

E-SULING: EXTENDED TECHNIQUES FOR INDONESIAN PERFORMANCE

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ABSTRACT

The paper describes the E-Suling, an Indonesian hyper-instrument modified with sensors and a microchip. We describe the software and hardware designs in a variety of different languages and frameworks. We also discuss how the E-Suling is used in composition and performance to extend new techniques to traditional Indonesian music.

1. INTRODUCTION

The proliferation and reduced cost of data transmitting electronic sensors along with the free and shared nature of an open source programming environment has fuelled a healthy and creative culture of user specific projects, in which musical applications are just one of a number of areas where innovative design is taking place. Within this area, the emergent field of computational ethnomusicology (Tzanetakis, Kapur, et. al., 2007) provides the opportunity to capture raw numerical data through instrument-specific interface design, representing performance information in the form of a highly detailed fieldwork transcription for a variety of cultures around the world.

Indonesian gamelan percussion ensembles provide rich testing grounds for computational ethnomusicology, in particular the early 20th century Balinese *gong kebyar* style that proliferated and still dominates on the island to a great extent. It is explosively fast and frenetic, yet tightly organised. This strictly composed and largely improvisation-free art form consists of many new and/or variant compositions that have no written notation. Taught orally and through demonstration to the group many of these compositions are never played again and are quickly forgotten, I Wayan Gde Yudane explains, *'Most recent pieces disappear, because they are played by non-permanent groups that are formed solely for a competition (Body, 2002)*. Even in Balinese gamelan works containing a western notated score one classically trained musician will dictate the musical information orally to the group and in some instances instrument specific melodic passages will be fleshed out from a prescribed note sequence in a way unique to the instrument and player/s, such as the sharing of

idiophonic melodic sequences on the reyong. These patterns may not be played the same way by a different group, and if the reyong players are of a high calibre the composer may find it difficult or impolite to directly infer his performance technique opinions. With the use of custom technology geared towards Indonesian music, we can start addressing some of these issues with modern data capture techniques.



Figure 1. Gangsa players performing a Legong in Ubud, Gianyar. Feb' 2011.

This paper presents the E-Suling, a traditional Indonesian instrument that has been modified with sensors and a microchip. Section 2 describes related work on computational ethnomusicology and hyper-instrument design. Section 3 describes the designing of the E-Suling, with software, hardware and infrastructure. Section 4 describes how the E-Suling was used in composition and performance environments. We conclude with future work and how our team plans to contribute to the field of computational ethnomusicology.

2. RELATED WORK

This section describes a non-exhaustive history on artists who have combined electronics with Indonesian music, as well as a brief discussion on hyper instruments.

The Indonesian gamelan has influenced numerous music scholars around the planet, leading to varied and innovative directions using these unique instruments as a creative foundry. The integration of electronics and contemporary art music aesthetics into gamelan related composition is a natural progression for these ensembles, especially for those of us who are not intrinsically connected to the use of gamelan as part of our own socio-cultural and religious heritage.

Columbian composer Alba Fernanda Triana completed the creation of the Gamelan Electronico in 2007¹. A Max/MSP programmed table with six light bars that react to the shadows of the interactive participant's hand motion, providing continuous control of parameters assigned to important elements of the compositional structure. The performance of the work is endlessly variable, based on the participant who takes on a dual role as performer and audience simultaneously. The outcome hinging on the balance between expectation and investment from said participant.

The Brooklyn based LEMUR gave birth to the Gamelatron² in 2008. Using robotics from other instruments and incorporating them into a mix of Javanese and Balinese gamelan, compositions performed by a fully robotic MIDI controlled orchestra were created and concerts are regularly performed. New versions of the Gamelatron are in development and this research will undoubtedly be of great value in those interested in reversing the information flow process to capture data from virtuosic and uniquely human performances, rendering a descriptive score that can be stored for future analysis.

The KarmetiK Machine Orchestra (Kapur, et. al., 2010) operates, a group of composers with specialisations in custom interface and robotic design. Works by the group include hyper-extension of instruments from Indian music as well as pieces where a human gamelan ensemble performs with a robotic *reyong*³ playing traditional Indonesian music.

The advent of the hyper-instrument began with Tod Machover's Hyper Cello (Machover, 1992). With an invaluable performative collaboration with Yo Yo Ma at MIT the practise of adding sensors to acoustic instruments was pioneered.

