2019

Composer-Performer Collaboration in the Development of Kinabuhi | Kamatayon For Percussion and Electronics

Louise Devenish
University of Western Australia

Stuart James
Western Australian Academy of Performing Arts, Edith Cowan University, s.james@ecu.edu.au

Composer-Performer Collaboration In the Development of *Kinabuhi / Kamatayon* For Percussion and Electronics

by Louise Devenish   and   Stuart James
The University of Western Australia   WAAPA @ Edith Cowan University

Abstract: This paper provides an outline of the collaborative approach taken in the creation of electroacoustic percussion work *Kinabuhi / Kamatayon* (2015) by Stuart James for performance by Louise Devenish. Written for eleven Indonesian bossed gongs and electronics, the work involved creative and systematic exploration of various percussive and electronic techniques with the primary aim of re-contextualising these instruments. This paper offers an overview of the collaboration process with percussionist Louise Devenish and how these techniques were used in the work. This includes discussion of the performance practices developed and a suitable notation system for effectively executing these compositional ideas.

Introduction

Composer-performer collaboration has been key in the development of contemporary solo percussion repertoire since the earliest solo percussion works emerged in the 1950s.[1] The creation stories of the composer-performer collaborations that produced defining solo percussion repertoire in the twentieth century are not only passed from teacher to student, but can also be found in emergent scholarly literature in the field.[2] Collaboration is crucial in the commissioning of a solo percussion work, perhaps more so than in the commissioning of other instrumental works. When commissioned to write a solo viola work for example, the instrument itself serves as a point of departure. When commissioned to write a solo percussion work, the instrument could be anything, from a concert snare drum to an Iranian *daf* to an everyday object. The solo percussion repertoire therefore encompasses an extraordinarily wide range of approaches to an equally wide range of instruments. Thus, in the composition of a solo percussion work, composers are often embarking on a work for a particular percussionist and their unique "instrumentarium," or the idiosyncratic collection of instruments and objects that each percussionist collects over the course of their career. Discussions of sound and instrumentation are frequently the first step, and instrument choices made are often the result of a combination of availability, practicality and the aesthetics of both composer and performer.

In 2014, Devenish began using two different Indonesian gamelan ensembles owned by the University of Western Australia Conservatorium of Music (UWA): a complete Balinese *gamelan gong kebyar* and a partial Javanese ensemble. When Devenish and James first met to discuss the possibility of collaboration, it was agreed that an overarching aim for such a project was the creation of a new work for an instrument without an extensive existing solo repertoire. As Devenish had an interest in exploring the sound world of the instruments in the gamelan ensembles, it was mutually agreed that a range of Indonesian gongs would be the instrumental point of departure for a new work.

Composed by Stuart James, *Kinabuhi / Kamatayon* (2015) was commissioned by Louise Devenish and premiered in *Electroacoustic Music for One Percussionist* at the Astor Lounge in

Perth, Western Australia on 16 September 2015 and recorded live by the Australian Broadcasting Corporation.[3] *Kinabuhi / Kamatayon* was the result of a confluence of both artists' various musical pathways in Indonesian instruments, spectral music and electroacoustic performance practice. Inspired by the sonic qualities of eleven Balinese and Javanese gongs, the collaboration process involved creative and systematic exploration of various percussive and electronic techniques to produce a work that brought together Indonesian gongs, western contemporary percussion performance practices and electronic music composition. This paper offers an overview of how the composer-performer collaboration process influenced these techniques, and how they were used in the work and the development of a suitable notation system. This is followed by discussion of the performance practices developed in order to effectively execute these compositional ideas.

Indonesian gamelan instruments are traditionally used in an ensemble context, as one of the features of Balinese music is collective music making. Thus, the traditional sounds produced by gamelan instruments and the mallets designed to execute these sounds have been developed for use in an ensemble context. Exploring these instruments in a solo context opened up new possibilities, and three key areas of interest were identified:

    1)   exploring the pitch relationships between different instruments
    2)   developing new acoustic sounds through extended techniques
    3)   expanding the sonic palette by incorporating electronics.

Recognising the unconventional use of the Indonesian gongs and our neophyte historical knowledge of these instruments, feedback was sought from esteemed gamelan ensemble artist and tutor Dr I Gde Made Indra Sadguna (Institut Seni Indonesia, Denpasar) in the early stages of development in 2014, and on the premiere performance in 2015.

