earnest within twenty minutes of receiving the standalone. As I have already outlined (3.2), feeling engaged in a rigorous and playful way with responsive sonic forms is particularly important at this early stage, and rewarding outcomes are motivating. This early expediency allowed me to lean on my experience as an agile, listening, adaptable improviser, while discovering the sounds and responsiveness of the system.

There are clear instructions for setup via a video tutorial (ibid., p186), a clear visual interface, with logical ordering running from top to bottom on the left hand side (Fig. 6.6). The design encourages a specific procedure:

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67 The abbreviation of ‘in it’ or perhaps a cheekier ‘innit?’ never quite clarified.
1. select the gruntCount version to be used
2. select the piece to be played
3. configure the audio as necessary (defaults to built-in settings)
4. set up microphone routing(s) (stereo in/out by default, with up to 8 inputs available)
5. choose whether to compress the input to optimise feed levels to the system (on by default)
6. adjust the microphone level (if necessary)
7. set a minimum audible threshold to which the system will respond (on a floating point scale from 0–1)
8. set the number of grunts (the granularity of response, theoretically unlimited)
9. route the Master output (defaults to stereo)
10. choose whether to record both input and output (up to 16 channels)
11. choose whether to diffuse discrete DSP parameters (up to 8 separate channel pairs)

I developed the habit of stepping through each, regardless of defaults, in order to build a procedure that reduces the risk of oversight, or forgetting changes made in a previous session, which can be saved via the configurable preset management system. Beyond basic functionality, the critical settings are the threshold and grunt count\(^68\), which dictate the approximate duration and level of physical effort of the piece. A low threshold will trigger a response with little effort, especially taking into account the output of the loudspeakers. A grunt count of 200, for example, will be represented by a scale of 200 points along the x axis, and result in a very short piece. Conversely, a high threshold requires louder playing to stimulate the system, which, combined with a high number of grunts, would lead to more effortful interactions of a longer duration. Nuancing the balance of these two settings, the performer is able to shape the duration and form of a piece, for example by ensuring a pause in the playhead when not playing. There is, intentionally, no way to definitively fix duration.

The transport across the top of the interface has keyboard shortcuts for initiating the performance and rehearsal modes, with the ability to stop or silence the piece. Players may rehearse from the beginning, or at any point in the piece, while the ‘perform’ mode clears any buffered samples from rehearsal and instantiates the recording of a multichannel sound file (input and output), automatically saved to disk alongside a dataset text file\(^69\).

\(^{68}\) I distinguish typographically here between the eponymous grunt count (or number of grunts) and the (italicised) gruntCount for the entire piece/system/instrument.

\(^{69}\) An example data file is included in the Supplementary Materials. Specific data relating to the performances here was unintentionally deleted and is no longer available. The data was not used or referred to in any way.
The vertical playhead moves forward one step (grunt) along the x axis each time the threshold is reached, corresponding to a DSP preset on the y axis, plotted in the composition. Rehearsability is embedded in the design: a practice mode allows each of the DSP presets to be experienced in isolation, with whole-step forward and back cueing and fine-grained x and y position adjusters. The presets are numerically ordered (scaled to two decimal points) on the y axis, affording smooth and dynamic transitions. Critically, these essentially instrumental modules—in Impett’s terms inventions that form a temporally distributed interaction between composer and performer (2001, p31)—are endowed with the potential to enact random mutations70. Each piece is essentially an imagined trajectory through these presets, with an open interpretation and timespace, mapped visually to a graphical onscreen score, referred to by Parker as ‘the curve’. In a further endowment of agency to the performer, these curves are editable, allowing for tweaks and cuts to be made with impunity—in other words, the system and its compositions come with full permission to be hacked.

The inherently open timespace, the devolving of material content and editing rights to the performer, and a ceding of formal control by relying on variations in effort and dynamic on behalf of the player, represent an enabling shift in compositional agency, from the communicating of specifically aligned sonic imaginings, to proposing a flow of possible sound fields. This reflects a wider move in the recent culture of interactive music towards composing musical interactions, rather than interactive music (di Scipio 2003, p271). From the performer’s side, this freedom from pre-determined material obligations places me firmly in the role of free improviser (typically Role C), with the computer providing a kind of hybrid of improvising partner and gaming interface. Affording performer authority over effort levels and temporal parameters enables a ludic approach that can be highly motivating, with results that Parker (2013, CD liner notes) describes as “step[ping] through a landscape of possibilities that teeter between the scripted and the surprising.”

So far, we have seen how gruntCount is an adaptable and motivating environment that is inherently performer-oriented in its conception and user design. It privileges spontaneous, interactive and virtual livenesses (Sanden 2013), drawing on the player’s inventiveness, playfulness and agility (Green 2011) in the negotiation of each curve. These, and other aesthetic livenesses in play (Croft 2007), via temporal and spatial distribution, are supplemented by an attempt to engender the sounds of liveness inherent to some popular

as part of this study. However, automatic saving of relevant performance data is a potential resource for further research and app development. In this sense, gruntCount’s auto-documentation accords with Impett’s observation that experimental interactive systems “generate behaviour which affords tracing and analysis” (Impett 2001, p7).

70 “To add to the excitement, a few parameter changes are not absolute, rather a change may simply offer permission for a meso-sonic sound element to be randomised.” From Parker’s website: http://www.tinpark.com/2011/06/gruntcount/ [accessed 9.8.17]
music performance: amplifier hum, fuzz distortion, and a sense of excitement, bordering on danger, derived from high levels of volume, particularly at low frequencies.

Control: sound

The timeline shows a growing engagement with both the specifics of gruntCount and the generalities of managing the augmented environment. Two modes of control emerge: one inherent to Parker’s design, and the other an adaptation specific to my experience. I will consider each in turn below. With hindsight a good deal of my desire to have more control over the computer was conflated with a more general wish to feel more in control of the situation (4.5). The hybridity of skill levels at this point meant still juxtaposing a long established expertise on the acoustic instrument with a novice status in terms of audio technology. My instinct as a classical performer, it seems, was to project a paradigm of mastery onto the assemblage, which drove my desire to ‘deal with’ or ‘correct’ certain elements of the interaction I had experienced early on with gruntCount.

Firstly, by interfacing at the level of sound, a degree of proficiency and expertise was developed whereby the responses of the computer became familiar and internalised. Intuitive actions were undertaken in response to an enactive knowledge of the way the computer was likely to respond: the system became instrumental. A considerable strength of gruntCount lies in the user’s ability to adapt and save settings as familiarity is developed with the system. This facilitated a fine-grained nuanced sound and interaction that brought a personal interpretation to the system—a personalisation of the instrument, similar to the way we make bespoke adjustments to traditional instruments.

Sound concept was sculpted here by historical and ongoing choices relating to the setup of the bass clarinet, by the way the sound was transduced into the system via microphone selection, placement and gain level, and by a considered setting of the threshold. I eventually became very particular about setting the threshold just high enough, for example, to allow for the use of very soft dynamics on the bass clarinet without triggering progression. This afforded a means to create moments of suspense and dramatic change at the crossover of two presets, or to prolong the enjoyment of a softly intoned interaction. Too low a setting might deny the ability to hold moments judiciously, or worse, risk losing any direct causality (if the sound from the loudspeakers is sufficient to activate a grunt). Conversely, too high a setting created a disjointedness, particularly in explicit transformations such as distortion, and drove the level of effort to a point that was both strenuous to achieve and served to differentiate the acoustic and electroacoustic elements of the instrument. This negotiation of physical effort as the locus of interaction in gruntCount is inherently instrumental (Shroeder & Rebelo 2007; Waters 2013).
Control: the GC-Remote

This second mode of control (Fig. 6.7), introduced just before my first public concert as sole pilot in March 2014, emerged innocently from a request to the composer for the implementation of a hands-free operation facility. It provided an efficient means to rehearse and perform gruntCount without engaging with the laptop keyboard. This encouraged a physical stance that obviated the need to switch from a habitual standing posture to one of reaching—an act which disturbs concentration, and upsets the physiological relationship with the large and slightly awkward low C bass clarinet (Spaarnay 2010, p61-63). I generally prefer to ready myself completely before beginning a piece in a single breathe-initiate-play gesture.

The app also includes the mapping of the master output level, which affords both in situ nuancing and a means to fade out completely. This ‘power of veto’ proved to be a potent further shift in agency (Furniss & Parker 2014, p186). I was now able to fade in and out, or silence the computer, creating solos, or concluding the piece early on my own musical terms, rather than insisting on the authenticity of the game. The ‘kill pedal’ represents a kind of last resort of performer agency, an example of dominion rather than empowerment.
within an ecology, and as such I began to feel ambivalent about it. Similar situational control over the threshold and grunt count settings was rejected by mutual agreement as overly hierarchical. However, when a compelling musical opportunity arose that warranted a fade, I now had an additional tool for shaping narrative liveness. Equally, when my ability to resolve a co-piloted formal thread was severely compromised, imposing an acoustic solo as a temporary emergency measure presented the least worst option. A sense of expectation is afforded by the fade back in, the computer slowly revealing the ongoing thread of its in absentia responses. For the Edinburgh Jazz Festival set (CD2:2) I used the veto as a deliberate compositional device (see below), and remain conscious of wielding its political power with due responsibility within the spirit of gruntCount’s agenda of social and technological co-creativity.

In terms of emerging sound concept, interfacing at the level of sound drew me into the system, contributing to the development of second-order mediation (telepresence) in the electronic assemblage as distal tool (Furniss & Parker 2014, p189; Riva & Mantovani 2012). On the whole, use of the pedal exerted a power over the system that reinforced the duality of player and machine. Performance, though, is a messy and contingent environment. As discussed in Chapter 2, while corporeal attunement to musical forms and optimal states of flow are to be celebrated, embodied interaction with a musical instrument also relies on the building of a repertoire of pragmatic coping strategies on the part of the performer in the face of contingent affordances and constraints (Green 2011, p142; Nijs et al., 2009; Leman 2008). That these contingencies are holistically recognised as recurrent and situational, and that the coping strategies become intuitive responses is also explicit in the development from novice to competent, and onward to proficient and expert on the Dreyfus scale. Pedal control was thus, on the one hand, a mechanism for self-sufficient and nuanced onstage level control, and on the other a crutch to my developing skill—an attending to my felt need for a final say in unfolding matters on stage. It remains a moot topic, and an example of George Lewis’ derided “magic buttons”71 (quoted in Kimura 2003, p290). However, while I am alone among other gruntCount users in availing myself of the GC-Remote, it has become so inherent to my personal assemblage to have become a stable and valued feature.

**Fluidity (and all that jazz)**

By the ECA performance (CD2:1, Perf. 3), there is evidence of a fluent, still at times analytical relationship with the system, and a confidence in handling initiation, crossing between parameter settings, and microphone technique (close, quiet playing to stimulate distortion without activating the threshold). Sections of machine-like, insistent loops in the

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71 While Lewis’ Voyager system has “no built-in hierarchy of human leader / computer follower, no ‘veto’ buttons, pedals or cues” (Lewis 1999), gruntCount, ostensibly does, at least as I use it.
output, which irked in the early stages, are handled without recourse to the volume pedal. A personal sound is emerging (a hybrid of Parker and myself) in habitual melodic fragments, a nascent jazziness, distortion, rapid ticking and synthesiser suspensions. The piece has a fervent energy, charged through with chaotic exuberance at the bass clarinet, with moments of stillness and computer solos, interrupted at opportune moments of transition. I tease out implied harmony and steer the narrative structure of the piece on my own terms. Negotiating the ending, I hover on a single pitch, with pulsing, *bisbigliando* and variegated voicing, waiting for the final grunt. Extending the improvisations to seven or eight minutes has become habitual, which meant, in this case, playing two pieces in a set.

For the the album *Bitter Together* with guitarist Haftor Medbøe (6.2.1), I effected a kind of hacking of the system (Furniss & Parker 2014, p188), whereby certain parameter regions were singled out and shaped into a set of relatively stable, undulating curves (Fig. 6.8), or ‘variable effects units’. This bespoke hacking, personalising what I knew out of a sense of viability for the recording, highlighted elements of the system I enjoyed, and served to personalise the system and move it away from its status as a set of pieces. For the Edinburgh Jazz Festival set (CD2:2, Perf. 4), a broad formal structure was outlined in a new curve, with spaces for solos, and with an estimated number of grunts to last for up to twenty minutes (Fig. 6.9). The event imposed itself on the improvisation, wherein I explored a jazz-inflected feel that I found to be quite natural territory. This idiomatic leaning revealed a tendency waiting to happen—having made the system my own, it teased out of me a jazziness that served the next stage of the work.

![Fig. 6.8](image)

*Fig. 6.8* One of the curves created for the *Bitter Together* album recording with guitarist Haftor Medbøe. This setting (rhythmi-california) is saved in a new version (deepspace9), with a low threshold for smooth response, and a large grunt count to accommodate indeterminate durations.
Maturity

It would be another six months before I performed gruntCount again. Ongoing doctoral research and a co-authored paper (Furniss & Parker 2014) offered a pause to reflect, mix recordings, and evaluate what had been achieved. The paper highlights a growing instrumentality (p188), discussing the musical instrument as “participatory space” (Rebelo 2006), and the proposal of being cognitively present (Riva & Mantovani 2012) in both the acoustic instrument and its augmentation. Rehearsing for the Lisbon performance (CD2:3, Perf. 7), this non-dialectic relationship with gruntCount developed further. By this point I was getting used to letting the system take charge, enjoying the interplay more. I still had access to a veto, but exercised it more rarely, often to make a point, rather than for solos as such—I was still in charge, but could handle anything thrown at me. Furthermore, I was more personally invested in the resulting whole, with the experience of the summer’s recording and Jazz Festival set drawing me rather more explicitly into the idiom. By letting gruntCount have its machine-ness, and being more explicit in my own jazziness, a fully mature, instrumental relationship unfolded.
Towards ensembles

Just as with the earlier collaboration with Medbøe, where happenstance led me to make a significant step towards establishing a personal sound with gruntCount, so too a chance meeting with flutist Anne La Berge served to drive what has already become the next stage in the development of the system—that of ensemble performance. In December 2015 Parker introduced a configurable network communications tab for up to eight performers using their own copy of gruntCount during a short period of research with La Berge and myself (including Perf. 26). We also discussed the issue of control, and agreed on the usefulness of a pause feature, whereby the playhead may be paused to extend moments of pleasing interaction, with the system freezing on its current preset, maintaining a slight variation, the shape of which may be designed in advance. This enhancement became known as the ‘reverie’ feature.

The version was successfully trialled and further developed for a further performance in Amsterdam (Perf. 27). Using iPads running Mira\textsuperscript{72}, we were able to observe each other’s progress on a shared curve, as well as playing/paused reverie status. The result was far more sophisticated than our original experiments with two players playing into one system (as a two piano duo is to a duet for piano four hands). Each player was able to make choices in the editing of the curve, the setup of the input threshold and number of grunts,

\textsuperscript{72} https://cycling74.com/products/mira [accessed 8.8.2017]
adaptations to DSP in the piece editor, and when to engage in a reverie. These developments are still work-in-progress, and have been documented for future publication. Here they serve to illustrate the open-ended nature of practice-based research in mixed music, particularly with regard to collaboration and shared responsibility in the updating and developing of systems. A humanising of gruntCount continues by means of its creator’s determination to maintain a co-agency in the design, development and performance of each successive version.

Conclusions

Like Impett’s meta-trumpet (1994), gruntCount was designed “with the intention of exploiting both physical and sound performance information as compositional material, […] such that instrument, computer and composition are folded together.” Unlike Impett, Lewis and many others, I did not create my own instrument, but rather forged and discovered one during a prolonged brokering of terms with gruntCount’s blurrings. It promotes a co-creative compositional role that privileges spontaneity in the ongoing negotiation of a musical thread, and a collective sound-building that, with sustained effort and experimentation, forges a dynamic and unique instrument. Here then, is a humanised and humanising environment for creative practice and learning. Its richness in both sound and interaction motivated an ongoing engagement with, and development of, the system, producing a variety of potential outcomes, including new pieces, new versions and new collaborations.

Working towards an independently operated maturity in the performance of gruntCount entailed a questioning of assumptions about performer-composer and performer-machine hierarchies, and a radical reappraisal of acoustic-electroacoustic dichotomy to favour the consideration of relational agencies and relative presences that can be generalised across all musical activity, resonating with Simon Waters’ observation that,

through our engagement with the unfamiliarities presented by such systems we become aware of the extent to which the bodily (and embodied knowledge) is implicated in our conduct with respect to, and understanding of, instruments in the broadest sense” (2013, p125).

This work also served to steer the course of my research more determinedly towards improvisation, and away, for a time at least, from repertoire. A growing confidence gained from performing, recording and writing about gruntCount propelled me towards compositional ventures rooted in improvisation, and in the embodied physicality and co-agency of my augmented instruments. It propelled me seek out new electro-instrumental sound concepts, while enacting a shift in improvisational style, and towards a more overtly jazz-influenced, open, relaxed, flexible embouchure than employed previously. As enabled interpreter, the creative freedom offered by gruntCount’s co-authorial role was shown here to feed both a re-evaluation of traditional practice, and a flexing of compositional muscle.
7 Role C: enactive composer

7.1 Case Study 5

Pete Furniss

with C-C-Combine: corpus-based concatenative synthesis in Max by Rodrigo Costanzo (2012)

Ajkad Csupa Vér (2015–17)

Fragmentations (no mouthpiece) (2017)

Fragmentology (Blues for Rod) (2017)
I’ve been wanting to do something with corpus-based concatenative synthesis (CBCS) for a while, using the clarinet to stimulate the process, and recently discovered Rodrigo Costanzo’s C-C-Combine for Max. It’s open-source software and available for download from Costanzo’s website. CBCS is […] essentially a neat way of scattering tiny fragments of sound from a chosen audio file in a responsive manner to your input, […] which in this case is the live sound of the clarinet. Within 30 minutes of downloading I was making music with one of the available sound sets (here I’ve used the glitch drums). By the afternoon I’d created a few of my own corpora—there’s some very clear built-in help for this. I was quickly able to start to experimenting with the configurable parameters and roughly recorded some takes with the drums, just in my kitchen at home in Edinburgh, using the built-in microphone/camera and headphones. Wanting to draw on the musicality of spoken language, one of these sets was adapted from a Public Domain recording of a poem by Endre Ady, Félig Csókolt Csók, about burning, stolen half-kisses on a wintry evening, including the words “…my lips full of blood, your lips full of blood” (Hung. ajkam csupa vér, ajkad csupa vér). I wasn’t so much drawn to the poem itself (which is nevertheless a beautiful thing), but to the idea of spoken language as music in itself. I learnt some Hungarian when studying there in the 90s and found the kind of musicality I was looking for in this reading: a suggestion of language, glimpses of words, hints at meaning through onomatopoeia, intonation, rhythmic insistence, and vowel harmony.

The software has an easy to use auto-record function, which is useful for testing and archive purposes. Once I’d made and roughly edited a recording with the voice, I fed the resultant sound file back into C-C-Combine with the drum sounds reloaded, and then quickly mixed the two together.

Technical and musical expediency were instrumental in bringing the pieces in this section to fruition, as attested by the above text73, written a day after downloading and trialling the software. The richness and fluid response of a corpus-based system demonstrated at the NIME conference a few months earlier (Schwarz et al. 2014), had

73 Adapted from an online article at https://vimeo.com/116210220 (see the Supplementary Materials), and a later post at: https://soundcloud.com/pete-furniss/ajkad-csupa-ver [both accessed 11.8.2017]
inspired me to look for a similar implementation for clarinet. Online research around the subject quickly led me to the C-C-Combine page\textsuperscript{74}. This performer-oriented patch matched my musical purposes, as well as being up to date, open-source and free to download, supplied with ready-made corpora and analyses. Finally, it was tested in the latest full and free versions of Max. The downloaded folder’s instructions were as user-friendly as those on the website:

Copy the required externals to the appropriate place (Max6\textsuperscript{75}/Cycling ’74/msp-externals/). You can leave all of them in their folders.