At the 2003 New Musical Interfaces for Musical Expression (NIME) conference Cleo Palacio-Quintin presented her Hyper-Flute, a construction conceptually akin to my own E-Suling, 'A standard Boehm flute (the model used is a Powell 2100, made in Boston) extended via electronic sensors that link it to a computer, enabling control of digital sound processing parameters while performing (Palacio-Quintin, 2003).'

These examples have shown differing yet related ways that people and instruments can interface with new technology, audience/participant; prescribed MIDI performance; and hyper-extension of human performance.

The Gamelan Electronico's requirement of interactivity from anybody who wishes to participate rewards swiftly by transferring simple hand gesture into changes in process, a creative 'meeting in the middle' between composer and listener/interactor.

The robot percussion ensemble's automaton-like performances show promise, however pre-programmed MIDI score control alone through velocity insensitive hammer action lacks a musical expressiveness that is still easily surpassed by human control with even rudimentary training. Perhaps robotic actuators will soon become more sensitively designed at an accessible cost to allow for more expressive development in this area.

Hyper-instruments are most relevant in both topical areas of this paper due to the concept of data capture and output to interfaces and software, allowing for mapping and control from real-time human expression in live effects processing, sound manipulation, or meaningful data collection.

3. ETHICS AND CULTURAL CONSIDERATIONS

The music of Indonesia is intrinsically connected to its cultural and religious beliefs and practices, the depth of which probably cannot be fully understood by non-indigenous people. However, the good-natured spirit of community and the eagerness to share this music internationally has seen gamelan ensembles spread throughout the world during the 20th century and today, Budi Putra lecturer in Central Javanese gamelan at Victoria University, Wellington, New Zealand explains, '*...gamelan does not belong to the people of Indonesia any more, gamelan is now anywhere, spread anywhere (Putra 2002).*'

With regard to traditional Balinese *gong kebyar* form it is highly unusual, possibly even unheard of to encounter non-indigenous ensembles that can match the power, speed and virtuosity of performance that takes place on the island itself, therefore, after a certain amount of time acquainting oneself performatively with works from the traditional Balinese canon the first author opines that, imitation is the sincerest form of flattery, but where cultures and technologies collide and cross pollinate, the creation of new hybrid forms offer the potential for genuinely fruitful results. These offshoots should run in parallel to conventional forms and are not intended as a replacement of the traditional socio-cultural context in which they are situated. In *The Tempest in Bali* David George describes the use of Balinese *wayang*⁴ theatrical style in a fresh representation of the Shakespeare play, firstly for

¹ www.albatriana.com

² <http://gamelatron.com>

³ Balinese, a long row of metal gong 'pots'.

⁴ In Indonesian *wayang* is used to describe theatrical performance, it literally means *shadow*.

western audiences and then presented back to Balinese audiences, ‘...for instead of those performances saying: “look how another culture might present one of our plays,” the offer now became: “look what we have learned from you and made of it (George 1989).’

4. THE E-SULING

4.1. The Flute

The *suling* is a traditional Indonesian end-blown flute that varies in size and scale/mode across the archipelago, the regional style version 1 of my self-constructed flute originates from is central Java and is tuned to the seven note pelog scale. The flute was built from scratch due the unavailability of *suling* instruments in New Zealand and the unwillingness to potentially damage existing flutes during the modification process. Two *suling* bought in Java made from PVC pipe and owned by the Wellington based Gamelan Padhang Moncar¹ group were used as a measurement and construction template.

This custom electronic flute is an attempt to extend the traditional techniques of the instrument into the realms of live audio capture and / or effects processing for the accomplished player looking to experiment. The intent is primarily for the virtuosic player to have a flexible controller that can be easily assigned to the parameters of favoured digital audio workstations and effects, keeping the hands on the instrument and focusing on fluid performability and spontaneous sound manipulation. Attached sensors such as the movement tracking triple axis accelerometer and a vibration measuring piezo that can be applied to other gamelan instruments in a manner useful for fieldwork data capture for transcription purposes.



Figure 2. Accelerometer and piezo attached to the lower end of version 1 of the flute.

3.2 Hyper-extension

Modifications on the flute include an electret microphone with a stereo 3.5mm TRS jack; a small force resistant sensor; three assignable buttons; a 50mm softpot strip sensor; a piezo vibration sensor; and a triple axis accelerometer for tracking physical movement. All sensor data is captured by the Arduino Mega microcontroller².