Pitch Relationships

Exploration of the pitch relationships between different gongs became a key focus of *Kinabuhi / Kamatayon*, a focus that stems from the design of the instruments themselves. One of the defining characteristics of gamelan ensemble music is the tuning, which is unique on three levels. First, no two ensembles are tuned identically.[4] Second, the instruments within each ensemble are tuned slightly differently from one another. Rhythmic beating emerges when the instruments are struck simultaneously, and this aids in defining the unique sonic identity of each ensemble. Third, the hand hammered construction results in a slightly irregular surface on each instrument, designed to produce a unique combination of overtones from each instrument. The complex interaction of overtones from each instrument combines to form their unique timbral quality. As the UWA Balinese *gamelan gong kebyar* was complete, it was instruments from this ensemble that we started with. Fig. 1 illustrates a spectral analysis and an accompanying musical transcription of a single Balinese *trompong* gong showing both the harmonic and inharmonic overtones that interact after the gong is struck.
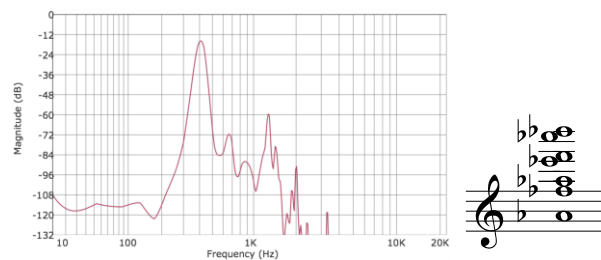

Fig. 1. A spectral analysis and musical transcription of the initial attack of a single *trompong*.

The tuning of these instruments offers substantial potential in the studies of alternative tuning systems such as just intonation, as well as phenomena in acoustics such as tremolo and beating

patterns.[5] Early in the workshop process, samples of pitches of a number of both the largest and smallest gongs in the Balinese *gamelan gong keybar* were recorded and analysed to reveal their acoustic phenomena. Tremolo is an effect discussed in the context of electronic music that refers to the cyclical rise and fall of energy in a sound. It was found that certain individual instruments within any gamelan ensemble exhibited tremolo effects acoustically as a result of their physical construction. Fig. 2 shows an audio waveform illustrating the rise and fall in energy over time following a single attack of the same *tromping*. In this paper, such an acoustic effect will hereafter be referred to as *natural tremolo effects*.
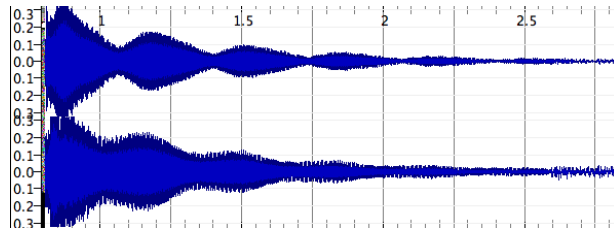

Fig. 2. A waveform view, or amplitude-time representation, of a single *trompong*.

Both the largest and smallest gongs in the Balinese *gamelan gong keybar* were recorded; this included the *gong wadon*, *gong lanang, kempur, reyong* and *trompong*. As both the Balinese gamelan and the partial Javanese gamelan ensemble available are tuned to the *pélog selisir* scale of seven pitches (referred to in this article using numerals), additional samples of some of the intact Javanese *bonang* and *kempyang* were also recorded.[6] The addition of the *kempyang* further diversified the acoustic sounds available for exploration. Following a discussion about the practicalities of transporting instruments and performance of the work beyond the premiere, it was decided that the instrumentation should be based around the smaller gongs. In the tradition of multiple percussion repertoire that brings together a collection of seemingly disparate smaller instruments to form one large instrument, a hybrid setup was created using individual Balinese *reyong* and *trompong* gongs, and Javanese *kempyang*. The eleven single gongs selected were arranged on a table covered with foam to ensure each gong resonated effectively, and to enable different configurations to meet various compositional aims.