Move the ‘C-C-Combine’ folder to the desired location (keep all files contained within together).

Open the main file (_Combine).

Follow the instructions in the “info” window and enjoy!

A minor issue relating to the required Max external objects\textsuperscript{76} was quickly resolved. Again, an initial exploratory setup of built-in input and headphone output facilitated the flow of the trialling process. Loading a sample corpus from the website was straightforward (drag-and-drop), and I was quickly absorbed in engaging and responsive improvisations with Costanzo’s \textit{glitch drum} corpus\textsuperscript{77}. Using the patch’s record function in tandem with a DAW afforded a reflective cycle of playing, monitoring, adjusting and repeating, with musically engaging, enjoyable results, and the process rapidly became absorbing.

While my improvisational practice was well established, and I had considerable experience of transcription, arranging, and collaborative composition, making something viable to perform publicly under my own name\textsuperscript{78} felt difficult, especially in a technological and academic social sphere dominated by innovation and complex, sophisticated systems. It was clear immediately that C-C-Combine offered a means towards original work, via a ready-made, performer-oriented platform, with a simple processing paradigm to negotiate, and a blank slate in terms of sounding material. This evidenced a considerable shift in confidence—the expediency of reaching of a highly satisfying level of musical interaction and creativity within a matter of hours had been both motivating and enabling. I had gained technical skills and knowledge through working with the parameter settings, developed new creative work that served a sketches for the pieces presented here. Importantly at this

\textsuperscript{74}http://www.rodrigoconstanzo.com/combine/ [accessed 11.8.2017]
\textsuperscript{75}The latest version of Max at the time of downloading.
\textsuperscript{76}Included in the Supplementary Materials. The downloaded set of Alex Harker’s objects differed slightly to those he had supplied for Fluence, but with sufficient duplicates to cause conflict warnings in Max. However, setting and changing file path preferences in Max was by now a familiar task—part of an essential operative knowledge of the contemporary augmented performer.
\textsuperscript{77}A recording of the first of these short improvisations, as well as the \textit{glitch drum} corpus sound file, are included in the Supplementary Materials.
\textsuperscript{78}The compositional status of improvised works notwithstanding (Nettl 1974; Bailey 1992)
stage of the research, I clearly felt sufficiently pleased with the results to share them on a public platform.

Fig. 7.1 First contact with Rodrigo Costanzo via his website comments. Within less than an hour, it was possible to become musically engaged, and absorbed in a process of reflective practice with the recorded outcomes.

Working with C-C-Combine

The software interface is clear and practical, designed with a clear remit to show need-to-see information only in its Presentation Mode default. Settings allow the user to scale the match rate (how active the output will be), grain size, and level of random processing of pitch. I kept match rate low to avoid a chaotic feel, and grain size generally high to draw whole syllables and privilege a level of causality in the recognition of grains. I set the random pitch variation off to begin with, later adjusting it to very low (0.03) in order to inflect the vocal output (and later, clarinet pitches), without perceptible timbral change. Setting the recognition parameters is where most of the experimentation occurred. Parameters based on loudness, pitch, centroid and roughness determine what the patch is ‘listening for.’ Setting these above 0.6 proved to be highly controlling, which at first was useful, and had a calming effect on the output. With much higher settings, however, there were long pauses, or limited, repetitive response, with only so many grains in the corpus that matched the exacting parameters.

Preset input types are available, which here were easily supplemented with custom clarinet input recordings and analyses (instructions for this are built in). The record facility is practical and enables a cycle of learning, and finally MIDI mapping of the parameters, initiation and output volume (for which a bar in the display was added to the interface) were facilitated by a user-friendly MIDI learn function.
Fig. 7.2 The C-C-Combine interface offers clear, user-oriented presentation and functionality. Parameters for control of the output, matching engine, input type and overall balance are logically ordered and readily mappable to MIDI control. My additions here were a preset management system (later abandoned) and output volume display bar (top).

Lips, fingers and words

An early test corpus of speech\textsuperscript{79} drew me into language. The idea to use poetry came from a performance I had recently taken part in of Kaija Saariaho’s Circle Map (2012), which features Persian text in the tape part\textsuperscript{80}. An online search for open source audio files led me to the Ady poem\textsuperscript{81}, and within minutes an mp3 of the poem was loaded into the patch. A few trial takes, recorded in the patch, established a sound concept, and an approach to musical material that drew the improvisations towards an emerging composition, and I began to further document the process with the laptop’s built-in camera. A secondary layer of response was created by playing one of the recordings through the glitch drum sample set, via the sound file input option, again recording the subsequent output. The two concatenations were edited together and ported to the video, in order to create an online archive of this rapid and productive process\textsuperscript{82}.

In this short Stage 1 period, a good deal of the piece was established, including a malleability of tonal quality and intonation of a traceably Eastern European or Turkish influence, with pronounced embouchure flexibility and mellifluousness—a sound also related to the pickup microphones used in those countries (2.3), which I had recently begun trialling. I was drawing on the language, but not overtly at this point Hungarian, but rather, an exploration of otherliness in the variance of timbre and tuning in the tone of the female voice. I had started using fingers on holes, without key noise, as a means to explore the

\textsuperscript{79} See the Supplementary Materials.

\textsuperscript{80} See blog post (Furniss 2014): Saariaho’s ‘Circle Map’: electronics and the orchestra [accessed 9.9.17]: https://petefurniss.wordpress.com/2014/05/18/saariahos-circle-map-electronics-and-the-orchestra/

\textsuperscript{81} Full text and translation at the end of this study (7.1).

\textsuperscript{82} See the Supplementary Materials. Also available at: https://vimeo.com/116210220 [accessed 9.9.17]
bending of pitches through finger slides and an exploration of imprecise microtonal fingerings (by sound quality rather than any schema).

Using speech encouraged a maximum (20ms) grain size in order to reveal whole syllables. Snippets of meaning emerge, via more or less truncated words formed by the arbitrary grain slice, eg. ajka- (lip), este (evening), tűz (fire, passion), fél - (half), egy (a, one). Language as carrier of meaning intruded on the original intention to interact with the words as pure sound, and from this point onwards, the text asserted itself in the piece and its performance. I became drawn into the poem, the reader’s nuances of delivery, and the granulation’s accidental affordances of meaning, the interaction thereby gaining further layers or interactive and authentic inner liveness.

**Embracing the machine**

The settings I instinctively found myself making were at first highly restrictive, and could be framed as *taming actions*, while at the clarinet I was preoccupied with exploring the push and pull of system, identifying thresholds, pivots, tipping points; hovering, testing, holding, pushing away, and teasing out ways to have the response feel instrumental on my terms. My background weighed heavily on these terms, which at this stage were close to John Croft’s conditions for instrumentality (2007, p64): that a system should produce traceable, synchronous, proportionate, connected responses, in terms of energy, morphology and timbre, and that the relationship between performer and system should be stable, consistent, learnable and above all fine-grained.

While C-C-Combine is configurable to a degree, it resists such strict interpretations of hybrid instrumentality. The premise of concatenative synthesis privileges an inherent disconnected choppiness, with the small grain size (0.2-20ms) and optional randomise function foregrounding an element of glitch aesthetic at the heart of its design (Prior 2008, p306; my emphasis):

... what Cascone (2000) has termed an ‘aesthetics of failure’, glitch explores the digital interruptions of machines commonly used only to omit mistakes or improve sound. At one level, it is what happens when the idea of human presence is almost totally subordinated to the machine, when music becomes pure programming. At another, it comprises the digital music of a technophilic generation negotiating its relationship to the history of electronic music.

Negotiating a technophilic relationship to the advancing history of electronic music shifted my research approach from one of “how can this technology be made more human/humane for the performer?” to a more informed, embedded and softened “how can this human performer be accommodated and empowered within an increasingly technologised environment?”
The answer, it seems now, lay in the accommodation, beginning with a resolution to rein in the veto of the volume pedal, and embrace the indeterminacy of the randomiser to provoke any staleness that might creep into the narrative. This can be heard most effectively in the final section of *Ajkad Csupa Vér* (CD2:5). I moved, both here and elsewhere, towards a more collective attitude to control. As with *gruntCount* before and *An Errant Soothing* after, it transpired that allowing a machine some space to be machine-like, negotiating a liveness of difference, makes musicking with machines more interesting.

The system relies on the performer to provide sufficient liveness to extend viable improvisations. Its static, one-way response represents an inherent risk to sustainable narrative liveness. My approach to this enabling constraint was two-fold: attending to the corpus on the one hand, and to inner liveness on the other. In negotiating indeterminacy, Simon Waters similarly identifies an inherent spontaneous and interactive liveness on the part of the performer (Waters 2013, p129):

Such a ‘counter-intuitive’ approach, evident also in faders or rotary controls with discontinuous mappings, glitches, or ‘zones’ of intensified or differentiated activity, similarly requires real-time evaluation and adjustment on the part of the performer—a sense of palpable engagement. [my emphasis]

Ultimate machine agency lay in the patch’s randomiser, while my volume pedal offered a power of veto from the other side. Traceable connections within the matching were not always obvious or predictable, nor stable—the ‘game’ to some extent became about sniffing out more or less stable responses, while treating the unexpected, non-linear and random processes as provocations for change, or parallel threads to run side by side with my own trajectory. The ‘sh-sh-shing’ and attenuated consonants of *Ajkad Csupa Vér*, and my response to its fleeting insistences on syllables and words (understood by me, if not the audience) form a kind of virtual liveness of dialogue, and an authenticity to my connection with the language and poem that feeds the overall sound concept of the piece—one imbued with sorrow and regret.

**Into the open**

The first performance of *Ajkad Csupa Vér* took place three weeks after the first sessions, and also included the first version *Fragmentations*, a loose holding title for improvisations with a second corpus, this time of clarinet sounds (Perf 9). I implemented of a preset system in Max, but later abandoned this, preferring to find settings in the run up to performances and recordings. For the live version, *glitch drum* samples were added to the a corpus alongside the vocal, but this crude attempt to recreate the dual layer of the early video was not particularly successful. Returning to the piece later that year, I focused on a simpler dialectic negotiation of clarinet and female voice (Perf. 24). For this second performance, during a period of research on his *Preludes*, Richard Dudas added a 4-channel output, which is used on each of the recordings here (CD2:5-7). The added spatialisation serves to clarify
the overall texture, especially where sections of highly active output might otherwise overcrowd the acoustic instrument.

For *Fragmentations*, an extended corpus of B♭ clarinet sounds was made, using mainly extended techniques: breath, spit, slap tonguing, multiphonics, and high frequency teeth-on-reed sounds, as well as free sections of more melodic material. In 2017, I added a further set of contrabass clarinet samples, which served to considerably enhance the overall sonic texture, providing a significant breadth of frequency range and tonal contrast, and began also to use the bass clarinet with this corpus, as its range sits neatly between the other two instruments.

**Capturing: Fragmentations (1)**

The recordings represent a third stage of development of these pieces, following the early sketches and subsequent performances. *Fragmentations* was the more straightforward of the two. Several takes were made on both clarinet and bass clarinet. I had explored playing the former without the mouthpiece in an early pickup-oriented system in Ableton Live (see 7.2), and was inspired to pursue the technique further by one of bassoonist Dana Jessen’s recent recordings. Pushing beyond my habitual improvisational style, rather than playing safe for the recording, I aimed for a blurring between live part and concatenated samples, and the outcome (CD2:6) provided contrast in my overall use of the software by deferring fixed pitches to the computer. It was a crude approach of onslaught over interaction, which, alongside the physical demands of the delivery, necessarily entailed short bursts of intense energy. In this complete take, I faded out the processing briefly to highlight a soft, liminal quality in the clarinet, leaning close into the lower microphone for an exaggerated, in-bore tonal quality.

**Accidents: Fragmentations (2)**

Improvisations can be difficult to find in the recording studio. The following commentary recounts how a chance discovery, through ongoing tweaking of settings now lost, led to *Fragmentology (Blues for Rod)*, which was edited from three takes at the end of the session, and named retrospectively in homage to both be-bop nomenclature and the system’s creator.

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Stepping back in: **Ajkad Csupa Vér**

The central challenge of recording *Ajkad Csupa Vér* was in negotiating its status as a piece—to what extent would I attempt to reconstruct the early video version, for example? It was important to keep hold of the piece’s sound concept, tonality, and certain melodic devices, as well as maintaining a consistency of interaction with the vocal. But improvisation and spontaneity lie at the heart of all of this work, and replicating past experience would place an emphasis too firmly on control. I settled on an overall guiding structure (based on the video) that left plenty of space for development and spontaneity. The final version (CD2:5) was edited from three full takes. I also explored the randomise function, mapped to a foot pedal, making a series of short extra takes that probed extended techniques, jumping
between randomised parameter settings and following whatever they afforded, which engendered a heightened spontaneous and interactive inner liveness. This further released the piece from the shackles of control, and provided a unique and engaging coda to the edit.

Moving to the acousmatic environment of a sound recording, a shift in the corporeal liveness became evident during the editing and mixing process. The granulated vocal achieved greater parity with the clarinet, for example, and extra care was taken to ensure the presence of the clarinet throughout. This revealed a further layer to the outward liveness of the piece, and raised questions of identity, as Jean Penny (2009, p55) also found:

The impact of melding voice or whispering, or of using the voice as narrative in disembodied projection immediately changes the expression: it becomes a recognizable human, located within, or distant from the player. The position of the player immediately becomes subject to distance perception, to reality challenges and identity questioning.

Summary

Overall, I responded positively to an accessible, robust and well presented piece of software that was designed by an experienced improvising performer for use by performers. Later, I used it as a tool for establishing more structured and/or sonically predetermined compositions. These pieces demonstrate the effectiveness of early expediency, and here offered a first taste of autonomous creative work that quickly led to viable public performances. Ideas were shaped into sketches that developed longer trajectories. A compositional approach was established that privileged enactive processes of continual engagement, new electro-instrumental sound concepts, and spontaneity, showing the humanising framework as a fruitful path to creating new work.

The challenge of sustaining sufficiently extended and engaged performances while restricted to one technical process required me to tease out connections and respond quickly to indeterminate responses. According sufficient voice to the glitch-inspired aesthetic of the concatenated output reflected a growing practice-wide shift in approach, from an emphasis on control to one of negotiating a liveness of difference and balancing performer-machine interagency.

Revisiting the works for further performances and recordings required determining the compositional nature of Ajkad Csupa Vér on the one hand, and finding multiple approaches to instrumentation and techniques in Fragmentations, stretching improvisations beyond the habitual, and taking advantage of fortuitous happenstance. Expanding the software output into four channels provided a further layer of immersion and spatial liveness, although this could be implemented more dynamically in future. Further research could also include notating Ajkad Csupa Vér, either in full or as a set of guidelines, with a standalone or Max runtime (free) version of the software, and providing suggestions for parameter settings in the score.
The poem

<table>
<thead>
<tr>
<th>Hungarian</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Endre Ady (1877–1919)</strong></td>
<td><strong>A half-kissed kiss</strong></td>
</tr>
</tbody>
</table>
| **Félig csokolt csók** | **Egy félig csokolt csóknak a tüze**  
**Lángol elébünk.**  
**Hideg az este. Néha szaladunk,**  
**Sírva szaladunk**  
**S oda nem érünk.**  
**Hányszor megállunk. Összeborulunk**  
**Égünk és fázünk.**  
**Ellőksz magadtól: ajkam csupa vér**  
**Ajkad csupa vér.**  
**Ma sem lesz nászunk.**  
**Bevégzett csókkal lennénk szívesen**  
**Membékült holtak,**  
**De kell az a csók, de hí ez a tüz**  
**S mondjuk szomorún:**  
**Holnap. Majd holnap.** | **We anticipate the burning flame**  
of a half-kissed kiss.  
The evening is cold. Sometimes we run.  
We run weeping  
And we never arrive.  
How often we stop. Embrace  
Burn and freeze.  
You push me away: my lips full of blood.  
Your lips full of blood.  
There’ll be no honeymoon today.  
With the end of the kiss we’d be happily satiated  
Dead bodies  
But we need that kiss, the burning of this fire  
And we sadly say:  
Tomorrow. Tomorrow.** |

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84 Hungarian text retrieved from: [http://mek.niif.hu/00500/00588/html/vers0101.htm#06](http://mek.niif.hu/00500/00588/html/vers0101.htm#06) [accessed 5.5.17].  
**Multilingual Poetry Collection 020** (LibriVox.org). Public Domain. Date unknown.  
[http://ia600303.us.archive.org/30/items/multilingual_1204_librivox/hungarian_feligcsokoltcsok_ady_dii.mp3](http://ia600303.us.archive.org/30/items/multilingual_1204_librivox/hungarian_feligcsokoltcsok_ady_dii.mp3) [accessed 8.7.17]
7.2 Case Study 6

Pete Furniss

An Errant Soothing (2016)

Simple system

Like Ajkad Csupa Vér, this improvisation-led composition was born of experiments at home with only laptop and headphones. I had become frustrated by the progress of a series of recordings (later abandoned), using my own effects-based system in Ableton Live that had been steadily developing in complexity for over a year. The rather planned improvisations had become overly complex in terms of design, control parameters, and layers of future editing. Before a last day of recording I decided to begin afresh, auditioning new audio effects, discovering and interrogating one after the other to find new sounds and responses. My hope was to find a new way to support extended and dynamic improvisations, with a convincing electro-instrumental sound concept, and which was straightforward in terms of processing and gestural control.

Following Stage 1 rehearsal at home, I brought the system straight into the recording venue, making four takes that same evening, of which An Errant Soothing is the last whole take, unedited. Stimulated a shift in approach, away from multiple manual and pedal control, towards a focus on sound as the primary interface. The piece was performed for the first time almost a year later, at Leeds College of Music (Perf. 33), with the following programme note:

The clarinet is augmented here with a combination of a highly touch sensitive stereo phasing effect, and multiple unstable audio feedback channels. This affords two distinct fields of expression: one (controlled) privileging stillness, touch, breath and modal tonality, the other unpredictable, effervescent, disturbing. The improvising clarinettist is tasked with negotiating a thread through this double landscape—a daydream perhaps, or some semi-conscious, troubled reverie before drifting into sleep.

In the following study I outline the first system’s emergence as a flawed but ultimately useful, confidence-building means to:

• produce original work for viable public performance
• develop strategies for collaborating with others
• pursue a discovery-led research practice that informed my overall approach

I then detail the rationale and process of this new system—which in the end became a piece—and provide a commentary on the recording (CD2:8).
Auditions and trials

Performance lies at the heart of Ableton Live’s design, rendering it relatively easy to use at the initial stages. The dual interface provides both a standard, linear DAW approach for recording purposes and a modular layout that facilitates the supervision of channel routing, set-up and effects chains. The user has access to a vast array of audio effects and Max for Live devices that can simply be dropped into tracks for immediate testing. Furthermore, mapping to MIDI controllers is straightforward, allowing for quickly put together and adapted ad hoc assemblages.

An early, discovery-led, Stage 1 process of auditioning audio effects, loading device by device into channels, listening via headphones, testing sounds, pitches, and short bursts of material, observing dials and meters, established a basic setup that dictated the future direction of the system. Anything that yielded interest, that held attention for long enough to keep playing, or stimulate a tweaking of parameters—whether understood or not—was saved into a growing stack. Further adjustments moved the process into a cycle led by embodied action and listening: where the ear informed, later reading of the manual and other related materials enlightened.