Composition specific coding was used in a number of performances and some of the outcomes were:

1. Button triggering of pre-stored samples.
2. Variable speed playback of samples, forward and reverse using a twisting action with the accelerometer.
3. Microphone input gain continuous control via thumb pressure on the small FSR.
4. Return to sample 0 via pressure on the softpot sensor strip.
5. Sample playback volume via small FSR.
6. Pitch shifting value via piezo vibration sensor.
7. Changes in effects chain via button control.
8. Switching of composition movement specific coding via simultaneous dual-button presses, allowing program kill and start-up without touching the computer keyboard.

Using Processing,³ a customised graphic user interface or GUI was created, in which to visually display incoming serial data from the arduino in the form of metered data displaying continuous control signals, and button position states. Processing then sent these messages via OSC (Wright et. al, 1997) to ChucK (Wang & Cook, 2003) , where it could be understood and interpreted as control change data.

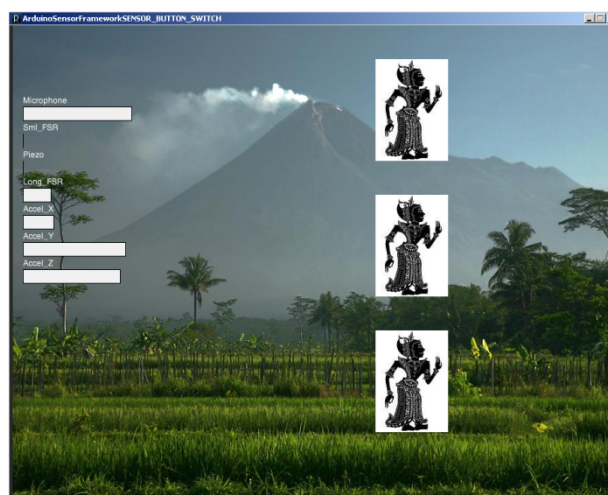


Figure 3. Graphic user interface rendered in Processing software to visualise incoming data.

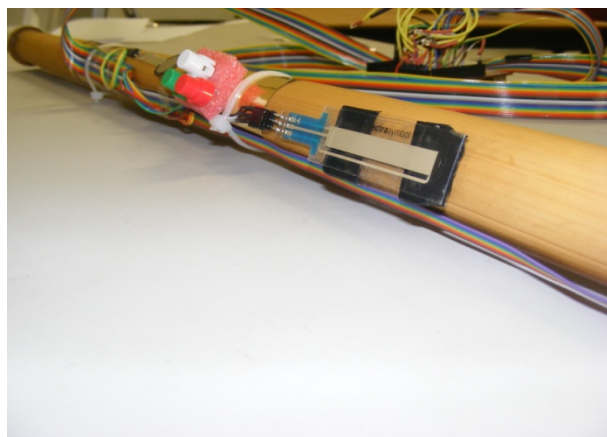
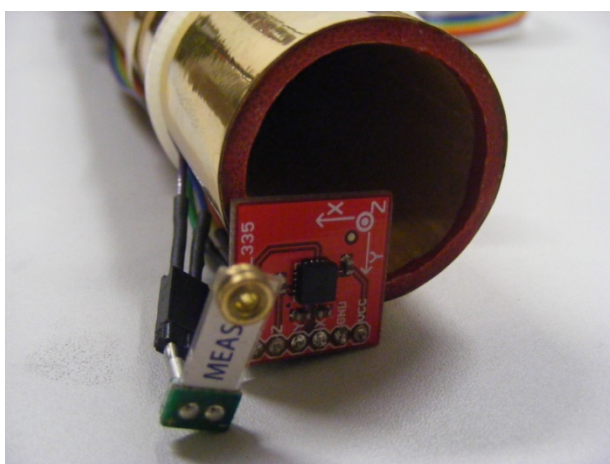
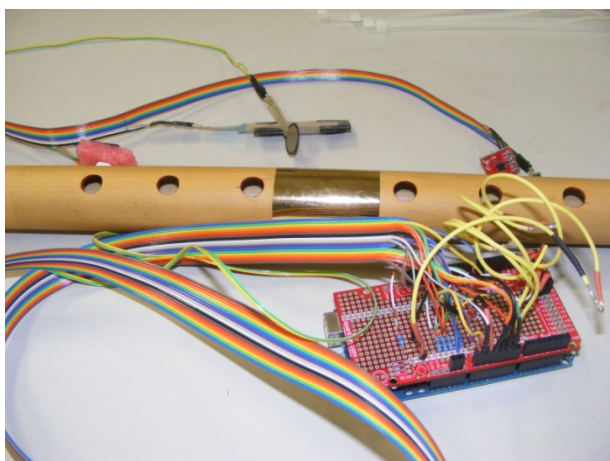
¹ www.gamelan.org.nz

