Extending Instruments with Live Algorithms in a Percussion / Code Duo

Paul Hession[1] and **Alex McLean**[2]

Abstract. Hession/McLean is a free improvising duo that confounds the usual classifications of musical genres. Hession has worked mostly within the jazz and free improvisation scenes and is now exploring working with live electronics and McLean has developed an improvised approach to electronic music, largely within dance-oriented genres, via live coding. In this duo Hession's drum set is extended using both analogue and digital technology, and McLean works as a live coder, writing software to generate music during a performance. This paper provides context for this collaboration, focussing on the development of Hession's practice, and his associated research programme; in particular the role of live algorithm techniques in providing a surrogate playing partner, combined with analogue technology inspired by the pioneering work of percussionist Tony Oxley. The focus is on the musical considerations at play, and how live algorithms may sit within a melange of physical, analogue and digital technology, and within gestural/instrumental and symbolic/linguistic approaches to improvisation.

1 Introduction

The present paper provides research context for the musical collaboration between the present authors, in particular Jazz Improv percussionist Paul Hession, and live coder Alex McLean. This work fits within a long history of ecosystemic approaches to computer-aided improvisation [3, 8, 9], and our main focus is Hession's research into the integration of live algorithms into his heavily personalised drum kit. By contrast, McLean's approach in the developing Live Coding tradition [2] goes against the grain of work in Live Algorithms; instead of treating algorithms as free-wheeling co-performers, McLean treats them more like linguistic utterances, creating, manipulating and deleting algorithms through the course of an improvised performance. As Hession's work is of greatest interest from the perspective of Live Algorithms in Music, the present paper speaks mainly from his perspective, describing his current research programme in detail, before situating the collaboration in this light.

2 A Surrogate Playing Partner in Improvised Percussion

I (Hession, first author) am working towards an original way of playing, using a percussion set-up of my own devising, which incorporates both acoustic and electroacoustic components. The electroacoustic dimension involves combined use of analogue and digital tools, to expand the sound-world at my disposal and to create a surrogate playing partner. This partner is a live algorithm which samples my input, randomises and replays it, so that I interact with (a mediated version of) myself.

My interest in using live electronics with percussion started with the work of the notable jazz and free improvising drummer Tony Oxley. He is a pioneer in the field of free improvisation, first using live electronics, or "amplified percussion" as he described it, in 1969. Integral to Oxley's ground-breaking developments in his playing was the creation of a completely personalised drum kit.

In 2010 I travelled to Viersen, Germany to interview Oxley about his playing in both jazz and free improvised music, and again in July 2013, to interview him about his use of electronics. On the latter occasion, I was fortunate to gain admittance to his practice studio and could examine and photograph his custom built equipment (Figs. 1 and 2).

Oxley constructed a metal frame to which he attached sound sources: clamped knives (to be bowed or twanged), taut springs, small cymbals, an electric motor and egg slicers to which three contact microphones were attached. The frame was positioned to his left, while he sat at the drum kit, and processed the sounds through custom-made devices: a ring modulator, an octave divider, a compressor, an oscillator and a volume pedal. The use of volume pedal is crucial from my standpoint, including within the collaboration with McLean described later (§3).

Figure 1. Tony Oxley in his present (shared) practice studio in Viersen with the latest (slimmed down) version of his drum set.

Tony Oxley's use of (analogue) electronic equipment is direct and immediate; he approaches the instruments as he would a conventional acoustic sound source – physical interaction elicits the sounds which are dependent on pressure, method of excitation and

[1] CePRA, University of Leeds, United Kingdom, email: mc10ph@leeds.ac.uk
[2] ICSRiM, University of Leeds, United Kingdom, email: a.mclean@leeds.ac.uk

sensitivity.

The challenge of playing *solo* percussion in an improvisational context is one that I have met head on, on many occasions, but the limitations of the conventional drum set are readily apparent. The instrument evolved primarily in an accompanying role, so it was an obvious and quite natural step to add additional sound-sources to the kit to give greater possibilities for timbral variety. Oxley developed his kit in this way, and his experience as a player of orchestral tuned percussion, while doing military service, informed his choices.

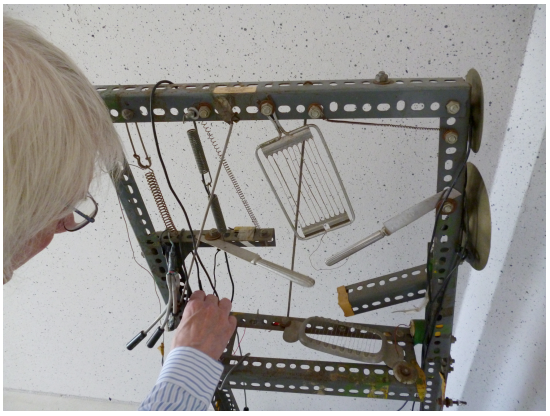

Figure 2. Tony Oxley with his Dexion frame. The sound sources are clamped knives, egg slicers, a small motor, taut springs, small cymbals and a large cymbal attaches to the threaded rod at bottom right. Three contact microphones are attached to the frame.