Growing

Once effects became established, the same process was applied to combinations, layering one effect after another in a chain, through a more or less considered curiosity. I threw one thing after another—for example, a harmoniser, looper, granular synthesis object and panning device—only attending to sound, and often with any knowledge of the theory behind the objects or their purpose. Expert advice was eschewed for a while, in order to work through the early steepness of the learning curve with a motivating sense of open exploration and play. I responded positively to this period of barely informed play as a creative tool, beginning to feel confident in the various sketches I was making. The first system grew from at first loosely exploring a free jazz-influenced approach\(^{85}\), via several experimental tangents\(^{86}\), to become a more or less established, naïve but viable system\(^ {87}\).


\(^{86}\) For example, this exploration of dirt, noise, granular synthesis and distortion: Rye Scream (2015) https://soundcloud.com/pete-furniss/rye-scream [accessed 9.9.17]. From notes included on the track page: “Here I seem to be letting off steam while embracing a high-octane sound world of dirt and loudness (up to 11). I put it down to all those years cultivating a richly warm, clean, expressive tone on the clarinet. Without throwing all of that away (far from it, I very much continue to evolve my sound on the instrument), the exploring of augmentations to an instrument may also involve finding creative ways to degrade it. Digital distortions provide their own modes of expression, just as ‘growling’ (vocalising into the mouthpiece while playing, as used in klezmer or jazz) can engender the dramatic urgency of yearning/grief/laughter; and just as multiphonics (here created by overblowing a note to produce an exaggeration of its upper harmonic partials) can move pitched sound towards noise.”
It was taken into various performance contexts, including solos at conferences (Perfs. 16-17, 25, 31), research seminars (Perfs. 24, 26, 29, 36), and extended to include small and large ensembles\textsuperscript{88} (Perfs. 13-14, 16, 23), visual art/dance collaborations (Perfs. 18, 21), and an improvised theatrical piece (Perfs. 19-20).

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{image1.png}
\caption{Outgrowing the first Ableton Live system. Two expression pedals, a 4-button foot controller and manual MIDI interface were used to control the Live set, by now running multiple looper in different speeds, two granular synthesis engines, a panning effect, two parallel harmonisers, stereo delay, bit reduction, and convolution reverb, as well as a separate gruntCount channel.\textsuperscript{89}}
\end{figure}

I became increasingly driven to add layers of complexity to the assemblage, in an attempt to find the kind of dynamic interaction that had proved so motivating in gruntCount, but eventually had far too many processing devices and gestural control parameters to maintain a convincing, musically driven narrative thread. I found the ad hoc complexity of the setup equally invigorating and confusing. During the latter stages, I had four buttons and two expression pedals at my feet, with the manual device at midriff height, running multiple


\textsuperscript{89} https://www.youtube.com/watch?v=qtKpbH5v8I&list=PLZYaObEdMoix8WB5WlofzdzrbOp301SE8&t=8s&index=13 [accessed 9.9.17] (Perf. 31)
loopers in different speeds, two granular synthesis engines, a panning effect, two parallel harmonisers, stereo delay, bit reduction, and convolution reverb, as well as a separate *gruntCount* channel (Fig. 7.3). Something needed to give. I had also become reliant on the isolated input K1X pickup microphone, without which many effects became compromised, and would, in case of malfunction or loss, be difficult or even impossible to reconfigure in a short space of time.

Fig. 7.4  Video analysis in Reaper was undertaken soon after a session using the first Ableton Live system, showing part of the commentary. The analysis indicated that, while I was motivated by musical concerns, physical interaction was still leading the decision making process, through analysis rather than intuition.

Outgrowing

An illustration of my outgrowing this early system was provided by an invitation to participate in Rodrigo Costanzo’s Improv Analysis project, which used quantitative methodology to support phenomenological accounts of experience. I made several video recordings and soon after made autoethnographic video analyses, completing a detailed and vernacular account of thought processes and motivations (Fig. 7.4). Costanzo analysed the commentary and uploaded statistical results to a growing repository of artists’ work.

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There is insufficient space here to digest the results of this analysis, but in short, the findings tallied with experience: namely, that some viable sense of electro-instrumental sound concept and fluency had been attained, but that on the whole my musical thought process and improvisatory instincts were tending to be undermined by an *analytical*, rather than *intuitive*, decision making process (Dreyfus & Dreyfus 1980). This supported the move to simpler, and less cognitively taxing control mechanisms.

The complexity of the mature early system had taught me to appreciate both its potential, and perhaps more importantly, the gulf in dynamic interaction in comparison to that achieved with *grantCount*.

**A new hook**

Embarking on the new project, the simplicity of a woodwind instrument without keywork was a starting point—my technique of playing with the clarinet’s ring keys depressed (see 7.1) afforded a pleasing combination of popping and pitch-bending via fingers on tone holes. I sought out a fine responsiveness to touch in the processing, drawing again on the physicality of Rich Contacts (Schwarz et al. 2014), and on the Mogees\(^2\) audio device. I was also keen to investigate a musical landscape that privileged quiet reflection, melody and modality—an approach that began with *Ajkad Csupa Vér* the previous year—which was in part probing a resistance to my tendency to break out into sections of chaos in improvisations.

For the auditioning process, I steered my attention towards Max for Live, as this also seemed to be a way towards configurable and self-designed systems for future research. The main ‘hook’ effect here was the Max BalanceStereo\(^3\) device, a stereo comb filter. I had immediately found what I was looking for, without really knowing what it was. Others effects were added (see below), based on a combination of instinct, growing technical knowledge, and persistence. The feel of the piece, as well as the modal material, were soon established in this Stage 1 home rehearsal environment, and were rapidly developed in the recording venue, with the K1X pickup microphone affording richer and more sensitive responsiveness to various applications of touch.

**Two streams**

There are two main streams of processing in the system—one effects chain and one send. Following the input from the pickup microphone to Max BalanceStereo, the signal is sent through three further devices: a flanger (Flange-o-tron), amplitude slicer (Max CutHacker)

\(^2\) [https://www.youtube.com/watch?v=30xWm0fyqsc](https://www.youtube.com/watch?v=30xWm0fyqsc) [accessed 9.9.17]

and finally, overdrive (Max Overdrive). The output is sent to the Feedback Network\textsuperscript{94} device, which is compressed, firstly (pragmatically) to avoid clipping, and secondly (personally) to achieve an appropriate balance, poised between affording the clarinet central presence in the mix, and pushing at a sense of overwhelming it.

![Fig. 7.5 The Ableton Live set for An Errant Soothing, showing the effects chain of EQ, compression, stereo comb filter, flanger, amplitude slicer, and overdrive (channel 3), as well as the feedback (send A) and reverb (send B) channels. Other tracks and sends are for diffusion or recording purposes only.](image)

The comb filtering is highly sensitive, which affords a playing technique based on an array of physical attacks on either the keys, the body of the instrument, or the pickup casing itself. Percussive gestures on the open holes, the body of the clarinet, the reed, or directly on the pickup microphone, produce high frequency transients that are amplified and processed, including a continuous, variegated rhythmic splicing. The effect is reminiscent of a kind of phasey sitar drone, with an implied (entirely unintentional) tonal centre of E.

While I chose the sound of the clarinet as the primary interface for the recording, three controls were added for performance, operated from a pedal controller: initiation of the piece (the comb filtering is immediately audible upon activation), and on/off control of the slicer and overdrive functions. Two expression pedals were used for both recording and performance, one controlling the feedback channel level, and the second mapped to the number of steps in the flanger output, again for variety of texture, should the overall field feel too static.

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\textsuperscript{94} Flange-o-tron and Feedback Network are both included in the Pluggo downloadable pack (Cycling '74): https://www.ableton.com/en/packs/max-live-pluggo-live/ [accessed 12.8.17]
Feedback Network features five units, each with a filter and delay line, and is fed by both the clarinet signal and the effects chain (Fig.7.5). I capitalised on the relative independence and randomness of the device to encourage an ever-ready backdrop of indeterminate and ambiguous nested dynamism, which could co-direct the narrative of the improvisation, and be brought in and out (or graded) at will.

The whole assemblage drew me into a meditative, soft, sustained and melodic delivery within an Aeolian/Dorian mode centred on F# (concert E), limited to a range of just over two octaves. I found the drama of an extended improvisation to be richer with the ability to bring the feedback in and out via the expression pedal. In the end, stillness and a plaintiveness in the clarinet figures were set against the unsettling illusion of acoustic feedback in the high frequency range. In the lower range, the feedback billows far beneath the lowest frequencies of the clarinet, while the busying energy of the mid range units support the rhythmic pulsing of the flanger and splicer.

A co-directed thread

A five-part structure emerges in the improvisation, which begins with a long introduction, establishing the omnipresence of the first effects stream, stimulated by percussive tapping on the tone holes of the clarinet. Waiting for the right moment, I fade in the feedback to follow the clarinet entry [0:44-52] and open into a melodic section, picking up on a sliced resonance in the processing [1:14]—I home in on these fluttering resonances throughout the piece, using them as pivots in the melodic line (later, I can be heard repeating a figure [2:23-33] to replay the effect). A playful, closed-ring tone hole figure [1:40] becomes (deliberately) insistent, and reminiscent of a kind of glitch or machine-like repetitiveness. This was something I had enjoyed playing with in an earlier take, and had decided to go looking for again if it felt right. The third section breaks out into a cry [1:55] that turns out to be a brief dynamic peak in an otherwise subdued and intimate delivery. The saturated, overdriven sound of the clarinet is highlighted in the final figures of the section [2.40-55].

Fig. 7.6 Feedback Network, a Max for Live device from the open-source Pluggo pack by Cycling ’74. The settings shown are as used in An Errant Soothing.
The piece then falls into a shorter, softer recapitulation, the feedback fading in solo this time onto the bed of tapping and processing [3:15]. There is an airier, feathery feel to the clarinet sound. I play a little with fading the feedback in and out, to follow the contour of the narrative, which doesn’t want to be subjected to a constant or sudden blurring here just yet [3:29 and 3:36-39]. There is a strong sense here of a variation on the original melodic section. I sense the beginning of an ending [4:33], but the feedback has different ideas, and I must wait. At times, I’m playing with one hand in order to activate the comb filtering effect [4:55]. The loose, flexible, jazz-inflected sound of this slowly easing section is finally drawn [5:20] into a strongly resonant, sliced, and overdriven F#, which becomes extended into a coda, and turns out to be a very long and final resting pitch. I move [5:23] to a more direct percussive tapping on the pickup itself while holding the F#, which only requires the thumb and first finger of my left hand, and continue to explore different attacks throughout the rest of the coda, until it feels right to close the piece.

Summary

An Errant Soothing reflects an iterative, reflexive, and discovery-led research process, revealing an electro-instrumental sound concept through the auditioning of audio effects in Ableton Live. The outcome was guided by a cyclical process of listening, recording, and performing, with a focus on touch sensitivity—the feel of the assemblage. An earlier setup became far too complex to sustain musically driven engagement and narrative liveness, but while it undoubtedly had a certain clumsiness, it had allowed me to bring my own voice and material to the public arena. This confidence was gained via expediency and attending to and both pragmatic and (especially here) personal issues of sound, liveness and control.

For this second system, material content and processing were simplified to allow room for the computer to take a co-directing role in the unfolding of the piece. Gestural controls were limited to initiation, level control of one of the channels, and optional timbral nuancing, while a reliance on equipment that would be difficult to replace was reduced (knowing that the processing had functioned well at Stage 1 using only the built-in laptop microphone). The emerging piece amounted to a fresh start, and proved to be performance viable beyond the initial recording.

A brief reflexive commentary on the recording revealed details that show the piece to have been engaging and viable in terms of creating extended, structured narratives in performance. There are livenesses of authenticity, discovery and spontaneity in evidence in the recording, traces of corporeality in both the clarinet line and the touch sensitive processing, as well as a looming and ambiguous liveness of threat, or danger, inherent in the feedback.

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95 A feature shared with infra-instruments (Bowers 2005; Green 2013), and not wholly a constraint.
Part 3

From mastery to presence
8 Conclusions

8.1 Summary

In Part 1, the augmenting of traditional instruments by electronic and digital means was seen to have developed over several decades, revealing spatial, temporal and causal dislocations between sounding sources, and giving rise to an oppositional dilemma in mixed electronic music. Chapter I outlined out a research framework designed to accord the performer sufficient say on sound, and to facilitate an ongoing thread of liveness. I aimed at the outset of this research to move towards an onstage, *embedded* operation of clarinet and electronics, in a contemporary culture whose technology is also homogenising and synthesising orchestral instruments. Developing self-efficiency of operation emphasised the considerable gulf in my familiarity and skill between the acoustic and electronic elements of the new assemblage. This *humanising* research agenda emphasised an ethos of personal empowerment, affording the requisite control to curate considered, creative and engaging musicking within a variety of performance ecologies.

Chapter 2 was concerned both with pragmatic issues of sound, and with the personal curation of *sound concept*, which contributes to a unique and externally perceived *personal sound*. A three-stage working methodology was established, privileging early on a minimal
setup that focused on musical expediency (Stage 1), moving into a period of rehearsal that simulated performance conditions (Stage 2). Internal mixing within the audio interface was found to be an efficient means to achieve requisite balance and blend and establish unified *electro-instrumental* sound concepts, and this *embedded* approach significantly enhanced efficiency and communication with technical co-performers on performance day (Stage 3).

Finding expediency in Stage 1 rehearsal was framed in Chapter 3 as a form of embodied *inner liveness* that anticipates the social environment of a performance. Different types of liveness were identified as being in flux, especially during the *outward liveness* of performance, forming an ongoing thread. An important aspect of managing attention was seen to be in my relationship to visual materials, where engrained habits of score annotation were translated to user interfaces.

![Fig. 8.1](image)

*Fig. 8.1*  An early (engrained) emphasis on control became tempered by an ecological approach. The clarinet’s materials and augmentations were understood to impose on my playing, as did the space and other people in it. Negotiating an interagency of the human-machine relationship was revealed as more rewarding than the idea of instrumental mastery.

In Chapter 4 an emphasis on technological mastery was seen to be inherent to my training and professional background in classical music. However, an ecological approach gradually emerged that aimed at balancing the various influencing elements, which were found to be myriad. This reflected a gradual shift in emphasis from a paradigm of control, towards one of negotiating an appropriate level of influence—a nuanced reassembling of the musical, in the service of sound and voice, inner and outward livenesses, and a guiding of interagency (Fig 8.1). Developing an embedded fluency with a particular augmented
assemblage was seen to (potentially) engender a unified instrumentality, contributing to a general reframing of musical instruments as filters of physical energy, identity and culture.

Reflections on Roles A, B and C

In Part 2, I specifically addressed three creative roles according to a performer’s material autonomy—executant interpreter, enabled interpreter, and enactive composer, and its six case studies detailed a growing balance of practice that feed into itself. The discipline of executing strictly notated compositions generally encourages rigour in improvisation, influencing form and giving rise to a confident, embodied use of tone colour, pitch range, dynamic shading and other techniques (extended or otherwise). Freedom of expression and spontaneous creativity encourage an exploration of thresholds, and of unfamiliar communities of practice. Experience of improvising may “promote the readiness to seek variation in musical play” (Benedek et al., p120). This suggests that roles B and C benefit the kind of creativity, agility and playfulness that are desirable in Role A. Overall, a wealth of expression and cultural awareness feeds the interpretation of precisely notated scores, and stimulates composer-performer collaborations. Fluence and gruntCount sit among a growing body of work celebrating the creativity of an enabled interpreter. In all roles, musical works become enlivened by a broad palette of technique and expression, and a considered and personal creative investment on the part of the performer.

The feeding of one role into the other betrays their somewhat arbitrary distinction along a spectrum from tight control of notated compositions to mercurial creativity in improvisation, and in reality they are often blurred. In the case of Fluence, direct switching between Roles A and B revealed a cognitive dissonance that was not entirely resolved by familiarity over time, while a long immersion in the inherently hybrid environment of gruntCount nurtured a growing confidence in technical operation, opened out my improvisations beyond their habitual style and duration, and provided a stimulus to new creative work, developing and exploring further systems and new collaborations.

8.2 Performing presence

In the mix

The issue of balance and blend was at the heart of my initial agenda, both in practical and personal terms. The clarinet’s inherently problematic relationship to microphone placement had led me to experience poor quality sound and ineffective full-range amplification on many occasions before undertaking this research. Finding viable options for the transference of sound—my personal sound—was a priority from the beginning. But
presence in this sense is more multimodal than mere level, resonance and timbre. My personal sound is my identity, and the myriad influences that nurtured it. Likewise, the requisite level of the loudspeaker output carries the presences of composer, system builder, and projected virtual identities, with attendant traces extending as far as one wishes to chase them.

The collective musickings of the whole assemblage also reflect and intermingle courtesy of the multitude of corners, curves and crevices in the space. This dance of sound waves from cone and cane, resonating through bore and body, and out among the architecture and congregation of the event, opens up the filtering and resonating assemblage beyond the strictly quantifiable. Wanting more say on sound turned out to have profound and layered implications of presence.

Fig. 8.2 Sound is curated on both a pragmatic and personal basis, with balance and blend particularly pertinent to an augmented practice. Beyond the technical arrangements, sound as an interface in interactive music draws on a performer’s experience and expressive capacity. Materials, time, identity and cultural influences are central to the forming of sound concept(s), which contribute to a performer’s personal sound.

In the space

During this research, I was for the most part the sole human presence on the stage, a visible and embodied presence set alongside ambiguously disembodied and virtual presences. Emmerson takes a holistic approach to presence in live electronic musicking, but with a firm commitment to the recognition of cause—”the ‘search engine’ that is our perception system.” (2007, p2) He identifies three simultaneous “search-responses” in our
ongoing feedback system, which could each be reframed within the humanising framework of curating sound, chasing liveness and negotiating the interagency of people and things:

- physical presence
- psychological presence
- personal and social presence

Jan Schacher (2012) is among several performing scholars (Kim & Seifert 2007, p234; Green 2011, p135; Bailey 2013, p62; Hayes 2014, p41) who draw on extended (Clark 1998) and enactive (Varela et al. 1991) philosophies of mind to illustrate the embodied fluidity of technique. This is perhaps what is meant by stage presence:

> a mastery that is not only known to the individual mediator himself but that is visible to others – we easily recognize by its precision and grace a gesture that is animated by full awareness. We typically associate such mindfulness with the actions of an expert such as an athlete or a musician.” (ibid., p28; quoted in Schacher 2012, p199)

### In the moment

As a performer, I negotiate dynamical hierarchies by managing an ongoing thread of attention with present physical action and reaction, and by relating to past (and projected future) experience. McCaleb describes this as “think[ing] through music” (2014, p125), or “performative musical knowledge” (p18) and proposes it as a discrete mode of knowledge, “emergent from experience as a listener and performer.” (p81) What I am doing when performing—thinking through music—is negotiating presence by the managing of context (my identity in relation to other people and things, to culture and history) and liveness (complex, pluralistic, and shifting). Cumming (2000, p160) speaks of performers who...
“animate the moment in an individualistic way,” and of an individual “moment of performing” that correlates to Schroeder and Rebelo’s performative layer (2009).

Fig. 8.4 Liveness has both an inner (personal) aspect and an outward (social) trajectory. Engaging performances are anticipated in rehearsal, where their viability is probed by a performer’s ability to negotiate a sustained and in-the-moment thread of attention amid an ongoing flux of known and contingent elements.

Emmerson’s (1994a) contrasting of liveness with real-time centred around concerns at the time that synchronous response was becoming seen as achieving liveness as a fait accompli. In contrast, living presence was offered as an enriching and harmonising approach to live electronic and mixed music, that enjoined a fidelity to traceable human action and timbral richness. He later predicted parallel trajectories in live electronic music (2000, p213), with evidence of either human presence—with a connection to at least the idea of a live performer—and human will, where the disembodied affordances of the acousmatic and virtual are privileged.