Fig. 3 shows the configuration used for movements one, two and three of *Kinabuhi | Kamatayon*. The gongs are arranged from left-to-right in the following order: [J] *reyong* 7, [H] *trompong* 2, [F] *kempyang* 7, [D] *reyong* 1, [B] *reyong* 2 in the top row, and [I] *reyong* 5, [G] *reyong* 7, [E] *reyong* 5, [C] *reyong* 1, [A] *kempyang* 5 in the bottom row. Here, an alphabetical sequence enclosed in square brackets is used to denote the position of gongs in the setup. The number of each gong denotes the pitch of each gong, which will be further explained below. In this configuration, four of the gongs are upturned, allowing the sides of the gongs to be struck and stirred. In movements four and five, all gongs are arranged upright, however in a slightly modified pitch order as shown in Fig. 4. The gongs are arranged from left-to-right: [J] *reyong* 7, [H] *trompong* 2, [F] *kempyang* 7, [D] *reyong* 1, [B] *reyong* 2 in the top row and [K] *trompong* 5, [G] *reyong* 7, [I] *reyong* 5, [C] *reyong* 1, [E] *reyong* 5 in the bottom row.

Fig. 3. *Kinabuhi | Kamatayon* setup as configured for movements one, two and three.

Fig. 4. *Kinabuhi | Kamatayon* setup as configured for movements four and five.

The pitch set selected was vital in initiating and developing compositional ideas. Each gong was numbered according to the *pélog selisir* scale, and with individual frequencies indicated in Hertz, as well as their detuning from equal temperament in cents (where A above middle C is 440Hz). Whilst the pitch set incorporated various gongs of different pitch, it also included several gongs of different types tuned to the same number of the *pélog selisir* scale, as shown in Fig. 5. For example, three '7' gongs were acquired using both Balinese *reyong* and Javanese *kempyang*.
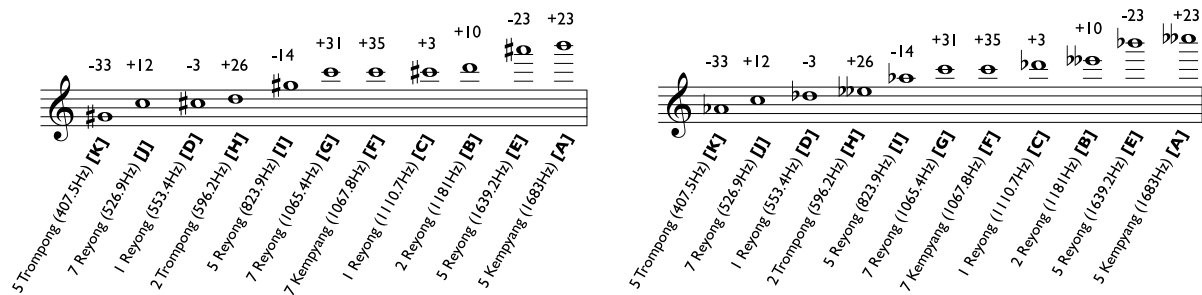

Fig. 5. The two pitch sets formed by the hybrid setups of *reyong*, *trompong* and *kempyang* gongs.

Acoustic Possibilities

Following finalisation of the pitch set, a series of collaborative workshops sought to draw a wide range of sonic possibilities from each individual gong, utilising a variety of mallets. Bossed gongs are defined by their feature of a raised area in the centre of the gong. Striking the gong in the centre of this area enables the fundamental pitch of the gong to be clearly heard. Although the *Kinabuhi |Kamatayon* pitch set was created based on these fundamental pitches—namely pitches 1, 2, 5 and 7—this was not the only pitch source explored. Due to the way each gong is made (a combination of cast metal and hand hammering), a myriad of sonic possibilities exists when struck in other areas and with other mallets. A series of workshops sought to determine the range of timbres within each gong using acoustic techniques. First, rubber and yarn mallets were tested on all of the gong

surfaces, followed by a variety of implements and preparations including knitting needles, brushes, wooden chopsticks, wooden snare and timbale sticks, fingers, nails, five-cent coins and fine metal chains. Finally, methods designed to induce resonances from individual gongs such as the use of tuning forks were tested. Those that were used in the completed work are outlined below in Table 1.

Table 1. Implements used to sound the gongs in *Kinabuhi | Kamatayon*.