2.1 The Electroacoustic Dimension

Entering into the world of electroacoustic music seemed like a logical progression from the work of Oxley, and a necessary step for me to take to fully exploit the potential of percussion, particularly in sustaining pitched sounds. Cymbals, gongs and bells are at the heart of my set-up, and the almost inaudible sub-harmonic partials, only apparent when listening close-up, offer rich raw material for electroacoustic exploitation. By contrast, membranophones (drums) do not offer much in the way of sustain, but by tensioning them to 'ring', a range of indeterminate pitches (with the potential for pitch change) are available. Instruments such as woodblocks do not sustain at all, but do offer possibilities for contrapuntal exploitation when combined with the other parts of the kit.

The role of electronics in my research is twofold:

- To add to the sound-world at my disposal by applying effects to the raw material (acoustic percussion) and, in some cases, by making the almost inaudible audible
- To run algorithmic programs that apply randomising parameters to create a surrogate playing partner.

2.2 Research Questions and Themes

The purpose of the Surrogate Playing Partner is to stimulate interaction, thereby simulating the push-and-pull that is intrinsic to playing with another human musician. This then poses the question:

Am I still playing solo while interacting with (a mediated version of) myself?

Further, I wish to challenge the audience to consider the same question, but also:

Figure 3. Paul Hession's drum set in his home studio.

- Is this a solo or a duet with either the performer or a machine?
- Is the computer output created independently by the machine or is it input from the performer?
- If it is the performer's input – when is it sampled, prior to or during the performance?
- If the performer is sampling in real-time, can this be observed/heard during the performance?
- Which sounds are created acoustically and which electronically?
- Who or what is leading (controlling) the performance – the performer or the computer?
- How is this achieved?

These questions are intrinsic to my research themes, which can be summarised as:

- Investigate the analogue electroacoustic work done by Tony Oxley and update it by combining analogue and digital tools. The focus will be on retaining the immediacy of the analogue technology while extending its capabilities with digital manipulation.
- Develop and evaluate an original approach to solo percussion performance, transcending the morphology of the drum set by the use of unconventional playing techniques and integrated electroacoustic technologies.
- Investigate how the digital technology (Max/MSP) can work most efficiently when combined with analogue and acoustic tools. Are its generative (algorithmic) capabilities best applied to create a surrogate playing partner and, if so, how can I address the issues raised above to challenge and stimulate an audience?

In order to develop a useable Max patch that fulfilled my wishes for a challenging and unpredictable outcome, I worked closely with Chris O'Connor, a programmer at the University of Leeds. My own interaction with the the technology is purely as an end-user and Chris and I developed the patch through a process of continuous refinement and, what Stowell and colleagues [6] describe in the context of Discourse Analysis. '...users construct it socially using analogies and contrasts with other interactions in their experience, a process which creates the affordances and contexts of the system.' The patch that Chris and I developed was named by him 'Max Wants To Play Drums' (MWTPD) and he describes it thus:

> "The audio is analyzed during the recording process, and used to set parameters and ranges for the playback and manipulation processes. Parameters pitchL and pitchH represent the

pitch range of the recorded audio, and are used to set the range of random values that set the playback speed of the samples. Parameters brightL and brightH represent the brightness of the recorded audio, and are used to set the range of random values that modulate the filter cutoff. Finally gapL and gapH represent the shortest and longest gaps between transients in the recorded audio.

These parameters set the range for the random time delay between the triggering of individual slices, so that if the drummer plays a rapid succession of transient hits the resulting computer improvisation will also be rapid, with quick triggering of modulation.The manipulation of the audio happens in the slice-engine, where the audio is sliced into shorter sections, relative to the length of the recording. A random clock controls the playback of these slices, where after a slice has been played back, a random interval of time based on the gapL and gapH parameters elapses before triggering the next slice. Every time a slice is triggered, the modulation of the slice is triggered, with a randomly generated modulation time. The modulation consists of playback speed, filter, and repeat. The playback speed modulation range is set by the pitchL and pitch parameters, triggering a random value for the speed to change to over the clock time. The filter is modulated in the same manner, except that the brightL and bright parameters set the range. Upon playback, the slices have a 30% chance of looping when they are triggered, so that they could potentially create a sustained tone during modulation."

After working as a solo drummer interacting with Max for some time, I was very interested to read Nick Collins' account of his ListeningLearning project with Eddie Prvost [1]. I was struck by the similarities with this project, given that Eddie and I are both free improvising drummers, although we have quite different approaches to playing. Collins refers to 'a primary emphasis on timbral and rhythmic alignment' and 'no pitch information treated' – an understandable leaning towards rhythmic analysis that seems to take precedence in most instances where percussion and electronics interface. Although rhythmic passages are bound to occur from time to time within an improvisation, as they will with any instrumentalist, my own area of interest with digital electronics lies primarily in the manipulation of pitch as a stimulation to action. As I am interacting with a surrogate, when playing solo (with the MWTPD patch), I am working towards developing an electronic collaborator that uses pitch – perhaps approximating a human player, such as a pianist, a trombonist or a singer.