My proposal is that, from the performer’s side, an inner liveness relates to the negotiation of a narrative-like thread of attention within enfolding strands of physicality, identity, fidelity, spontaneity, interaction, virtuality, and perhaps danger—and that this inner liveness is nascent in rehearsal as an essential driving force in a trajectory towards the outward liveness of performances. This is exemplified here as a search for expedient beginnings that might harmonise these two strands and “reclaim the riches of the acousmatic universe […] placed under the expressive control of the truly ‘live’ performer” (Emmerson 1994a, p101).
Disruptions to hitherto fluid performance techniques and habitual states—dehumanising, perhaps—may be due to an “interrupted moment of our habitual standard, comfortable being-in-the-world” (Riva et al. 2009, p7; quoting Heidegger 1968). The skilled practitioner would only typically notice “significant variations in the feeling of presence: *breakdowns* and optimal *experiences*” (ibid.). For an experienced musical performer, the foreground of conscious attention is engaged with positive or negative divergences from the expected—distractions, mistakes, malfunctions—and, occasionally, a self-reflexive awareness that all is very going well, without actually attending to its going well. This negentropic, or antitelic state, more commonly referred to as *flow* (Leman 2008, p107; Csikszentmihalyi 1990), which also corresponds to Dreyfus and Dreyfus’ rare and ephemeral stage of *mastery* (1980). Phrases such as “being in the moment” or “the music was playing through me/us.” are habitually used by musicians describing this state.

In the instrument(s)

Riva offers a definition within the cognitive sciences of an altogether more enactive presence (2008) in skilled mediation, which, as outlined in Chapter 4, may extend further into *telepresence*, or *second-order mediation*. This translates here to an embodied augmentation of the primary, already embodied, musical instrument, through a process of familiarisation—a progression through stages of skill acquisition (Dreyfus & Dreyfus 1980) towards intuitive, non-analytical expertise. Presence is described as “evolved from the interplay of our biological and cultural inheritance, whose goal is the enaction of volition: presence is the non-mediated (intuitive) perception of successfully transforming intentions into action.” (Riva et al. 2009, p3). The claim here, and elsewhere (Nijs et al. 2009, p123; Bailey 2013, p21), of an attendant sense of non-mediation, is overstated, and altogether too dialectical an insistence to accord with my experience. This feeling of removal from time and place occurred occasionally in private rehearsal and recording, feeling immersed in a personal, inward, narrative of liveness. However, there is simply too much at stake in performance, where meeting the outward liveness of social engagement presses on my attention just enough to maintain a modicum of self-reflexivity. As Riva himself proposes (2009, p6):

> A higher level of presence is experienced as a better quality of action and experience: the more the subject is able to enact his/her intentions in a successful action, the more he/she feels present. [my emphasis]

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96 There are countless examples of this sort of phrase in published interviews, particularly with improvisers. For example, saxophonist Sonny Rollins (2014) insisting: “I’m not supposed to be playing, the music is supposed to be playing me. I’m just supposed to be standing there with the horn, moving my fingers. The music is supposed to be coming through me; that’s when it’s really happening.” Or trumpeter Tom Harrell’s reference to “that interplay, when the music takes off, it gives you the experience I have, maybe once or twice a year, that the music is playing me. You lose your sense of self in the music.” (quoted in Santoro 1997, p124)
Far from feeling the self fall away, or becoming unmediated, a more intense (self-) awareness of presence is felt with the onset of the performative layer (Schroeder & Rebelo 2009).

Present performers

There exists a confused notion of what being a contemporary performer may imply within the conservative body of mainstream classical music—namely, a specialist in contemporary music97. This work has been shown again and again to have both reinvigorated and reframed my relationship with the clarinet, the bass clarinet, the recording process, amplification, digital technology, and the practice of music performance as historically and culturally situated. Colin Lawson (2006, p12) notes that in the early 1800s clarinettists provided their own bespoke solutions to the development of keywork, mouthpiece and reed design in order to adapt to the demands of a burgeoning repertoire, a variety of spaces and the demands of an itinerant lifestyle. Likewise, building a robust, lithe and adaptable sound concept using the technology of the present day forms the basis of my contemporary practice.

Defining and situating an adaptable, contemporary and personal practice within a diversity of genres establishes a platform from which to consider the broadest interpretation of the instrument. I propose present performer to be a much more useful description of someone who engages with contemporary musical culture, ideas, technologies and practices, but who maintains and nurtures a set values relating to those of the past.

Optimal performing presence

The motivation for this research was to develop an embedded and personal augmented practice of the clarinet, via a humanising framework that attended to my established and contingent priorities as a performing musician. This led to a growing encounter with differing notions of presence, which emerged as a term fitting several of the practical and theoretical outcomes, as well as of the idea of a humanised practice itself. I therefore argue that the agenda of this research could be more usefully framed as curating optimal performing presence. This is pursued by the orchestration of five elements:

- physical presence in the space (by scale, in the case of recordings and broadcasts)
- balancing elements within a community of voices
- attending to an ongoing thread of attention (narrative liveness)
- cognitively extending into the instrumental assemblage (perceived bodily mediation)

97 The term contemporary music is widely applied to refer to music of the present day, or very recent past. Usage of the term within the classical community is not widely understood elsewhere, unless specified as contemporary classical.
• engaging with contemporary practice, ideas, and technology, while maintaining a set of values relating to the past

Thus, as a present performer, my practice aims to be contemporary, embodied, live, balanced, and personally invested, asserting its own values while embracing cooperation, innovation and change within a diversity of performance ecologies.

![Diagram](image)

**Fig. 8.5** The humanising framework facilitates *optimal performing presence*, by attending to (a) sonic fields and personal sound concept, (b) negotiating shifting threads of inner and outward liveness, and (c) balancing the interagency of people and things within a given performance ecology.

### 8.3 On recording

In the Boulez, Dudas and Harker, recordings allowed me to wrestle a little more control of sections that were difficult in performance. Some passages in *Strophe V*, *Prelude 2* and *Fluence*, for example, lay at the edge of my technical limits. By offering the luxury of time for a considered, repeated and temporarily dissected approach, and learning to perform edits and mixing, the recording process afforded more presence to the interpretation. The outcomes reflect the inner liveness of what I was *aiming* for, which might be quite different to a negotiated outward liveness in performance.

Recording is an electroacoustic creative practice, whereby the work of art is newly created from recorded sonic fragments, formed into interpretations that whose possibilities are distinct from live performance, which is inherently more pragmatic and indeterminate.
The concert has more room, and tolerance, for spontaneity, publicly exhibits the requisite physical stamina and virtuosity of the work, and has social, spatial and cultural aspects of a communal event. The modern recording, meanwhile, offers time to choose from takes that present subtly different qualities of expression. Accuracy in reflecting the notation, for example, carries greater weight in the light of repeated listening. The recording remains a situated narrative on the trajectory of an interpretation. The rather more embedded approach to editing and mixing here reflects my disposition at the time, and relationships both with the enjoinments of the composers and the technology to hand.

The enabled editor

Becoming more familiar with recording technology—from audio equipment and DAWs to software editing, mixing technique, EQ, compression, reverb and other post-production audio effects—afforded considerably more say in the final outcome than previously experienced. While I might assist in the mapping of editing sessions, or be consulted on edits for approval, I remained at a distance from its actualisation. By contrast, during this research period, choices of microphone and placement were mine (with expert advice from collaborators), resulting in a greater investment with regard to overall sound concepts with which I had become so embedded. Meanwhile, in the editing suite, balancing levels, choosing takes, making cross-fades, adjusting timings and pacing, coordinating (and re-coordinating) the electronics, was a kind of slowed down performance that aimed for optimal presence in the final edit.

Fish out of water?

The Reid Concert Hall is rather suited to the clarinet, thanks to its 19th century ‘shoebox’ form, high ceiling, and a profusion of wooden surfaces. I was able to play with a full dynamic range, enjoying the warmth of the room and its generous reverberation. In the case of gruntCount, however, recordings were made in the hall, but these have not been included, for various reasons. The B♭ clarinet version of gruntCount lies outside the focus of the case study, besides which, I was not happy with quality of the performances. Furthermore, bringing gruntCount back to a concert hall setting after a variety of small, informal, ad hoc and club venues, the system—as I had come to know and play it—felt less at home in the formal environment of the formal, and empty, space. gruntCount seems to enjoy the liveness of a less formal environment. This tentative thesis may, however, be disproved or developed by continuing research.
8.4 Research questions

In Chapter 1, it was noted that practice-based research is inherently discovery led, and therefore not driven by, but revealing of, research questions. This research was rather motivated by an ostensible agenda of humanising, which, when probed, elicited a framework for action that brought opportunities for its clarification. For example, the question of instrumentality—what are we making with an augmented instrument? A dialectic of forces, or a hybrid new instrument? My findings posit a scalable position on a spectrum between instrumentality and interaction, informed by a broader reframing of instruments as filters and resonators of energy, identity and culture. Similarly, humanising as a notional alleviator of rigid or oppressive practice emerged as the key to unlocking an approach based on a privileging of inner liveness, interagency, and ultimately, presence.

In the spirit of compliance, however, I offer the following conclusions relating to the three questions offered in Chapter 1:

• what does a contemporary performer of mixed music gain from onstage control?
• how does augmentation of the clarinet affect personal sound concept
• what do experienced performers require of interactive technology?

1 Gains from onstage control

These have been shown to be considerable, including having much more say on the balance and blend of the electro-instrumental sound. Embedded rehearsal was shown to be a way to develop a practical, experimental approach to the technology and to begin to form embodied relationships. Simplicity of initial rehearsal and preparedness in the second stage led to increased confidence and efficiency in the concert space, self-efficacy and in some cases the genesis of instrumentality to the interaction. This embedded approach offered a means to develop creative work in a meeting point of diverse traditions that aided communication and encouraged a more considered, experimental, and ecological approach to both interpretation and improvisation.

2 Effects on personal sound concept

Augmenting required an electro-instrumental approach to the wider instrument. Multiple, motivating affordances in terms of new and varied sound concepts were also seen to broaden both my scope and that of the instrument. The performer’s role was understood to be similar to that of ensemble leader, or orchestral concerto soloist/director. Personally invested performances of notated compositions revealed deeper possibilities for interpretation and sound sculpting, while the enactive creating of compositions fed back
into the ongoing development of a personal sound, with explicitly jazz-influenced inflections teased out by the work with gruntCount.

3 What do I need?

Performers’ requirements are essentially pragmatic, personal and time-based. Accessible, workable materials are vital to efficiency and motivation. Software should be up to date and plug-and-play, allowing for musical expediency from the earliest stages of rehearsal. Configurability and straightforward mapping facilities considerably aid the rapid development of engaging interaction. Visual interfaces should be clear, with minimum distraction, and salient information displayed clearly and prominently. Adaptability offers the opportunity to satisfy an engrained habit of annotation, bringing clarity and comfort to a performer’s attention levels and concentration while playing. As we have seen, early expediency has shown to be inherent to each successful outcome of this research. Essentially, I need to get down to musically engaging work as readily as possible.

Finally, responsibility for adaptation, maintenance and updating of materials should be shared between composer, performer and publisher (where applicable) in the current climate of rapid technological advances and obsolescences.

8.5 Contribution & further research

By a combination of practice and reflection, this research considered the implications of a humanising approach to mixed music performance that privileges the onstage performer’s situated and contingent concerns towards process, learning and practical outcomes, at the heart of a narrative enquiry into electronic and digital instrumental augmentation. It gathered findings from a necessarily swift and schematic interdisciplinary traversal of fields, and contributes most pertinently to Music Performance, Improvisation and Composition; and also to Music Education, Embodied Cognition, Performance Studies, Organology and Instrument Design, Interface Design, and Human-computer Interaction. It furthermore offers a practitioner’s perspective to the fields of Music Psychology, Philosophy and Sociology.

Performer-centred and practice-based accounts have grown in the literature since the turn of this century as part of the interdisciplinary and practice turns (Schatzki et al. 2001; Stern 2003; Bell 2016; Impett 2017), bringing voices to the academic table that complete the circle of concept, process, design, creativity and action within the Performing Arts. These research outcomes offer knowledge in the form of publicly engaged performances, a set of self-directed recordings of a quality commensurate with public commercial release, and a framework for developing practice that is applicable to performers, composers, sound
engineers and technicians, interaction designers, educators, course designers, and instrument makers.

Shared responsibility

The following recommendations stem from personal experience of public, solo, augmented performance practice and reflection, and call for shared responsibility in attending to several areas, including:

- the sound in the space
- the design and user experience of software interfaces
- the upkeep of materials
- efficient, clear respectful communication during all stages of the process.

1 Performers

As outlined in Chapter 2, I worked in three stages, from an early, simple set-up for expediency, through a period of simulation, and into the sound check and (where possible) full dress rehearsal in the venue. Stage 1 was entirely taken up with testing, rehearsing, recording, adjusting, becoming familiar with playing into headphones, and finding simple, workable solutions to control parameters, whether gestural or sound-oriented. Getting down to the business of making viable music for performance was my only priority at this stage. Stage 2 became about sound and control preferences for interaction. I took the time to grow a sense of trust in the functionality and performance viability of the piece or system. Having a degree of flexibility in terms of equipment, with several options, insured against faults, mis-specification or airline restrictions. Before the performances, I developed a preference for making technical lists for myself, and sent clear technical riders, stating what I would bring as well as what is required, with a floor plan or measurement of the designated stage area, and explicitly mentioning the onstage operation of the electronics, which is far from normalised, especially in classical environments. A rehearsal cycle of setting up, opening and closing software in piece in order, and packing down was also very useful in terms of procedural training and projected timings.

Pre-mixing in as much detail as is possible, using the exact or similar equipment, led to efficiencies of time in the sound check. I made the effort to understand the signal flow for each item, and wrote it down—the head gets busy, and things may go wrong. Attending to the acoustic instrument fully beforehand allowed for the requisite attention to potentially long and irksome technical rehearsals. A clear and respectful use of language with technical co-performers and venue staff, a degree of tact, and readiness to delegate are also advisable on the day.
Finally, for optimal technical security—and the attendant peace of mind—a second laptop, ready and tested is certainly ideal (though usually impractical). A complete backup to external drive of all files, drivers and related software, including saved settings files, is essential. I had both a portable SSD drive and identical cloud storage backup for each performance.

Caveat augmentor

Finally, a brief warning from the early era of real-time interactive music (Puckette and Zack Settel 1993):

A relatively new phenomenon has appeared thanks to the possibility of single-handedly controlling extremely high sound pressure levels with speed, grace and precision. This possibility has introduced a form of rapture of the deep, into which improvising soloists may fall, no longer able to judge the passage of time.

Empowered in a humanised augmented practice, the fluid and freely improvising augmented performer carries a responsibility for the outward narrative liveness bound to other humans in the space. Once a few recorded rehearsal takes are made (perhaps therein touching the realm of the deep rapture above), a feel for potential durations emerges. I hold onto this, no matter the exaltation of the performance experience, maintaining a feel for the room and the energy of the event—while a performer in flow is undoubtedly engaging, witnessing another’s extended catharsis in sonic form requires a generosity of spirit that cannot be entirely depended on in every situation.

2 Composers and publishers

Given the blurring engendered by interactive music technologies between piece and instrument, and between performer and composer, proper consideration of the time required to develop an embodied fluency is especially relevant to composers and system designers. Providing materials early, and leaving time for fluency to develop, is part of an already established composer-performer relationship, as well as back-and-forth dialogue with performers (Roche 2011, p122 & 146). Again, the visual interface is part of the score, the piece and the instrument, and should therefore be clear, uncluttered, and (ideally) adaptable. I support Berweck’s proposal that publishers take “a pro-active attitude in preserving the works, as opposed to a reactive one” (2012, p169). I emphasise a tripartite responsibility here in relation to maintaining works—future access to these relies on a mutual sustaining of this performer-composer-publisher relationship.
Further practical research

A whole gruntCount album is certainly on the way, including collaborations with other artists, a larger ensemble, and in multichannel environments. New compositions, transcriptions and remixes are also planned, with an emphasis on collaboration, after four years working on solos. In terms of improvising systems, simplifying my approach in An Errant Soothing has encouraged a redesign of the earlier system, based on sound as the primary interface. More embodied and fine-grained sensors would also bring a richness of interaction.

Education

Educational considerations of this work were set aside at the outset, for reasons of time. However, the opportunities to bring this work into the community are several. Dreyfus & Dreyfus (1980, p16) advise being:

aware of the developmental stage of the student, so as to facilitate the trainee’s advancement to the next stage, and to avoid the temptation to introduce intricate and sophisticated aids which, although they might improve performance at a particular level, would impede advancement to a higher stage, or even encourage regression to a lower one. [my emphasis]

A rapid introduction of audio theory, coding, and complex technical equipment were rather demotivating in the early months of my research, and a performer-led approach might have been better placed—namely, expediency (finding inner liveness), sounding good (enough), and identifying minimum control parameters and cognitive distraction.

gruntCount strikes a balance between entry-level access and a quickly found fluidity on the one hand, and the need for time to engage creatively with the sound, structure and the interface of the system on the other. The curves teach you how to play them, and in your own way (conforming to the Humanist emphasis on meaningful learning). It is ideally adapted to educational use, as augmented instrument pioneer Anne La Berge has already shown with high school students, undergraduates and professionals.

In a contemporary performance culture of increasingly ubiquitous amplification, and increasing musical cross currents, certainly every undergraduate instrumental and vocal performance student should be able to:

• record themselves in high quality for reference
• understand relevant microphone types and placement
• be able to specify audio equipment
• understand choices regarding levels of autonomy and influence
• know how to communicate their priorities with collaborators
• embrace ongoing change in hardware, software and learning methodologies as inherent factors that call for a shared responsibility

Etudes for mixed and interactive music (Butler 2008) would be welcome—of a similar length and difficulty in overall terms, to Dudas’ Prelude 1, for example, which has already been transcribed for several different instruments.

A notable restriction on the porting of this work to the wider community would the sheer expense of some of the equipment. Open source, cross-platform software would be more appropriate for educational purposes. Finally, the issues of fair trade and sustainability also loom over the practice of all electronic and digital music as a largely undisputed topic of rapidly unfolding urgency.

8.7 Coda

Why a personal sound?

A recent session for a jazz-folk recording included an improvised bass clarinet solo that we had taken a few rather careful takes of, and I was holding back from anything too esoteric in the coming final take. The producer insisted: “come on, show [them98] what the samples can’t do!” This entreaty led to a version that I initially felt may have gone too far—I had drifted from the chord structure, taken risks with range and dynamics, inserted some chaotic material, pushed my contribution outward99 in a way that drew directly on personal sound concepts from the work described here. However, on listening back, the solo fulfilled the producer’s (and my) eagerness for something live, instinctive, unique—it was human, in the sense that it stood in contrast to the ever-increasing sophistication of samples and their common usage in the recording studio.

Forging a personal sound and approach to instruments matters—it keeps alive the practice of orchestral instruments as they become increasingly commodified and homogenised, on the one hand by the availability of high quality sample banks, and by an institutional conservatism in conservatoires and the professional mainstream on the other.

98 Expletive replaced here.
99 In the sense of Eric Dolphy’s 1961 postcard to composer George Russell: “Trying to play the new concept with an outward bound feeling” [my emphasis]. Photograph at: http://georgerussell.com/gfx/dolphy.jpg [accessed 29.5.17]
Final words

Overall, a privileging of embodied action, personal sound (identity), and diverse livenesses (narrative) humanises and enriched these performances, while affording the requisite space to contributing elements—predetermined or contingent, human or non-human—achieved a balance of interagency. A level of presence, or harmonising of presences, was achieved that directly reflects curatorial decisions I made within a constantly shifting and evolving relational framework. Music performance was revealed as a situated curation of presence, including elements of sound, physical and virtual identities, narratives and trajectories, and embodied relationships to technology. While physically present in the arena, I was also:

- engaged in contemporary technologies and with communities of practice
- considerate of ecological factors
- present in the instrumental assemblage
- present, personally and socially, in the livenesses of the performative layer

Finally, while this research has been framed around an augmented solo practice of the clarinet, this was (in part) pragmatic in terms of scope, and (in the main) in order to focus on that work which musicians must do alone: negotiate terms with technology, develop a sound concept, form interpretations, develop routines and procedures, employ coping strategies.