² www.arduino.cc

³ <http://processing.org>

3.3 Version 2.0 of the E-Suling

The first author was presented with a gift of a *gambuh suling*¹ during a trip to Bali in February of 2011 from his *kendang*² teacher, a larger and much more skilfully constructed flute than the first self-constructed Javanese prototype. A much wider tonal and dynamic range is accessible as a result of this to the skilled player, although some time must be spent by the first author on acquiring the circular breathing technique required to play the instrument with traditional authenticity. A full rewiring is currently taking place of all sensor and button components, along with a system of attachment that will cause no damage to this organic, handcrafted instrument. Improvements include a correction in the small force sensitive resistor circuit to provide a wider range of continuous control data, a correction to the 50mm membrane strip soft-pot circuit design and arduino code (Murphy et. al., 2010), and a rescaling of components to fit along the larger sized flute body.



Figures 4, 5, and 6. Version 2.0 of the E-Suling, new flute and wiring.

5. COMPOSITION / PERFORMANCE

5.1. Gendru Wo / Yamato Damashii

During mid-2010 the first author co-composed the work *Gendru Wo / Yamato Damashii* with fellow student Bridget Johnson for custom built interfaces, the E-Suling, and Johnson's Magnetic Tapes³. The work was a discourse between two idiosyncratic interfaces, influenced by the musical cultures of Indonesia and Japan. The work was structured through three set movements allowing room for improvisation in musical phrasing and gestural exchange.

The first movement involved triggering and manipulating sampled field recordings of organic material such as shaken tree branches and the shuffling of stones. By twisting the flute the playback rate was increased, decreased, and scrubbed back and forth. At slow rates branches sounded gigantic and small stones became boulders, creating the sound world that one could imagine the *Gendru wo*, a Javanese stone throwing, tree dwelling spirit would inhabit.

The second movement relied heavily on the incorporation of LiSa, and it's integration into the live sampling granular synthesis engine developed by Dan Truman, with some minor modifications of the first author's own such as randomisation of panning position in the stereo field of returning sample slices, and altering of the grain pitch shifting array to return tones suitable for the composition. Staccato flute notes divided and scattered, long blown, bended notes harmonised and spread out around the room, finger snaps fed back into the microphone via a nearby monitor speaker and unexpectedly took on the texture of flowing water.

The final movement utilised button presses to trigger subtly effected samples of the *demung*, a lower pitched foundational melody instrument in the Javanese gamelan. Improvised soloing on the flute was alternately completely dry and unamplified, and processed at will via a thumb pressure pad rounded out the work.

¹ Large Balinese bamboo flute nearly a meter in length

² Traditional Balinese drum.

³ <http://www.youtube.com/watch?v=SdNBaBIShDA>

6. CONCLUSION AND FUTURE WORK

Now that two versions of the E-Suling have been designed and software has been implemented to drive compositions and performance that borrows from and expands Indonesian forms into an extended realm of sound, new compositions for the flute will be developed requiring fresh sound worlds. A Balinese gamelan composition currently underway that incorporates the E-Suling, a *jegogan* interface and a *kempli* beater interface will be performed in October this year. This composition also includes a process element using numbers extracted from the Balinese *pawukon* or permutational calendar. A tour to Indonesia is highly likely to occur next year and will include a trip to Bali where the first author will have the opportunity to present the work in the home culture of these extended instruments. Feedback from the Balinese will be collected while there and reported upon return.

The next step will look at how to address issues of the lack of the preservation of performances from an oral tradition outlined in the introduction and how computational ethnomusicology could assist with this. We plan to build new data capturing interfaces for the instruments for performance and transcription purposes. These interfaces will also allow for interaction with robotic gamelan systems such as the previously mentioned Machine Orchestra.

Controller connection to other digital audio workstations, such as Ableton Live will also help in electronic explorations of the flute's organic sound source.

7. ACKNOWLEDGEMENTS

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