I am aware that I am not a pioneer in this field and there are many illustrious antecedents, such as George Lewis and those described by him [4], but my adoption of analogue electronics (inspired by Tony Oxley) combined with digital tools (Max/MSP), hopefully goes toward presenting an engaging musical event which might retain the primacy of human agency within this area of musical research.

3 Hession/McLean Duo

To date the duo has performed at Cafe OTO, London (August 2013), and at PRISM, Sheffield (November 2013), presenting a challenging playing situation which might confound any pre-existing prejudices. Hession uses his drum set as described above, and McLean uses his live coding language Tidal [5], making his work visible by projecting his screen in the Live Coding tradition [7]. We play as distinct entities, without any connection between our technologies, besides reacting to each other's sound as Human musicians.

From Hession's perspective, the duo requires an approach radically different from the solo improvising discussed so far. The duo is all about interaction, towards a fairly dense, contrapuntal outcome, and so applying the input/mediation/playback live algorithm approach in the same way can be limiting. Hession's use of the volume pedal as the final controlling factor with the electronics has therefore proved to be a primary tool. The volume pedal can be used to mute the signal in order to concentrate on playing acoustically, before fading electronic elements in and out at will. In this context then, the role of the live algorithmic component of Hession's instrument is to provide surprise; recording acoustic sections, a path is prepared for playback by the live algorithm in the near-future. This approach provides energy for the performance, satisfying the duo's desire for an open and unpredictable outcome.

The duo provides a major shift of focus in McLean's usual approach. His Tidal language represents pattern both in terms of discrete and continuous structure [5], and is designed for fast, fluid changes in improvisation, originally motivated by an earlier collaboration with drummer Alex Garacotche. Working with Hession has led McLean to explore the limits of this software, exploring new strategies focussing on the nature of change in performance. The collaboration also frees McLean from fixed tempo and time signature, which can be an awkward limitation in collaboration between instrumental and live coding improvisors. Whereas normally the instrumentalist must either fit to the laptop tempo, possibly with a click-track, or otherwise work within the current limits of machine listening for tempo-tracking, in this duo the rhythmic layers share tempo only fleetingly. This frees McLean to explore live coding as a conversation, and a shaping of complexity and timbre.

3.1 Conclusion

We have contextualised the use of live algorithms in improvised percussion performance, describing different usage in solo work and in collaboration with a live coder. In both cases the live algorithm works as a surrogate co-performer, in solo performance working alongside analogue electronics to manipulate and/or accentuate tonal qualities of the drum set which would otherwise not be heard, as well as injecting uncertainty and richness as an algorithm with its own musical qualities. In the collaborative duo, the live algorithm takes a different role, placed more often in the background, but brought to the foreground to bring in changes of direction, using sections of acoustic playing as source material. This development of the musical collaboration works alongside Hession and McLean's separate research programmes in live algorithms and live coding, acting as a confluence of research into practice.

REFERENCES

[1] Nick Collins, 'LL: Listening and Learning in an Interactive Improvisation System', Technical report, University of Sussex, (2011).

[2] Nick Collins, Alex McLean, Julian Rohrhuber, and Adrian Ward, 'Live coding in laptop performance', *Organised Sound*, **8**(03), 321–330, (2003).

[3] Agostino Di Scipio, 'Sound is the interface: From interactive to ecosystemic signal processing', *Organised Sound*, **8**(3), 269–277, (December 2003).

[4] G. E. Lewis, 'Live Algorithms and The Future of Music', *CTWatch Quarterly*, **3**(2), (May 2007).

[5] Alex McLean, 'The Textural X', in *Proceedings of xCoAx2013: Computation Communication Aesthetics and X*, pp. 81–88, (2013).

[6] D. Stowell, A. Robertson, N. Bryan Kinns, and M. D. Plumbley, 'Evaluation of live human-computer music-making: Quantitative and qualitative

approaches', *Int. J. Hum.-Comput. Stud.*, **67**(11), 960–975, (November 2009).

[7] Adrian Ward, Julian Rohrhuber, Fredrik Olofsson, Alex McLean, Dave Griffiths, Nick Collins, and Amy Alexander, 'Live Algorithm Programming and a Temporary Organisation for its Promotion', in *read_me — Software Art and Cultures*, eds., Olga Goriunova and Alexei Shulgin, (2004).

[8] Simon Waters, 'Performance ecosystems: Ecological approaches to musical interaction', in *Proceedings of EMS*, (2007).

[9] Michael Young, 'NN music: Improvising with a 'living' computer', in *Computer Music Modeling and Retrieval. Sense of Sounds*, eds., Richard Kronland-Martinet, Sølvi Ystad, and Kristoffer Jensen, volume 4969 of *Lecture Notes in Computer Science*, 337–350, Springer Berlin Heidelberg, (2008).