Evolving an approach to hybrid practice and learning, reframing the idea of instruments as a situated social, historical and technical assemblages, and reorienting the humanising agenda from control towards interagency, led me to venture into a diverse community of fellow practitioners and researchers—performers, composers, instrument makers, mixed media artists, and academics—to which each brought a set of values with an open mind. This growing musical community of individuals with an openness to change reminds me of George Lewis’ (2010) description of the Association for the Advancement of Creative Musicians (AACM):

> ... to avoid becoming a clique [...] you have to be open to new ideas. You just take upon yourself the notion that you’re going to support people in whatever they would like to do; that becomes a part of personal transformation, a community of people who all are engaged in personal transformation. It becomes a practice of the self that looks outward toward the community, and without limits.” [my emphasis]

As creative, present performers, our responsibility is to learn where and how we are able to exercise influence within a contingent and an increasingly technological environment, to what extent we wish to do so, and how to articulate this clearly with our collaborators—negotiating our way to a broader creative practice that continues to evolve and which asserts its own values while embracing ongoing change and innovation.
References


Appendices
Appendix A

Scores

Pierre Boulez  
*Dialogue de l’ombre double*

Richard Dudas  
*Prelude No.1*

Richard Dudas  
*Prelude No.2*

Alexander J. Harker  
*Fluence*

Facsimile
A facsimile of my performing copy of *Fluence*, as used on the recording (CD1:4). The original A4 landscape format sheets have been amalgamated to A3 portrait for ease of reading and page turns. Markings show *fields* clearly delineated in blue to delineate sections and facilitate task switching (see 3.5).
pierre boulez

dialogue de l’ombre double
pour clarinette/première sur scène
et clarinette/double enregistrée

version aux chiffres romains

partition avec regie son

universal edition
This figure represents the 6 potentiometers which control the levels of the six principal high-frequency loudspeakers. (The figure representing one of the potentiometers is also used.)

Dieses Abbildung stellt die 6 Potentiometer dar, die die Pegel der 6 um den Saal herum angeordneten Hauptlautsprecher steuern. (Darüber hinaus wird auch ein Symbol verwendet, das eines dieser Potentiometer darstellt.)

- The pictogram represents 6 potentiometers controlling the levels of the 6 main loudspeakers placed around the hall. (A pictogram representing one of the potentiometers will also be used.)

Cette figure représente le potentiomètre qui contrôle le niveau du signal de la réverbération du piano qui sera mélange avec le son direct de la clarinette.

Diese Abbildung stellt das Potentiometer dar, das den Klavierhall regelt, der dem Live-Klang der Klarinette beigemischt wird.

- The pictogram represents the potentiometer controlling the level from the piano reverberation to be mixed with the live sound of the clarinet.

Déplacer le potentiomètre indiqué jusqu’au niveau spécifié aussi vite que possible (env. 0.1 sec.).

Bewegen Sie das angezeigte Potentiometer so schnell wie möglich auf den angezeigten Pegel (in ca. 0.1 sec.).

Move the indicated potentiometer to the specified level as fast as possible (ca. 0.1 sec.).

Déplacer le potentiomètre un peu moins vite (env. 1.5 sec.).

Bewegen Sie das Potentiometer langsamer (in ca. 1.5 sec.).

Move the potentiometer less quickly (ca. 1.5 sec.).

Déplacer le potentiomètre pour obtenir le niveau spécifié au repère indiqué dans la partition.

Bewegen Sie das Potentiometer so, daß Sie an der Partitur angegebenen Stelle auf dem angezeigten Pegel ankomen.

Move the potentiometer at such a rate as to arrive at the specified level at the point indicated in the score.

Indique la position des potentiomètres au repère donné.

Zeigt die Position der Potentiometer für jeden Einsatz an.

Indicates the position of the potentiometers at any given cue.
**Version aux chiffres romains**

1. Jouer ces notes répétées de longue durée avec des doigts différents, de façon à changer légèrement l'intensité et l'harmonie. / Varies Sie bei den langen Sequenzen wiederholte Melodie mit dem Finger, um die Klangfarbe und die Tonhöhe leicht zu verändern. / Play the long runs of repeated notes with different fingerings to change colour and pitch slightly.

2. Jouer ces si rés répétés avec des doigts différents, pas obligatoirement les mêmes chaque fois. / Varies Si beim wiederholten Händen die Finger, um die Klangfarbe und die Tonhöhe leicht zu verändern. / Play the repeated Si with different fingerings to change colour and pitch slightly.

UE 18407
strophe V

Clartet de première

* les couleurs [ ] très courtes / die Zäsuren [ ] und sehr kurz / the caesuras [ ] very short
Les deux dernières mesures de strophe V correspondent à peu près aux deux premières mesures de la Transition.
Die letzten beiden Takte von Strophe V entsprechen in etwa den ersten beiden Tälern der Transition.

The last two bars of Strophe V correspond approximately to the first two bars of Transition.
Agilité J =152, temps et dynamique plus marqués

Sub. plus modéré J =116

Sub. agilité J =152

cresc. poco a poco

(cresc.)

Sub. agilité J =152

Sub. plus modéré J =116

(cresc.)

Sub. plus modéré J =116

Sub. agilité J =122

Sub. plus modéré J =116

(cresc.)

Sub. plus modéré J =116

(cresc.)

Sub. plus modéré J =116

Clarinette/parole

Très agilité J =152, d’un expresso persistant et répétitif

* plus vite si possible / even möglich schneller / faster if possible

**respècter ce que la clarinette/double bass tend ce n’est pas à réitérer sans qu’on le remarque; donner l’impression d’un son interrompu encore moins, c’est-à-dire qu’il doit sembler que la clarinette/double bass ne se fasse plus entendre après le passage de la clarinette/double bass, mais que le son se soit brusquement arrêté et qu’il ait fallu un temps pour qu’il se puisse reprendre. De même, le dernier ou, quel que soit l’effet, doit sembler très lointain dans une espace acoustiquement résonnant.

Les mots de toutes les sections sont à jouer très lentement. Les sons doivent être légèrement plus sonores, même après l’effet, et il doit sembler que le son se soit brusquement arrêté et qu’il ait fallu un temps pour qu’il se puisse reprendre. De même, le dernier ou, quel que soit l’effet, doit sembler très lointain dans une espace acoustiquement résonnant.

From time to time, all high Ds will be played very loudly, they should, however, be recorded sounding more and more distant, with progressively longer reverberation. The last high D, although played softly, should sound very distant in extremely resonant space.
dim. poco a poco

poco a poco

dim. poco a poco

(dim.)
Richard DUDAS

Prelude
for Clarinet and Computer
(2006)
Prelude for Clarinet and Computer

Program Notes:

Prelude for Clarinet and Computer is the second in a series of interactive pieces for solo wind instrument with live computer processing. The piece explores (and blurs) the fine line between the sound of the live clarinet and the computer processed clarinet sound by the use of multiphonics in the clarinet part. The computer is also used to fill in the “missing” even harmonic partials in the clarinet’s odd-harmonic sound spectrum, morphing its sound into one resembling a saxophone.

The piece was written for clarinetist Peter Furniss who premiered it on a concert of music for clarinet and live electronics at the Forum Neues Musiktheater in Stuttgart, Germany in April of 2006.

Performance Notes:

All of the computer-processed sounds come from the live sound of the clarinet player – the composition does not rely on pre-recorded material. The computer part is realized with a “patch” (i.e. software program) running in the software Max/MSP from Cycling '74 Inc., and is available from the composer in either a stereo or a quadraphonic version. The software tracks the pitch of the live instrument and “follows” the clarinetist through the score, triggering certain musical events automatically as specific notes are reached. Consequently, no pedals or foot-switches are necessary, but a technical assistant is strongly recommended for concert performance. Boxed numbers in the score correspond to the main events or cues that the computer is “looking for”. Boehm-system fingerings for the multiphonics are provided above the clarinet staff in the score. The fingerings follow those provided by Rehfeldt, although individual instruments may require slight modifications in order to produce the notated pitches. The 4-channel version runs comfortably on a 1.5 GHz Macintosh G5 processor, slower machines are not advised!!
Prelude
for clarinet and computer

Richard Dudas

Tranquillo \( \dot{=} 58 \)

Poco Agitato \( \dot{=} 104 \)

(temo giusto!)
computer echos clarinet and speeds up, following clar. rhythm
denser than this
denser than this
something in electr.
something in electr.
denser than this
electr. tacet here
electr. tacet here, too
(piu veloce poss. - al piacere)
(piu piano poss.)
delayed transpositions fed back into each other
Scorrevole $\approx 144$

(tempo giusto!)
Più liberamente

these fragments are recorded and played back in a free, canon-like manner; their pitch content is modified

Tranquillo

(radioed from opening cl note)

delayed transpositions (within) with feedback

electro text
Fluence
Alexander J. Harker

Clarinet and MaxMSP

for Jonathan Sage

c. 14’

In several recent pieces I have explored the idea of the coexistence of two musical worlds. In one, time and pitch are articulated clearly and cleanly, as if on a grid; in the other, things are blurred, unclear and constantly morphing. Fluence takes this idea and places the two worlds side-by-side, although in this case the temporal grid is treated as if it were elastic, constantly stretched and compressed.

In Fluence I was able, for the first time, to devise a system in which I could create a kind of ‘real-time tape’ music, constructing the electronic part from samples in a way that remains flexible in performance. Each gesture in the electronic part is constructed from a bank of over a thousand clarinet samples. Particular samples are almost never specified, rather the computer selects samples according to certain shapes and parameters, meaning that each time the electronic part is realised it is slightly different.

The piece is written for and dedicated to Jonathan Sage. I’m extremely grateful to Jonathan for his patience, hard work and commitment to the project.

Fluence was commissioned by Ergodos (ergodos.ie) with funds from the Irish Arts Council / An Chomhairle Ealaíon.
Key

Formal Notation

[ ]  Denotes Ideas for Improvisation
\(/\)  Separator (shows grouping of ideas for improvisation)
\(\rightarrow\)  Continue Similarly
\(\rightarrow\)  Transform Into Next Idea / Notation

Add Idea (combine vertically or horizontally with what is already being played)

Electronic Cues

\(\text{70}\)  Cues with a downward arrow should be placed as precisely as possible to synchronise with the indicated note.

\(\text{71}\)  Cues without an arrow should be realised more freely.

Non-Metric Sections

Non-metric sections are notated in bars representing a given duration in seconds. These durations do not need to be adhered to exactly, but are provided to give a sense of the intended timings. Within each bar, each event in the clarinet part is marked with a letter. The clarinettist and computer operator should devise a clear strategy for cueing and synchronising each event. It will mostly be convenient for the clarinettist to control the progression from one event to the next, but at times the player will need follow the electronics.

Technical Setup

Equipment

- Laptop / Desktop Computer (Mac only)
- 1 or 2 Condenser Microphones
- Audio Interface
- Stereo Amplification System

The computer should have a dual-core 3.06GHz Intel Core 2 Duo processor or better and at least 4GB RAM.

The patch takes only mono input, but two microphones may be used for amplification purposes if desired. If two microphones are used, the two signals should be mixed and sent in mono to the audio interface.

The electronics should be balanced so as to support the solo part, but not overpower it. Levels may be adjusted during the performance to ensure a good balance between the two. The clarinet should be amplified slightly to allow a higher level for the electronics, but with the aim of as natural a sound as possible, rather than a highly amplified sound.

Software

The following software is required:

- MaxMSP (5.1.6 or later)
- Fluence Patch
- Externals

A number of externals are required, which should be installed on the computer running the patch. The externals are provided with the patches, and should be placed in the MaxMSP search path. For full installation details see the installation guide included with the software.
Detailed Software Guide

The patch realises the electronic part from a large bank of samples, according to pre-defined cues. There is a small amount of tracking of the clarinet part in places, which necessitates the audio input, although much of the piece will function correctly without input. In performance it is only necessary to advance through the cues at the appropriate times.

Setup is minimal, but in order to avoid a lengthy patch load time, sample loading is instigated manually, as this process generally takes around a minute. Reverb may be added to the live clarinet part in the patch if it is deemed necessary (a dedicated reverb processor may also be used if preferred).

---

Load Samples
Advances to the next cue.

Panic
Stops all audio, maintaining the position in the piece.

Reset
Stops all audio and returns to the beginning of the piece ready to start.

Cues
Displays the current cue (the last cue triggered).

Sound Files Loaded
Displays the number of sound files loaded. This should read 1667 when all files have loaded.

Clarinet Reverb Sends
The piece makes use of three reverb settings. Here, the clarinet part may be sent to one or more of these reverbs in order to improve the blend with the electronics, or compensate for a dry acoustic.

Audio Controls
The audio controls replicate some of those in the standard MaxMSP DSP Settings window.

Audio
Turns audio on and off and displays the current state.

Driver
Selects the appropriate audio device.

Sampling Rate
Displays the sampling rate (should be 44100Hz).

I/O Vector Size
Sets / displays the I/O vector size (should be as low as possible).

Signal Vector Size
Sets / displays the signal vector size (should be as low as possible).

Max Scheduler in Overdrive
Sets / displays whether the scheduler is running in overdrive (should be set on).

Scheduler in Audio Interrupt
Sets / displays whether or not the scheduler is running in audio interrupt (should be set off).

Input Channel 1
Sets / displays the audio interface input to use.

Output Channel 1
Sets / displays the audio interface output for the left output.

Output Channel 2
Sets / displays the audio interface output for the right output.

Input Levels
Displays the level of the input (the peak level in dB is also displayed numerically).

Group Levels
Displays the level of the groups. Note that these levels are pre-fade, and often exceed the 0dB level. This is not a technical fault. These meters are provided for confidence only.

Output Levels
Displays the levels of the outputs (the peak level in dB is also displayed numerically).
Still, calm

A: + pick + roughness + (poco a poco cresc. / $\approx \approx$ ad lib.)

B: + (suss. take over) + noise (breath) + with slurs, chord change

Soft, pure

A: + note selection + colour trills + (with noise bursts) +

B: + (breath) + noise "cloud" +

Intense, edgy

A: + higher + higher partials + teeth in reed +

B: + with slurs +

Soft, pure

A: + colour trills + gliss ad lib. +

B: + depiction + (ad lib.)

C: + ($\approx \approx$ ad lib.)
Appendix B

List of performances

December 2013–March 2017

1. 20th December 2013
   Edinburgh College of Art (ECA) Multichannel Research Space (B28)
   Creative Music Practice PhD Showcase
   • Prelude 1
   • spacedOut (gruntCount)

2. 18th April 2014
   Informatics Forum, University of Edinburgh
   Edinburgh International Science Festival in association with Dialogues Festival
   • Prelude No. 1
   • Ripped Up Maps (Andrew May 1998-2011)
   • spacedOut (gruntCount)
3. 27th May 2014

ECA Multichannel Research Space (B28)
Sonic Warehouse and ECA Objects of Sound Research Festival
• \textit{thisHasLongPauses/RestsInIt} (\texttt{gruntCount})
• \textit{worksAsAFastOne} (\texttt{gruntCount})

4. 23rd July 2014

Festival Theatre Studio, Edinburgh
Edinburgh Jazz and Blues Festival
• Solo improvised set (\texttt{gruntCount})

5. 31st October 2014

Austrian Cultural Forum, London
Soundings 2014
• \textit{Lood} for bass clarinet and fixed media (Arturo Fuentes 2012)
  \url{https://www.youtube.com/watch?v=9SzTeL1yQHQ}

6. 21st November 2014

Faculty of Fine Arts, University of Lisbon
INTER-FACE, 2nd International Conference on Live Interfaces (ICLI)
Conference paper presentation: “\texttt{gruntCount}: blurring the piece/system/instrument distinction.”
• \textit{liveInterfaces-showtime} (\texttt{gruntCount}) live new version creation and performance with Martin Parker (electronics).

7. 23rd November 2015

Ze Dos Bois (ZDB), Lisbon
INTER-FACE, 2nd International Conference on Live Interfaces (ICLI)
• \textit{worksAsAFastOne} (\texttt{gruntCount})
• \textit{spacedOut} (\texttt{gruntCount})

8. 17th January 2015

IRCAM, Paris
Improvisation with Omax (course)
• Improvisation
9. 1st February 2015
Reid Concert Hall, University of Edinburgh
- Interactive Quartet (Nicola Baroni 2015)
- Ajkad Csupa Vér
- Fragmentations
With Emma Lloyd (violin), Clea Friend (cello), Nicola Baroni (electronics).

10. 17th February 2015
Henry’s Cellar Bar, Edinburgh
- Bitter Together improvised set
With Haftor Medboe (guitar).

11. 21st May 2015
ECA Alison House Atrium
Bitter Together album launch
- Bitter Together improvised set
With Haftor Medboe (guitar)

12. 27th May 2015
University of Sheffield
Keynote performance, 2nd Philosophy of Human+Computer Music Workshop
- Ripped Up Maps
- worksAsAFastOne (gruntCount)

13. 2nd June 2015
ECA Alison House Atrium, Edinburgh
Edimpro
- Improvised set
With Michael Edwards (saxophones, live electronics), Dave Murray-Rust (laptop), Karin Schistek (piano), Jack Weir (guitar), Jess Aslan (analogue synthsiser, live electronics), Raymond MacDonald (saxophones), Martin Parker (live electronics), Fritz Welch (drums, percussion), and Robert van Heumen (live electronics).
14. 7th June 2015
Electric Cinema, London
• *Not So Silent Movies* improvised scores to silent movies
With Philip Sheppard (cello and electronics), Elspeth Hanson (violin), Al Doyle (keyboard), Mark Neary (bass guitar, analogue electronics, slide guitar), Hamilton Lee (drums).

15. 20th June 2015
Gamlehorten Gjestergård, Horten, Norway
Horten International Chamber Music Festival
• *Ripped Up Maps*

16. 26th June 2015
Centre for Contemporary Arts (CCA), Glasgow
xCoAx 2015, Glasgow
• *Fermata* improvised set
With Thor Magnusson (live-coding).

17. 27th June 2015
ECA Alison House Atrium, Edinburgh
• *Fermata* improvised set
With Thor Magnusson (live-coding).

18. 28th June 2015
King’s Stables, Edinburgh
Hidden Door Festival
• *The end and the beginning* visual art/dance collaboration
With Darkland Collective: Yulia Kovanova (producer), Yoann Mylonakis (live electronics).

19–20. 27th and 29th August 2015
C Venues (ECA Adam House), Edinburgh
Edinburgh Fringe Festival
• *The Society of Strange*
With Extempore Theatre: Adam Meggido, Andrew Pugsley, Ian Alex Bartram (actors), Christopher Ash (music and sound design).
21. 2nd September 2015
ECA Alison House Atrium, Edinburgh
Bitter Together album launch
- *Bitter Together* improvised set
with Haftor Medboe (guitar)

22. 28th September 2015
ECA Tent Gallery, Edinburgh
- *Shadows* visual art/dance collaboration
With Yulia Kovanova (producer), Emma Snellgrove (dancer), Karol Szarek (dancer).

23. 3rd October 2015
Roxy Assembly, Edinburgh
Tinderbox Fest
- *Bitter Together* improvised set
with Haftor Medboe (guitar).

24. 3rd November 2015
Hanyang University College of Music, Seoul
AHRC funded research residency (CREAMA/University of Edinburgh)
- *Prelude 1*
- *Prelude 2*
- *Esquisse* * for bass clarinet and real-time electronics (Richard Dudas 2015)
- *Ajkad Csupa Vér*
- *thisHasRest/PausesInIt* (*gruntCount*)
with Richard Dudas* (electronics).

25. 27th November 2015
Barbican Centre, London
Techno (Un)conference
Performance and illustrated talk: “Clarinetronics—evolving instruments and the extended self.”
- *New York Counterpoint* (Steve Reich 1985)
- *Prelude 1*
- *Ripped Up Maps*
- *Improvisation* (Ableton Live)
26. 15th December 2015
Reid Concert Hall, University of Edinburgh

- chipButtie (gruntCount)

With Anne La Berge (flute), Martin Parker (electronics)

27. 1st May 2016
Splendor, Amsterdam

- Nougatine (gruntCount)

With Anne La Berge (flute).

28. 2nd May 2016
Studio for Electro-instrumental Music (STEIM), Amsterdam

Musical Organics Symposium
“Humanising augmented instruments—evolving technology and the extended self.”
Research presentation and performance.

- The Outside-in Side (Pete Furniss 2016)

 https://www.youtube.com/watch?v=xNiOgjLOcM
 https://www.youtube.com/watch?v=DG2a5lO_zs

29. 18th May 2016
University of Edinburgh
Reid School of Music PhD Symposium

Illustrated performance talk: “Musical instruments and their practice as evolving assemblages.”

- The Outside-in Side

30. 12th June 2016
Gamlehorten Gjestergård, Horten, Norway

Horten Chamber Music Festival 2016, Norway

- Prelude 2

31. 1st July 2016
St. Mary’s Kemptown, Brighton

3rd International Conference on Live Interfaces (ICLI) 2016

- (Im)miscible (Pete Furniss 2016)

 https://www.youtube.com/watch?v=qtKpbHSv88I&list=PLZYaObEdMolx8WBSWlofCdzrbDp301SE8&index=13&t=0s
32. 26th August 2016

Assembly Rooms, Edinburgh
Edinburgh Digital Entertainment Festival
Pierre Boulez: a celebration
  • Dialogue de l’ombre double
With Owen Green (sound), Martin Parker (producer, lighting)

33. 17th March 2017

Leeds College of Music
Theatre in Surround 2017
  • An Errant Soothing

34. 24th March 2017

Leggate Theatre, University of Liverpool
Open Circuit, 3rd Annual Festival of Experimental Music and Technology
  • thisHasRest|PausesInIt (gruntCount)
  • Clasp Together  " (Harry Whalley 2017)
  • worksAsAFastOne (gruntCount) *
  • Fragmentations
With Richard Worth* / ** (flute), Hilary Browning** (cello), Harry Whalley** (electronics).

35. 27th March 2017

Edinburgh College
“Clarinetronics: what is an instrument in the 21st century?”
Illustrated performance talk.
  • Prelude 1
  • An Errant Soothing
  • worksAsAFastOne (gruntCount)

36. 11th May 2017

Reid Concert Hall, University of Edinburgh
Jazz and Everyday Aesthetics Symposium 2017 (AHRC)
  • Improvised set
With Haftor Medbøe (guitar), Tom Bancroft (drums)
http://jazzaesthetics.org/events/edinburgh/

[all links accessed 9.9.17]
Appendix C

Published works

Submitted with full permission of co-authors.

C1

C2

C3
Transcription, Adaptation and Maintenance in Live Electronic Performance with Acoustic Instruments

Pete Furniss
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ABSTRACT
This paper examines processes of musical adaptation in a live electronic context, taking as a case study the authors' collaborative work transcribing Richard Dudas' Prelude No.1 for flute and computer (2005), to a new version for clarinet and live electronics, performed in the Spring of 2014 by clarinettist Pete Furniss. As such, the idea of transcription and its implications are central to this study. We will additionally address some of the salient information that the user interface in a piece of interactive electro-instrumental music should present to the performer, as well as some possible ways of restructing not only the interface itself, but also the déroulement of the piece to aid the solo performer to the maximum degree possible.

1. INTRODUCTION AND MOTIVATION
The process of adapting an electro-instrumental\(^1\) work has afforded the opportunity to consider three modes of transcription and their implications. Firstly, the musical material itself has been transcribed and transposed for a different instrument, as have some of the events in the electronic processing – those which stem necessarily from the new instrumental circumstances. These include adapting the pitch transposition and revoicing the harmonic material generated from within the software. Secondly, the user interface has been modified from a desktop-oriented design to one fit for on-stage performer control. Thirdly, with a view to future performance of the work, a software-neutral, graphical transcription of the technological processes has been created as a form of "study score". The score-following technology employed to trigger events during the piece was also "transcribed" to use a more recent, and potentially more robust, system, but this has subsequently been revised and reworked, due to issues of maintenance, control and the licensing of third party software. The processes described here represent an ongoing work in progress, towards the publication and a future commercial recording of the piece.

Widening access to a composer's output has historically provided an incentive to produce adapted musical material for performance, particularly before the advent of commercially available recordings. Such adaptation also contributed to the expansion of available repertoire for instruments which may have been under-represented in the catalogue as a whole. The tradition of musical transcription goes back at least as far as the 18th century, when it was important to both composer and publisher for the generation of maximum sales, and a broader dissemination among the music making population. Many composers have produced pieces in versions for alternative instrumentation or reused their own ideas, and indeed whole works, in different contexts\(^2\). The piece that this paper uses as a case study, Richard Dudas' Prelude No.1 for flute and computer (2005), seems ideally suited to this purpose, due to the concise nature of its instrumental and technical requirements, its short duration and its pedagogical potential as entry-level live electronic repertoire.

Just as the initial impetus or compositional sketches for a musical work may be quite different from the final notation supplied to the performer(s), so the visual user interface of a live electronic piece may require significant adaptation from that designed during the work's creation. Moving from a "sketch" or prototype interface intended to drive the compositional process, towards one which is designed for use in performance, is an important and sometimes overlooked consideration; a stream-lined interface is essential in providing the optimum "user experience" for any performer. What players often find presented in the software interface provided may offer only limited help to them in terms of both operating the software and learning how to interact in a comfortable and confident manner to the computer’s musical output. In order to be more closely engaged with their electronically augmented instrumental environment as true soloists, some musicians are beginning to move...

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\(^1\) The genre is sometimes referred to as "mixed" electronic music, primarily in the francophone community, or simply "live electronic" music, which generally implies the presence of one or more acoustic instruments. There is to date no universally recognised term and we will use both the rather technical "electro-instrumental" and perhaps more elegant "live electronic" interchangeably here.

\(^2\) For example, Beethoven’s Septet Op. 20 was transcribed as Clarinet Trio Op. 32, and Mozart’s String Quintet No.2, K.406, from the Serenade in C minor K.388.
towards taking as much onstage control as possible in electronically mediated performance [1][2][3][4]. As a practical result of taking these performer-oriented factors into consideration while adapting Prelude No.1, it now contains a more performer friendly interface with several options that allow performers to choose how much control over the electronics they would prefer to exercise. As a potential entry-level piece in the genre, this flexibility also extends to providing for both stereo and quadrophonic output.

2. THE ORIGINAL COMPOSITION

Prelude No.1 is a short piece for flute and real-time computer processing from 2005, originally entitled Prelude but since renamed, as it is now the first of an ongoing series of works for solo performer with live computer processing. All of these pieces so far share an initial tabula rasa state in their electronic component, in which no pre-recorded samples or synthesized sounds are used. Every sound produced by the computer is a direct result of the live input from the musician, either processed directly, delayed (and optionally processed), or recorded to memory an earlier point in the performance and played back (with or without processing).

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Figure 1. A block diagram of the DSP structure for Prelude No.1. The dashed line represents a symbolic link between the recording and playback functions which both access the same sample memory.

The digital signal processing (DSP) for the piece was designed in Max/MSP, and made use of a rudimentary pitch-tracking and score-following system to trigger a series of predetermined events that control live processing of the instrumental sound [5]. The structure of the audio processing part of the DSP engine is shown in figure 1. It includes a compact and carefully chosen selection of sonically simple, musically intended sound processing algorithms:

- real-time transposition
- amplitude modulation
- delay
- buffer recording with granular playback (used primarily for a “sustain pedal” effect)

- panning
- reverb/beration

The sound is ideally diffused on a 4-channel speaker system, set up either in the usual quadrophonic arrangement at the corners of the hall, or alternatively in an arc, radiating outward from the live instrumentalist’s central stage position. It may also be performed using a simpler stereo output, the inclusion of which was not a later concession, but rather one of the original design plans. It serves to widen the programmability of this brief and rather straightforward instrumental piece beyond the context of highly technical concert productions. Furthermore, since the majority of instrumental performers do not themselves own specialized technical equipment, a stereo option also enhances rehearsal-ability, allowing for practice using the built-in internal microphone and simple headphone output of a standard laptop.

As was the case with another piece originally for flute and electronics – Thea Musgrave’s Narcissus (1988) – a clarinet transcription seemed to be an apt choice when, in 2008, we required a short piece to complete a programme of pieces for clarinet, piano and electronics in Seoul. The initial transcription for that concert was rather hastily made, but in retrospect provided an important step within the context of this developing series of succinct, “blank slate” live electronic pieces for solo performers [6], which now includes works for clarinet (2006), alto flute (2010) and percussion (2014), as well as forthcoming works in the series for violin, piano and bass clarinet.

3. A COMPOSITIONAL PERSPECTIVE

The transcription from flute to clarinet was not as straightforward as it would have been for a piece without electronics, or for a piece with piano accompaniment. As with all adaptations, it involved making choices regarding modification or preservation of musical, notational and technical elements of the piece. The first problems to tackle were those resulting from changes in instrumental range, including those stemming from changes in timbre, and instrumental fingering considerations. Although several different transpositions were tested to fit the piece into the clarinet’s range in both 2008 and 2014, the fact that all of them were downward transpositions to a significantly lower pitch meant that the real-time transpositions of the processed sound in the electronics needed revoicing and adjustment throughout. In many places this went beyond simply adjusting entire chordal transpositions by an octave. Similar transpositions of longer pieces have made use of various transpositions for different sections, with slightly recomposed bridging material (as with Narcissus), but the brevity of Prelude No.1 seemed here to obviate the need for such measures.

Eventually a downward transposition of a tritone was settled upon together by composer and performer, since it

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3 Hanyang University Paiknam Concert Hall, 2008.11.15: Sarah Nicolls (piano), Pete Furniss (clarinet), Richard Dudas, Jongwoo Yim (electronics).
retains some of the brilliance of the flute version\textsuperscript{4} and falls comfortably into clarinet fingerings, especially where trills are concerned. Differences in instrumental timbre between the flute and clarinet, alongside this significant transposition, necessitated a revising of the vertical (chordal) structures in the piece in order to clarify their texture. Adjustments to the volume levels within the signal processing component were also made at certain points in the piece in light of these distinctive timbral considerations.

Although making a transcription may involve compromising some of the original musical choices, in this case the transfer in fact enabled the reinstatement of a number of pre-compositional ideas that had been abandoned out of practical considerations in the original flute version. This included restoring a low trill in place of a flutter-tongue, and keeping the melodic profile of the opening motif when it returns at a lower pitch class towards the end of the piece. In both versions all decisions made with regard to the electronic processing originate from musical motivations.

4. A PERFORMER’S PERSPECTIVE

Although some performers are committed to working within the context of a team of skilled technical collaborators, a growing number of specialist players within this field express a preference (where practical or desirable) to cultivate independent control of the electronics \cite{1, 2, 3, 4, 8, 9}. Whilst this requires both a deeper understanding of software platforms, and a considerable commitment to learning how to operate them in combination with various forms of hardware, it serves to create an augmented practice that affords a much fuller understanding of the structure and pacing of all components of a piece, both electronic and acoustic. A musician working in this way, who has spent years developing a distinct personal “sound”, optimises control over it in the electro-instrumental environment, before passing it into the hands of the sound engineer in the venue.

A technically prepared musician should be capable of managing a complete sound strategy, expanding their instrumental perspective to include control of the wealth of electronic components that present such a vital contribution to the overall “performance ecosystem”, comprising musician, instrument, technology and space \cite{7}. From a performer’s point of view, a two-player version of an interactive live-electronic piece (alongside a technical operator at the computer) may not feel very interactive. Rather it is weighted towards the reactive, which is quite unlike performing a duo with another human musician \cite{8, 9}. A solo version of the same piece, with the computer controlled on-stage by the performer, creates a more plastic relationship, leading to a more integral musical performance.

The objective of this approach is not simply the acquisition of wider control in performance, but rather the promotion of a more holistic, practice-led learning of the piece in rehearsal – an embedded process of learning by doing. It has been all too common for performers to be confronted with the electronics for the first time at the dress rehearsal stage of an event. By contrast, a more embedded learning practice, in which a musician has been able to adjust, rehearse with, and interact with the computer at home, is an entirely different experience. This process of learning “from the inside outwards” can lead to a performance of fine-grained integrity and understanding, in so much as it enables the performer to feel at once individually responsible and also at the helm of the whole virtual ensemble.

In approaching Prelude No.1 in this way, several aspects of presentation needed to be addressed in the software materials provided. Often the computer part in such a work is not intended to be operated or monitored by the performer, but rather by a specialist technician – in many cases the composer-programmer. In such cases, significantly lower priority may be given to creating a user-friendly interface – especially in the all too familiar scenario of a composer working up to the hour of a premiere performance to debug their software. Even when the piece has been performed multiple times, and the GUI has been revised and streamlined, what is presented on-screen may still be tailored for a technically proficient sound engineer or computer musician, working either offstage or alongside the performer on the concert platform.

Just as the music itself was transcribed from flute to clarinet, the graphical interface in the Max/MSP patch needed to be “transcribed”: from a composer-oriented interface to a performer-oriented one. An element of user adaptability within music software interfaces has long been encouraged \cite{10, 11}, and with a growing number of musicians capable of effecting onstage control of electronic elements, there is an emerging need for a more nuanced, flexible approach, towards “expressive, higher-order music notations” \cite{12}, which reflect an emphasis on “user experience”. A genuinely performer-friendly Max patch needs to be designed to be “plug-and-play”, with clear, logically ordered instructions and optional performance settings which are grouped together in one region of the interface. Some examples of such performer-oriented interfaces are shown in figures 2 and 3.

\begin{figure}[h]
  \centering
  \includegraphics[width=0.8\textwidth]{image.png}
  \caption{The performer-oriented interface (work in progress) for Prelude No.1.}
  \end{figure}

Whether fully or partially notated, graphic or descriptive in nature, scores notated on paper are often personal-
ised by musicians to ease the process of learning and manage attention in performance. User-adapted Presentation Mode in Max/MSP provides a relatively uncomplicated means for musicians to adapt and personalise their visual material in an analogous way. Several prototype interfaces were made in this way for the Prelude, leading to the current work in progress shown in figure 2. Patch cords are no longer visible and many items have been enlarged, coloured distinctively and ordered into sequentially and logically organised task groups. These include text instructions for both set-up and running of the piece, settings such as audio input, output and volume levels, cues and other items relating to the score-follower. Naturally, these options should be configurable to the performer’s preferred concert defaults.

The Max Note Slider has been adapted to present written – i.e., transposed – pitch, as would be notated in a traditional B♭ instrument part, so that the performer now sees the note which is played without the need for mental transposition. This interface clarifies the process of setting up audio and software, and provides clear and relevant visual feedback. A MIDI expression pedal connection was also added to control the global output volume of the patch, in order to nuance both dynamics and shape in some entries. For example, as a result of timbral differences between the clarinet and flute, certain cues were found to require a softer than expected attack and more exaggerated quiet dynamics, in order to create the desired effect in the (now clarinet-voiced) musical material in the electronics.

The issue of trust is analogous to an orchestral conductor’s cue, in that it has more to do with communication and collaboration than the specific functionality of synchronicity. The initial cue, for example, is silent (with no output in the electronics) and is only employed to provide reassurance to the musician that the system is “listening”. Although it was originally in bar 3, it was moved to its current position at the very beginning of the piece, in order to avoid having a period of 10–12 seconds before any such feedback is given. This type of “blank” cue provides a similar function in a later passage that does not feature electronic output. Fostering even a momentary degree of trust in the system is an important consideration in an environment which can be unpredictable and prone to error, allowing performers to worry less and manage their attention in a way which supports a confident and fluid performance.

A degree of error intolerance was encountered with each of the aforementioned score-following systems (detailed below), both in terms of feedback from the loudspeakers and accuracy of tracking within the score itself. The use of a parallel input from a piezo pickup mounted within an alternative upper section (barrel) of the clarinet provided adequate isolation against audio feedback. The pickup was fed only to the score-follower in the patch and not to the audio processing itself, which continued to receive its input from superior quality external microphones. This process was later adapted using an inexpensive contact microphone of the type used to feed tuning devices, simply clipped onto the bell of the instrument. The score-following system that was finally settled upon was found to respond extremely robustly to input from this latter microphone, providing an efficient, lightweight and non-invasive solution—more importantly in the context of this repertoire, one which is widely and cheaply available to any non-specialist performer.

5. TECHNICAL CONSIDERATIONS

The making of minor musical changes to the Max/MSP patch for the purposes of a transcription, and the above-mentioned need to improve the user interface for ease of use by solo performers, highlighted the fact that there have been several upgrades to both computer hardware and operating systems in the decade since the original flute version was made, not to mention several major incremental software releases of Max/MSP itself. There has already been considerable discussion around the issue of updating electroacoustic compositions and maintaining performability in the face of technological obsolescence and “data archaeology” [3][13][14], and there are various schools of thought concerning the slavish imitation of the original, or the making of improvements in the update [15]. This is an intrinsic concern for all those involved in electroacoustic practice, and although it remains important to continue the community’s ongoing engagement in a thorough discussion, a more detailed examination lies beyond the scope of this paper.

The score-following system used in the Prelude is implemented in Max/MSP [5] and uses a third party pitch-tracker at its core: Miller Puckette’s pt~ object. The
choice of this particular pitch-tracker over other, more recent solutions has been discussed in more detail elsewhere [16]. For this transcription, the object initially needed to be recompiled for use with the 64-bit signals used by Max 6.1, but after updating and re-compiling the code, the object appeared to behave slightly differently (and much less reliably) than it had in the previous 32-bit environment. It was therefore decided to evaluate an alternative score-following system based on IRCAM’s antescofo – object [17].

For the purposes of transcription, a considerable attraction of this system is that the antescofo – object’s textual “score” also contains the musical event parameter information which will be used to control the DSP. This means that a single common Max/MSP patch may be used with individual “scores” for the different instruments. Another supporting factor was the active development and maintenance of the object within a relatively stable, institutional environment. The main disadvantage of antescofo – is that, as a third party object, it does not come with standard Max/MSP distribution; performers would be required to purchase it separately at their own expense. Another consideration is that, whilst in theory the object exists for both Mac and PC platforms and has been compiled for both Max/MSP and Pd (thereby accommodating performers using the most widely established platforms and software), in practice the PC and Pd versions are often out of date and updates to them appear only occasionally. After evaluating the transfer to a system based on antescofo –, we decided to return to the older (Puckette-Lippe) system, since it proved to be more tolerant of noisy input and lenient in regard to performer error. After necessary fixes were made to some objects, the original system proved in fact to be significantly more robust.

The act of transcription within an electroacoustic environment additionally highlighted the need for “future-proofing” in the form of a descriptive notation of the electronic part, in addition to the software itself, via a software-neutral graphical “score”. Therefore, it is intended that on publication, the piece will be supplied with a full description of the electronics that contains all the necessary information for the realisation of the piece using any musical software package, alongside the traditionally notated instrumental part, technical rider and current software materials. Figure 4 shows an example page from this score.

This idea of a text-based or graphical “study score” for electronic music may be traced back to the early pioneers of the genre, but it is commonly overlooked in current practice. It is very easy for composers to assume that the software itself constitutes the “electronic score” for their piece. However, having a published representation of the electronic part of the piece in a software-neutral form that can be used as a point of departure to re-implement the piece in the future will help to secure the piece’s performability, at least in the short to medium term. As an alternative example to that described here, figure 5 shows part of the printed score for John Croft’s Intermedio III for bass clarinet and live electronics (2012), which includes a software-neutral description of the electronics in the form of a “simplified process diagram” that additionally serves as a guide to any potential performer, regardless of their software literacy.

Figure 4. Cues 3 and 4 from Prelude No.1 in a software-neutral graphical representation.

but may be daunted by both the technological expertise necessary and by an unfamiliarity with the style and aesthetics of sonic art practice. This piece is accessible both musically and technologically, and there is no reason why Prelude No.1 couldn’t eventually exist for a multitude of instruments; it is, in fact, ideally suited for this, with its relatively short duration and simplicity of technical demands. Upon publication, the patch itself should additionally exist in a simpler version that disposes of the score-following and uses manual (or pedal) cueing, to allow the piece to be performed by less experienced performers, with relatively little concern for the triggering of the electronics and with a primary focus on musical aspects.

It is often the case that close composer-performer interaction is fruitful for a musical project [18] and this method of working often generates ideas for future development. We propose that it would be helpful to be able to have multiple Presentation Modes available in Max/MSP patches: certainly at least alternatives for rehearsal and concert use. This would enhance a more intuitive, graphic design-based approach to what is essentially an extension of musicians’ score personalisation. Whilst it may already be possible within the current software to further elaborate the interface design, this currently requires detailed knowledge of the software beyond the scope of most performers, certainly at entry level to the genre.

Although score-following techniques have been in use since 1984, when both Dannenberg and Vercoe first published their independent work in this area [19][20], there are still a number of problems and shortcomings with computer-based score-following, including a certain amount of difficulty in force-navigation through the score (particularly in reverse/rewind mode). The ongoing issue of relative intolerance to error in these systems places considerable, perhaps unreasonable or even unethical, demands on performers. Nevertheless, and despite the difficulties listed here, the genre continues to develop and define established principles of good practice, and to afford a richly rewarding environment for composer and performing musician alike.

7. REFERENCES


GRUNTCOUNT: BLURRING THE PIECE/SYSTEM/INSTRUMENT DISTINCTION

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ABSTRACT

Martin Parker’s gruntCount is a multi-version, configurable composition for improvising musician (or musicians) and computer. Performers embark on a journey through sound processing modules that are specifically customised to individual playing styles. It exists in no fixed state, yet allows for a growing set of reheasable, replicable and configurable pieces, in which all musical material, timing, overall duration and levels of effort are managed by the live musician. In order to optimise elements of flow and of liveness in each performance, gruntCount challenges traditional definitions of ‘piece’, ‘system’ and ‘instrument’, instead establishing an environment for human-machine improvisation that serves the musical result and not the system itself. This paper refers to a selection of sound examples from the bass clarinet version (2012-14) and examines formal time-shaping possibilities within a structured performance, while exploring the environment’s qualities of coaction and configurability in an era of new score types.

KEYWORDS

1. INTRODUCTION

The work described here represents an attempt to address fundamental concerns of contingency and spontaneity within a structured framework that offers maximal performer agency, but also allows both composer and performer to be heard through the music. Martin Parker’s *gruntCount* is a multi-version, configurable composition for improvising musician (or musicians) and computer. The digital signal processing (DSP) parameters employed are created and formalised in an improvisatory environment with the performer and subsequently plotted onto a series of graph-like curves on the visual interface. These pieces are enacted from the performer’s interaction with the on-screen notation. The live musician’s sound stimulates the onset of the computer’s responses, which evolve (and occasionally provoke) as a path is negotiated through the piece. Players are also at liberty to create and store their own plots within the software, thereby providing the potential to use *gruntCount* as a tool in other musical contexts. We will examine how *gruntCount* inhabits aspects of piece, system and instrument, and how, through its use by performer and composer, it blurs the distinctions between.

We would like to note that this work also contributes to debates around the computerised landscape of live electronic musicking (Small 1998). Feenberg describes computerisation as a missed opportunity to inform and empower labour (Feenberg 1991). Citing Zuboff (1991, 94), he proposes that it has instead tended to further entrench divisions between management and labour. We see *gruntCount*’s approach as a step towards a more even distribution of authorial agency and view the ‘computerisation of the musicplace’ (to paraphrase Feenberg and Zuboff) as an opportunity to explore liveness, flow and newness, rather than to impose even tighter restraints on the performer, such as those implied by pitch-trackers, tapes, click tracks and score-following softwares. This is not an ideological stance, however. Working in the ways we describe below, we like the sound that comes out – while the player is definitely improvising, what is delivered has the potential be a formally coherent concert item.

1.1. GRUNCTCOUNT

Each edition of *gruntCount* is personalised from the outset, with composer and performer working together to produce the elements of a system for creating well-defined and structured musical pieces that invite liberal performer input, spontaneity and intuition. In the bass clarinet version (2012-14), this preparatory stage involved a period of system ‘training’, in which the composer engaged in real-time free improvisations between himself and the player, creating at speed a unique set of interrelated DSP parameter presets – these constitute the version settings. The electronics are all derived from the way in which these version settings respond to live input (there is no sample library).
A trace of this interactive, improvisatory exchange is present in every subsequent rehearsal, performance and adaptation of the version.

Having designed these settings, gruntCount’s compositional agenda proceeds with the plotting of various journeys or curves through the DSP settings. These curves may resemble a graph or automation curve, but in fact represent specific trajectories through a parameter space, which itself has nested settings within it. There is a formal design here, a quality and style, and yet the manner in which the piece is individuated is entirely defined by the live performer, whose physical efforts (or ‘grunts’) move the assemblage forward.

The vertical playhead in the gruntCount interface, passing from left to right through the performance, will only move when excited by sound. This affords the performer absolute control over the initiation of the piece, and a considerable degree of influence over its pacing and flow. Notably, the ability to create moments of suspension within the reactive electronics is possible when the player is silent or plays under the activation threshold. By setting the number of grunts to be detected, the approximate duration or timespace of the piece may be estimated. This timespace, in conjunction with adjustment of the input threshold volume, determines the level of effort that will be required to bring the piece to its conclusion. In this way the immediate concerns of the performer on stage are not system-based but sonic and musical. The player can openly respond within an ongoing feedback loop, “managing unfolding states of attention.” (McCaleb 2011)

Figure 1 The latest version of gruntCount (v4.2). Setup procedure is ordered down the left hand column, including version and curve selection, an array of audio in/out settings, sample rate, vector size and microphone input(s).

The first incarnation of gruntCount was created with flautist Anne La Berge in 2011, and the environment was soon adapted for other improvisers. The initial stand-alone application, made in Max/MSP 5, incorporated gruntCount’s distinctive graph-like interface. This version was used for the bass clarinet premiere in Edinburgh in March 2012, as well as for the CD recording session (Parker, 2013). The latest version was created anew from a second studio session. It has a refined interface, branded for the publisher sumtone.com (Fig. 1), and features an ordered setup procedure designed to be learnable by non-specialists in digital audio technology (for which reason it is also a stand-alone app). A short video tutorial by the composer is included to facilitate this learning process, which here allowed for practising to begin within 30 minutes of downloading the software package. Finally, full-screen display functionality is added for any laptop size, so that visual elements are optimally viewed and attention can be managed without irrelevant distractions.

In April 2014, a remote application was added to allow for hands-free, on-stage operation of the main settings by the performer and for expression pedal control of overall output from the electronics. This small addition had the unintentional yet profound consequence of affording absolute control – a power of veto in effect – to the live performer, now able to suppress the electronics, fade in or out, or conclude the entire piece before the end of the curve.

2. PIECE, SYSTEM OR INSTRUMENT?

In order to optimise elements of flow and of liveness in performance, gruntCount challenges traditional definitions of ‘piece’, ‘system’ and ‘instrument’. The following section will examine how gruntCount inhabits aspects of each and how, through its use by performer and composer, it blurs the distinctions between them.

2.1. THE PIECE MODEL

A piece of music may be described as a discrete unit that has some replicable features for future performances. It has a structure and a quality of style or aesthetic that is imagined in advance of a performance. A piece is more or less predictable, and has a relatively consistent duration. Pieces are (for our purposes) inherently hierarchical – pitches and their order, note lengths, tempi, dynamics and other elements are prescribed to a degree and require a score or other form of instruction.


3. Version 4.2. The session took place on March 26, 2014 at University of Edinburgh, Edinburgh College of Art, Reid School of Music.


The composer’s role is to imagine, to create, shape and notate, whereas a performer will learn, practise, interpret, reanimate (Emmerson 2007) and reveal.

Representations of imagined music for interpretation by another person inevitably involve a measure of indeterminacy. Elements of timing and space, fine-grained dynamic shading and phrase shaping, as well as adapting the piece to different venues and concert scenarios mean that all live music is in flux. Pieces are always subject to contingency and intuition in performance. The gruntCount software is, at least in some sense, a score. The curve produces a structure that reflects compositional choices and projections, constituting a framework around which the improviser negotiates a path through the piece.

A gruntCount curve represents an act of formal composition. Whilst this is a replicable form, to be re-enacted anew, a high value is attached to considerations of liveness in performance and to the improvisatory skill of the experienced performer. Like a piece, gruntCount requires practice – it must be learnt and understood. It requires the finding of techniques and the building up of a bank of experience and familiarity. Getting to know and recognise the character of an electronic part is analogous to learning the other instrumental parts to a piece of chamber music or concerto (Winkler 1998; Pestova 2008). Familiarity with the behaviour and character of the composer’s DSP settings (the orchestration of the electronics), their particular ordering and nuancing within the composed curve, and discovering the potential for drama or space in the whole, requires rehearsal.

However, the intention from the outset in gruntCount was to bring performer agency and autonomy to a level approaching that of the non-hierarchical structures accessible to improvisation ensembles (Lewis 2000). By inviting a co-created and improvisational quality to each performance of the same piece, some aspects of gruntCount’s piecelessness begin to blur. The more it relinquishes hierarchical interrelations between creator and enactor in favour of a model of coaction, the more systematic it becomes.

### 2.2. SYSTEMS

As a configurable composition, gruntCount could be seen as a contribution to contemporary obsessions with choice and individualisation. However, we were more interested in the idea that configurability, choice and individuality are innate dimensions of music. Performers discover what it feels like to play within a constantly adapting environment, choose how to play, what to play and when, but with the confidence that a plan for the improvisation is already in place. In this respect, gruntCount is presented to the player as a system first, then a piece.

Computer music systems tend to be designed to anticipate a wide range of input – they don’t just do one job. They are not limited to producing music of a specific duration and most systems are built robustly with the expectation of being used by others. They are also highly config-
urable, so that parameters may be adjusted to allow for the independent musical style and aesthetic of various users. gruntCount was developed as a composition system with flexibility, adaptability and scalability built into many aspects of its design. Its systematic nature evolved iteratively as different problems and solutions to them became apparent.

Systems theorists well know that a system imposes itself upon its users in stealthy ways: “when a system is set up to accomplish some goal, a new entity has come into being – the system itself.” (Gall 1975) When using music systems for piece creation, they also bring a voice to the composition. In the case of gruntCount, as work with more performers developed, composerly considerations of sound and form shifted towards designerly issues of interface and ease of use. At a point in the system’s development, it reached a stage where it became impossible to change the behaviour of some of the sound processing modules without rendering obsolete all of the previous versions for multiple instruments that by then were travelling with various performers. In this way, the system had imposed a block on its further development. New versions can of course be made, but changes to the components can no longer be implemented.

One unexpected outcome of working on the bass clarinet edition was a warping of the system’s purpose by the player to create a kind of simple, bespoke digital effects rack. By creating fluid curves within isolated bands of just a few selected settings, distinct units of sound processing became available as the basis for the bass clarinet’s character in a recording session of improvisations with a guitarist. This act of appropriation (or patch-hacking) by the performer reflects a confidence in its operation and configurability, and demonstrates a form of instrumentality in the combined assemblage of acoustic instrument and computer music system.

2.3. INSTRUMENTALITY

Before it sounds, an instrument must be played, requiring a more or less ongoing input of energy to maintain its sound production. It is spontaneous but limited to a definite character. Its timespace is only set out in the number of simultaneous sounds that can be made and their duration (the resonance of a string or drum skin, for example), but remains otherwise open. Acoustic instruments are resistant (Waters 2013; Parker 2007) and experiencing these resistances requires the player to either overcome them or explore their qualities and limits.

Schroeder and Rebelo frame the performer-instrument relationship as “a multimodal participatory space” (Schroeder & Rebelo 2007) – one in which all elements have an affective influence. They argue against the objectification of instruments as extensions of the body, where the relationship with the performer is seen as “a transfer from the body to the world”, preferring a back-and-forth interdependence that is revealed by an exploration of physicality and resistances. “This means that the performer only becomes acquainted with the ‘thing’ at hand by
being able to test boundaries, negotiate subtleties and uncover threshold conditions.” (ibid.)

Because of the the constant slippage of certainty away from the player in gruntCount, and the not-quite-knowableness of the parameters (nested dynamism), situations arise which require practice, familiarity and the development of a contingent and nuanced control. It then becomes possible to ‘play’ the whole, making subjective decisions about sounds and their qualities prior to and during a performance. Choosing the number and types of microphone and loudspeaker to use and their positioning, for example, and the balancing and spatialisation of the software output alongside the amplified live sound, can be determined in advance, very much as part of the setting up of an instrument for performance and integral to the idea of an individual player’s ‘sound’.

Riva and Mantovani suggest that in first-order mediated action (acquiring fluency in the use of a tool) our perception of our bodily selves moves outward (Riva & Mantovani 2012, 206). They explain that our sense of space and what we can do in it operates by integrating two “reference frames” – the peripersonal (immediately reachable with the body) and the more subtle extrapersonal (how we remember and learn to relate to the space beyond our reach, and to objects in it) – and conclude that “our peripersonal space is extended by the proximal tool: we are present in it.” (ibid., 207) Developing the operation of a secondary (distal) tool constitutes second-order mediated action – in our case performing with gruntCount – and “shifts the extrapersonal space to the one surrounding the distal tool: we are present in the distal tool and in the space surrounding it.” (ibid., 208)

Green also remarks that we tend to focus on the “material boundaries of whatever particular device is taken to be the locus of sound production”, whereas from a wider viewpoint, “objects form a part of a network of relationships with other objects and with people.” (Green 2013). These relationships are in constant flux, so there must be an ongoing reassessment of the nature of the environment. We can therefore view an instrument as a “coalition of resources being used at a particular moment.” (Ibid.) One interacts with an instrument to form a broader one, blurring the distinctions between elements in the performance ecosystem (di Scipio 2003; Waters 2007). A new human-instrument identity is established as an aggregate, and it behaves as an assemblage of intimately tied agents.

3. BLURRING: WHAT’S IN IT FOR ME?

3.1. PERFORMER INTERVIEW

MP: As a player, what do you gain by the blurring of these edges?

PF: For me now it’s not a piece, not a series of pieces, anymore – it’s an environment in which I can quickly access either a way to put together an existing piece, a way to create a new one, or even a way to provide the basis for a hacked software instrument. I also learned as I used it
it taught me things: how to set up a live electronics system, about configuring DSP settings and soundcards, how to manage the input coming into the system with the threshold and number of ‘grunts’ – at which point I realised these adjustments are to do with the level of physical effort in a performance. It helped me to feel like an active and invaluable agent in the creative musicking process.

In performance it’s a bit like going into a wrestling bout, or a tricky negotiation. It’s that same feeling you have when you’re about to do a free improv with another person that you know well: you know the sorts of things that might happen, you’re in a space you’ve been in before, but you don’t know exactly what’s going to happen. It provokes you but you can poke it back, and stoke it up with chaos knowing that it feeds on all that high energy. It can also be surprising and playful, amusing even. I remain open in the way that improvising actors are open to receiving offers – gruntCount makes a lot of offers, but I have the choice between control and influence and can also choose deference to it. I can just let it be.

On a more prosaic level, as a system it allows me to manage the physicality of my performance, which is important for a wind player. I pace myself by manipulating the settings for each performance, and define the level of effort required to get through a piece, up to a point – of course, you never know where it’s going to take you exactly. And when it came to finding a solution for playing a solo set with electronics at short notice, I only had to learn a few small things to get gruntCount to do what I needed it to do. It already sounded great, and responded to me in a way I was familiar and happy with. Sometimes you need to just go with what you know.

3.2. COMPOSER INTERVIEW

PF: What do you get from musicians across different countries carrying this around in their backpacks?

MP: As an experimental musician, it’s frustratingly difficult to run actual experiments on the same idea that many times. More often than not, similar experiments tend to run across multiple projects when the fortuitous opportunity to get some music out there comes along. However, in the case of gruntCount, I’ve been able to repeatedly explore this work with multiple players in many different contexts and it’s so far had an exciting life. I’ve learned a lot about the range and scope of collaboration between player and composer.

I discovered that if you try to rush the initial stages where settings are designed, you just don’t get very coherent sound worlds that work with the instrument and the player long-term. However, if you’re careful in the training stage and if the performer practises the curves, much like they would a score, the piece takes shape very quickly. I have also discovered that if a performer understands how the software works, what’s going on under the hood, even a little bit, their performances are very strong.
It’s important for me that this work sounds live. I want to hear the performer thinking through what’s going on, playing with their own sense of anticipation, tension and release. For me, this is where music really starts to happen. I’ve often thought that a player on stage who is free enough to think about what’s going on in the room, they’re perhaps not feeling oppressed, tense, or subject to demands that are beyond their control. A player who is thinking is a player who understands, is well informed and practised and for me when gruntCount works, it’s got the sound of spontaneity, a here and nowness that’s considered, not just bursts of energy.

4. NESTED DYNAMISM

The signal processing in gruntCount is made up of four ‘voices’ and three live ‘effect’ processors. Voices are content creators/co-players, in that they respond to and develop material provided by the player. The effects are used as colours that help to smooth between live sound and processing. Live player or computer voice can be mixed into any of the live effects processors (Fig. 2). Every sound a player makes pushes the playhead through a slippery set of parameter changes that are linked to audio processing modules mixed in parallel. Live sounds provoke movement through the dynamically evolving DSP settings, which is highly engaging for the player, as the ground shifts beneath them with every sonic gesture.

![Figure 2](image_url)

Figure 2 Versions are made and edited in the piece editor window. The four ‘voices’ (middle) are content generators and co-creators, while live ‘effects’ (right) help to colour both these voices and the performer’s sound.

The state of each moment is also modulated by sound. For example, in the ‘soundStealer’ voice, different amplitudes of input trigger differ-

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6. The four voices comprise a ‘soundStealer’ (a multiple sampling engine), synthesiser presets, a pulse generator and a granulator. The three effects are reverb, distortion and the ‘preserver’ (a dynamic sustainer of material).
ent live sampling processors that can also listen to – and sample – each other’s output. One sampler might take only very loud sounds, while another may be ultra-sensitive and pitch-shifted deeply. The processing employs a method that we describe as nested dynamism. This idea is key to sustaining a sense of movement and flow in the computer part and maintaining a distinctive, meaningful and dynamic relationship between player and electronics.

5. LIVENESS AND FLOW

The flow of these improvisations – their pacing, coherence and sense of space – is directly influenced by the way that an inner thread of attention is maintained by the musician throughout the performance. This may also be understood as the managing an evolving flux of liveness. Several authors have proposed a deeper understanding of liveness as incorporating various qualities (Stroppa 1999; Emmerson 2007; Croft 2007; Sanden 2013) and it is to Sanden’s terms for a nascent taxonomy that we will refer here:7

- liveness of spontaneity
- interactive liveness
- temporal liveness
- liveness of virtuosity
- spatial liveness
- causal, or corporeal, liveness
- trace corporeal, or vestigial, liveness
- liveness of authenticity
- virtual liveness

The gruntCount performer directs and influences some of these qualities, such as the spontaneous liveness of improvisation, the interactive liveness perceived in moments of wrestling or negotiating with the electronics, particularly since the system is designed to produce occasional unexpected elements (a kind of benign provocation). While gruntCount is purely reactive, any perceived sense of interaction should not be dismissed. Emmerson has proposed that “what we perceive when we perceive ‘interactivity’ becomes a measure (but not the measure) of liveness” (Emmerson 2012, his emphasis) and Sanden goes further, claiming that “the value of liveness is not located in what is actually happening but in what we perceive as happening.” (Sanden 2013, 109)

There is also a temporal play of liveness during a performance: the electronics refer back to the initial studio session, reactivity happens in the moment and the sampler is fed with material for future regurgitation, which we then recognise from the recent past. There may also be a liveness that resides in the performer’s virtuosity. There are qualities of spatial and causal liveness, since both musician and loudspeakers are physically present in the room – the resultant sounds can be heard and the player’s effort witnessed. Spatial frames may be played with

7. although rather out of expediency than any suggestion of ideological supremacy.
Certain elements remain outside the sphere of control of the performer, such as the *trace corporeal* presence of the composer, some *vestigial* traces of will, and other spectral elements from the wider culture which affect live performances but remain mostly unnoticed. Notions of *authenticity* contribute to liveness — in *gruntCount* we are true to ideas of what the piece/system should and should not be and do, to the way the live instrument and electronics should sound (artistic voice), and to how the whole reflects the relationship captured in the initial studio interaction.

Finally, there is what Sanden terms *virtual* liveness in digital technologies, addressing the significance of identities not actually present, but formed in the minds of performer and audience. Humans exhibit a tendency towards animism with regard to objects and to a “systematic anthropomorphism” (Guthrie 2012), which by extension may lead to the projection of virtual personae in an interactive computer music environment. In a performance of *gruntCount*, player and listeners each experience this subjectively and may perceive it (as this performer does) as a form of *personality* within the electronics. This seems to be helpful, perhaps even necessary — after all, to wrestle, to negotiate, to play, to make music together, requires a partner, a companion, an adversary.

The balancing of these various elements forms part of the musician’s embodied knowledge and skill as acquired over a considerable period of time. This shifting assemblage of liveness qualities can produce a sense of abstract narrative, a more or less taut thread of attention drawn between musician-instrument and audience. When successful, this thread may contribute to another sense of flow: that of ‘optimal experience’ (Csikszentmihaly 1975), where the perception of time is altered or even suspended and levels of concentration, motivation and enjoyment are significantly raised.

### 6. CONCLUSIONS

The main compositional aim for *gruntCount* was for it to behave credibly as music on stage, while meaningfully addressing challenges of liveness and spontaneity. The identities of visible performer and instrument on stage, as well as perceived virtual identities within the

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8. which is here connected to an idea of optimum user experience (UX)

9. This is not the place for diving into a detailed discussion of flow as optimal experience. Which is not to say that studies of flow in musical performance are still relatively thin on the ground (Wrigley & Emmerson, 2013) and that research in this area would be both welcome and potentially influential.
purely acousmatic electronics, become part of a *gestalt* in which each element is augmented. While existing as both a set of discrete, replicable pieces and a configurable system with which to make these pieces, we have discovered that *gruntCount*’s ease of use and emphasis on performer agency also afford it qualities of instrumentality. This level of user experience is to be welcomed in live electronic music practice and appears to engender flow in the performer, although more tailored research would be required to assert this.

By making a piece with a system that plays like an instrument, we further blur the definition of each. Importantly, our individual roles are also smeared. The performer does much more composing and top-level piece design, taking greater overall responsibility for what is heard. Meanwhile, the composer is required to become a more expert systems designer, making fewer concrete decisions about what should happen on stage, instead defining a range of possibilities that afford what *might* happen. Given the numerous considerations involved in mixing and blending acoustic sound with electronics, both composer and performer also become instrument builders. The blurring of these roles, and the shifting of their emphasis in appropriate directions, leads to an environment where composer and performer are more able to focus on bringing liveness and spontaneity to musical ideas.

**ACKNOWLEDGMENTS**

Development of *gruntCount* began in 2011 with flautist Anne La Berge and a remote collaboration with saxophonist Henrique Portovedo. Further development of the bass clarinet version has been made possible by the Arts and Humanities Research Council (AHRC).

**REFERENCES**


ABSTRACT

An improvisation for bass clarinet and computer, in which aspects of timing, flow, duration and effort are controlled by the performer, who negotiates a plotted and nuanced journey through sound processing modules which have been specifically designed around his individual playing style.

Martin Parker’s gruntCount is a multi-version, configurable composition for improvising musician (or musicians) and computer. Pete Furniss is the musician here. He embarks on a journey through sound processing modules that are specifically customised to his individual playing style. gruntCount exists in no fixed state, yet it allows for a growing set of rehearsable, replicable and configurable pieces, in which all musical material, timing, overall duration and levels of effort are managed by the live musician. gruntCount challenges traditional definitions of ‘piece’, ‘system’ and ‘instrument’, establishing an environment for humanmachine improvisation that serves the musical result and not the system itself. The authors investigate formal time-shaping possibilities within a structured performance, while exploring the environment’s qualities of coaction and configurability in an era of new score types.

LINKS TO AUDIO & EXTENDED TEXT
Towards an Aesthetic of Instrumental Plausibility for Mixed Electronic Music

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ABSTRACT

The implementation of live audio transformations in mixed electronic music raises the issue of plausibility in real-time instrumental transposition. The composer-performer collaboration described in this paper deals with two of the composer’s existing pieces for solo instrument and computer, addressing issues of timbre and intonation in the output and adapting the existing software with improvements informed by both the physical resonating properties of musical instruments and by instrumental ensemble practice. In preparing these pieces for publication, wider performance and further instrumental transcription, improvements stemming from both compositional and performative considerations were implemented to address this issue of plausibility. While not attempting to closely simulate a human approach, the authors worked towards a pragmatic heuristic that draws on human musical nuancing in concert practice. Alternative control options for a range of concert spaces were also implemented, including the configuration of user input and output at interface level in order to manage common performance-related contingencies.

1. INTRODUCTION

Following several years of collaboration on the performance of mixed electronic music, the authors decided to return to two existing pieces, Prelude I for Clarinet and Computer and Prelude II for Clarinet and Computer, in order to modify and update their technological components. The primary motivation behind this was simply to make the audio processing “sound better” for the purposes of including them on a published sound recording. The second motivation was to prepare the pieces for wider dissemination, including transcription of one of the pieces for a variety of other instruments, through publication of the score and technical materials. Both motivations necessitated an updating and refinement of the underlying audio processing. Improvements to the audio signal processing were geared toward the implementation of a plausible instrumental transposition – one that is informed by physical resonating properties of instruments and by instrumental ensemble practice. In doing this, we were not attempting to simulate a human approach, but rather create something pragmatic that draws on human musical nuancing.

The desire for a plausible instrumental transposition required addressing the way that audio effects can modify the perception of instrumental resonance in uneven ways. While resonant filter banks have been used frequently to simulate instrumental resonance where sound synthesis is concerned [1, 2], here they were employed to provide a homogeneity within the transposed material. Furthermore, the recent move to 64-bit has brought subtle improvements to clarity in audio signal processing that become musically significant in multi-layered musical and sonic textures. It was therefore necessary to make updates at the code level to some project-specific software. Finally, it was decided to break from an exclusive use of equally tempered semitones as a subtle step in an attempt to impart a chamber music aesthetic to the computer processed output.

The work undertaken on instrumental transcription and interface design represents a continuation of the authors’ earlier research on Prelude I [3]. Improvements to the interface and audio processing chain were implemented in order to address the configuration of user input and output for the management of common contingencies in the performance space. The existing user interface was further adapted to provide a diversity of options for control either onstage by the performer or offstage by a technical assistant.

2. RESONANCE AND FORMANT FILTERING

The two pieces referred to here each employ real-time transformations of the live input, including transposition both within and beyond the actual range of the instrument(s) to create the effect of a virtual ensemble. Where these transpositions extend beyond a perfect fifth in either direction, the question of plausibility becomes an issue [4] in respect of an overall ensemble aesthetic. In the case of the Prelude I, transcription of the original solo flute part to both violin and viola had led the composer to adapt the software to string instruments by first filtering out the fixed formant structure of the resonating instrumental body using notch filters before transposition, and later adding the formants back into the transposed sound through the use of resonant filtering. This creates a greater sense of homogeneity, since the formants remain stable when the sound is transposed. (Refer to Sound Example Set 1 via the link provided at the end of this paper.)

In comparison to stringed instruments, the spectral envelope of woodwind instruments is heavily dependent on both pitch and volume (this is especially true of the clar-
structure, and does not have an entirely fixed formant structure. However, a generalized pitch-invariant formant-based model has been shown to be helpful in improving perceptual evaluation of synthesized instrumental tones [1, 2], so the technique used with the string versions of the piece seemed potentially appropriate for any woodwind transcription. Therefore, in addition to including formant filtering in the violin and viola transcriptions of Prelude I, it was decided to introduce a similar filtering system to the clarinet version of the piece [3], in order to improve the instrumental perception of transposed audio material. [5] Had string versions of this piece not been created, the use of fixed formant filtering would probably not have been considered for wind instrument transcriptions, however, since the filtering had been implemented in the performance software and proved to be effective with the clarinet when tested empirically, it was added to the clarinet version.

Wind instruments are inconsistent in their resonating tube lengths across the range of musical pitches available, in comparison to other instrument classes. [6, 7] Orchestral stringed instruments, the guitar and the majority of percussion, for example, maintain much the same resonating body over a variety of frequencies. In valved brass instruments, there are a small number of differing resonating tube lengths, according to which valves (or combinations thereof) are depressed, or which harmonic is being emphasised by the embouchure of the player. The trombone has a relatively consistent, though smoothly scalable resonating tube. In order to assimilate a plausible overall resonance for the clarinet, we decided to take samples from the resulting transpositions become more credible in terms of the instrumental textures they are modeling. (Refer to Sound Example Set 2 via the link provided at the end of this paper.)

3. UPGRADING DIGITAL AUDIO RESOLUTION

Upgrading the software to 64-bit sample compatibility was initially enacted out of the necessity to maintain performance software. [3] However, side-by-side comparisons of 32-bit and 64-bit audio output were also found to present higher clarity and definition, particularly noticeable in musically dense passages. [2] (Refer to Sound Example Set 3 via the link provided at the end of this paper.) On a technical front, the update of the MSP external objects themselves was fairly straightforward: it simply required making minor modifications to the code in accordance with the specifications in the most recent Max Software Developer’s Kit and recompling.

A sample rate hike to 48kHz or much higher was discussed, which could potentially further improve the quality of transposed sounds from the live input. However, although the recording industry currently leans towards 96/192kHz, such a retrofit would have required considerable recording of the patch, which was considered overly laborious to be of notable kind at the present time. Nevertheless, higher rates will certainly be investigated for future pieces in this series.

4. INTONATION

“The question of intonation is evidently relevant to nearly all instrumentalists... and has a profound influence on the way composers and performers collectively think about harmony and intonation.” – Mieko Kanno

Where real-time transpositions are concerned, manually hard-coding intonation choices is burdensome and time-consuming, even with the aid of the computer to help pre-calculate ratios to semitones; this is especially true when compared to the immediate and multiplex tuning adjustments that trained musicians make by ear. [8, 9, 10, 11, 12, 13] Therefore it was decided to create an algorithm to automate intonation for real-time transposed chordal structures defined in the score in terms of semitones for these pieces, in lieu of simply providing transposition in cents, or fractions thereof. This is not an issue of user interaction but rather a compositional and aesthetic choice. There are prior examples of this kind of system, such as Eivind Groven’s automat for adaptive just intonation [14, 15], the algorithm for which makes a note choice from a selection of fixed pitches. Many such systems are appropriate for keyboard instruments (Groven’s was first implemented for organ), but the basis for these is quite different from the type of tuning that other instrumentalists or vocalists may intuitively execute in performance. Kanno cites Fyk in relation to four distinctive types of “expressive tuning” employed by instrumentalists (and singers): “harmonic, melodic, corrective and colouristic.” Harmonic tuning relates to just intonation in relation to explicit or implicit vertical structures, while melodic intonation concerns a relative broadening and tightening of intervals based on melodic direction. Corrective intonation is “instinctive tuning” which occurs when a performer hears a discrepancy between projected and perceived pitches, while fine adjustments of timbre may be achieved by colouristic intonation choices. All of these ongoing manipulations of pitch require “the linearity of time against which to map out [their] expressive intention.” [10]

Many common chords (such as triads or secundal/quartal harmonies) are relatively straightforward to tune. For example, a major triad consists of three justly tuned intervals: a perfect fifth (5:3 ratio or 1.666) and a minor third (5:4 ratio or 0.875) both delineated by the central pitch’s relation to the two outer pitches. Each of the just intervals aligns perfectly with the others to form the triad (1.25 * 1.2 = 1.5). This would not be the case for a three-note vertical structure with a sharp 4th degree such as C # F G, since the just ratios for the tritone (11:8 or 1.375) and minor second

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1. It was not necessary to revisit the original flute version since the basic spectral correction used for that version was already taken into consideration during the compositional process.
2. For a single stream of audio processing there is often little to no perceptual difference between the two, however there is an audible difference when mixing multiple audio streams. This could have something to do with dither being at a lower volume when mixing multiple sources, or just an increased amplitude resolution mitigating high frequency phase cancellation when mixing multiple signals.
(17:16 or 1.0625) do not superimpose to comprise a justly tuned perfect fifth (1.375 * 1.0625 = 1.4609375 not 1.5). This implies that, if we want the outer notes to delineate a justly tuned perfect fifth, we need to make a choice between tuning the F# to the C (with a just tritone), or tuning it to the G (with a just minor second), since it cannot be justly tuned to both notes and yield an in-tune perfect fifth between the outer notes. In each of scenarios the F# will cause beating with one of the two other notes. Alternatively, we could split the difference between tritone and minor second and tune the central note somewhere in-between, so it beats evenly (or even unevenly) with both of the (in tune) outer notes. For many musicians, including string players but also singers and players of wind or brass instruments, the fine adjustment of this intonation is an instinctive, internalized process based on years of experience and deliberate practice. For the computer, however, it is rather more complicated, since the programmer must create an algorithm to find the appropriate tuning nuance in each case.

The algorithm used here measures the intervallic content of chordal structures, calculates individual frequency ratios for each interval, and adjusts the calculated frequency of each note based on the weighted consonance of each interval within the chord [16, 17, 18], with respect to a reference pitch in the chord (usually the note being played by the live instrumentalist in mixed electroacoustic music). Once a midis note is identified from the input, it is converted to a frequency value and thereafter dealt with on a ratio basis instead of using semitones and cents. A very slight amount of random variation proportional to the frequency of any given pitch is added to the final tuning to emulate human error, and keep highly justly tuned chords from becoming static, seeming too mechanical or perceptually fusing into a single note. This humanizing of the intonation is heuristically modeled on the various types of tuning that brass instruments, the fine adjustment of this intonation is an instinctive, internalized process based on years of experience and deliberate practice. For the computer, however, it is rather more complicated, since the programmer must create an algorithm to find the appropriate tuning nuance in each case.

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The software was restructured to allow for various user-configurable inputs, as well as gain and balance controls at various stages in the processing path. This is often overlooked, but allows the patch to be tailored to a variety of different performance scenarios. Similar one-patch-fits-all approaches have been used by a variety of composers (e.g., Kaija Saariaho, Martin Parker and Alexander Harker among others). It was also noted here that an increasing number of performers in the field are preferring to run their electronic parts directly, without the aid of an offstage technician. These user-oriented input and output controls within the onscreen interface allow for relatively rapid and simple adjustments to be made by the performer in situ, in response to aspects of the performance space, such as balancing microphone signals into the system, setting live direct output level and managing feedback with a variety of input solutions.

While many clarinetists employ two or more microphones to adequately cover the range of the instrument, an additional, isolated (e.g. piezo or contact microphone) input may be used to track pitch without feedback from the software output. (3) Although the quality of these transducers may be inferior to a high quality condenser or ribbon microphone, it was considered advantageous to provide for the use of up to three inputs for any instrument, with the ability to mix relative levels directly from the user level of the software interface. In our case, the third input was disregarded entirely for output purposes (being used only to feed the pitch tracker). This allows a performer to make adjustments quickly according to varying performance ecologies (the acoustic space, loudspeakers, microphones etc), which may differ considerably to rehearsal conditions, in order to manage feedback and projection levels. (Refer to Sound Example Set 5 via the link provided at the end of this paper.) A continuation of this input/output configurablility relies on performers adopting strategies such as presets, VST plug-ins, or drop-ins [19], in order to assert established priorities regarding their overall sound.

The restructuring also involved separating the sound sources produced in the piece from a fixed speaker definition, so it can be performed with any given multichannel (or stereo) speaker configuration. It was previously limited to 4 or 2 channel output – it now deals with spatial location using a standard azimuth definition – presuming that the speakers are arranged more or less along a circular path around the hall, when using a multichannel setup. (In a stereo scenario the left-right panning information is extracted from the azimuth.)

6. CONCLUSIONS

In implementing the above improvements to two existing pieces, it was discovered that the additional filtering before and after transposition was worth the effort in terms of a timbral strengthening of the instrumental plausibility in the electronic part. Furthermore, although the upgrade to 64-bit signal processing was dictated by the necessity of software maintenance, it was a pertinent element in improving the clarity of the electronics, particularly in densely scored sections.

Further research to determine the perceptual effectiveness of intonation adjustments could be undertaken using a music perception experiment, with the results used to determine improvements to the algorithm. In the two pieces discussed in this paper, both instrumental plausibility and

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3 The same holds true if other ratios such as 7:5, 10:7, 24:17, 45:32, etc. are used to define the tritone.

4 Considerable improvements continue to be made in this area. For example, we use the Rumberger K1X Advanced Piezo Technology condenser microphone mounted within a specially adapted clarinet bell. The relatively high quality of this device gives further options in the blending of input sources to accurately reflect the performer's sense of priorities in terms of their sound.

5 Vector based panning (VBAP) [20] was used to accomplish this.
effective transcription [3] were enabled by the adaptation of filtering and an approach informed by both the physical properties of instruments and the needs and priorities of their players within a variety of performance environments.

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7. URL

http://www.richarddudas.com/ICMC2016Sounds/

8. REFERENCES


Audio CD 1

Recorded at the Reid Concert Hall, University of Edinburgh, September 2016 (1-3) and February 2017 (4).

Edited and mixed by Pete Furniss. Assistant producers Peter Nelson, Stuart MacRae, Michael Edwards, J. Rafael Subia. Engineered and mastered by Owen Green.

Audio CD 2

Track 1 recorded at Edinburgh College of Art, May 2014; track 2 at the Festival Theatre Studio, Edinburgh, July 2014; track 3 at Zé Dos Bois, Lisbon, Portugal, November 2014; track 4 at Studio 4, Alison House, Edinburgh College of Art, April 2015; tracks 5-8 at the Reid Concert Hall, University of Edinburgh, July 2016 (8) and May 2017 (5-7).

Engineered, edited and mixed by Pete Furniss. Mastered by Owen Green.

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