Mallet	Gong area / position / technique
Yarn mallets: Balter 23R (blue) Balter 22R (green)	Boss to produce fundamental pitch. Side of upturned gong to produce a pitch bend.
Knitting needles: Size 10, metal	Use of both shoulder and tip on: • Boss • Flat surface surrounding boss • Side of upturned gong Stirred around inside rim of upturned gong.
Rubber mallets: Musser M2	Boss to produce fundamental pitch. Flat surface surrounding boss to produce a lighter sounding fundamental pitch.
Timbale sticks: 1/3rd of an inch diameter, wood	Use of both shoulder and tip on: • Boss to produce fundamental pitch • Flat surface surrounding boss to produce a lighter sounding fundamental pitch
Fingers	Pad of fingers on: • Boss to produce fundamental pitch • Outer edge of upturned gong to produce resonant tone

The workshops revealed that each gong responded to each implement in different ways, eliciting unique timbres and tuning. This led to discoveries of alternative methods of exploring tuning. For example, in addition to their perceived pitch, the lower gongs yielded prominent and sustained overtones. The most common sustained overtone from the lower gongs sounds a minor 6th above the lowest perceived pitch of each gong. Fig. 6 shows a peak frequency spectrogram highlighting how the pitch decays on *trompong* [K], leaving the longer sustain quality of the minor 6th.
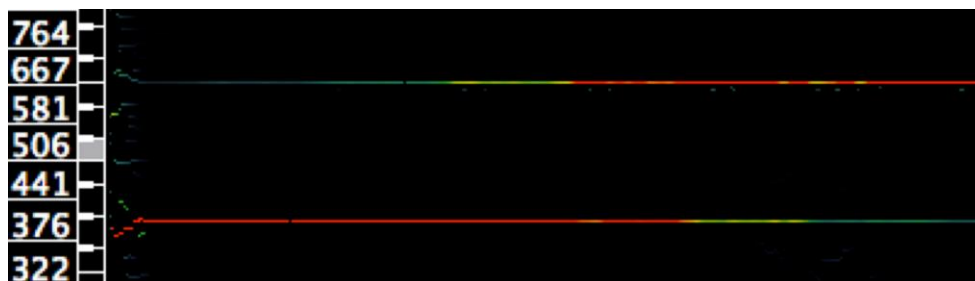

Fig. 6. A peak frequency spectrogram of *trompong* [11].

Additionally, it was discovered that striking the gongs in their upturned position not only changed the perceived fundamental pitch, but also revealed that individual gongs could be coerced to play either one of two dominant harmonics when struck in specific areas at moderate and loud dynamic levels. When a medium-hard yarn mallet was used to strike the side of a gong closer to the open edge, a slightly lower pitch resonated than the pitch produced when the same mallet at the

same dynamic level was used to strike closer to the closed edge. This is the result of the hand-hammered construction of the gong. This characteristic was used intentionally in the work to introduce subliminal or implied harmonic tension, a feature noted in the review of the premiere performance: "these semi-abstract gestures are suddenly traded for a 4/4 emphasis and a tonal centre (it seems to be a minor key), see-sawing chimes forming a suspenseful ostinato that won't let up."[7] This contrapuntal underpinning was deliberately explored in the work, playing on the minor 6th overtone as a way of extending the available pitch set, and exploring harmonic suspensions that never cadentially resolve.

In addition to responding uniquely to a variety of sounding implements, six of the gongs used in *Kinabuhi | Kamatayon* produced pronounced natural tremolo effects of varying degrees: 5 *trompong* [K], 5 *reyong* [I], 7 *reyong* [G], 1 *reyong* [D], 1 *reyong* [C], and 2 *reyong* [B]. Within this set, the *reyong* exhibited this effect more than the *trompong* and *kempyang*. In addition to the natural tremolo effects exhibited, combinations of gongs also created a chorusing effect, usually produced from two or more gongs with slight tuning differences. Along with the beating effects of different gongs sounding in combination, the sound world produced seemed to create complex shimmering effects across the gong setup, and this was a significant point of departure for the work.

Electronic Possibilities

The second stage of research focussed upon the effective development of electronic processing software, and included further collaborative workshops. The primary aim in developing electronic processing software was to extend the sound world of the gongs, and to accentuate some of the acoustical idiosyncrasies of the instruments, such as the natural tremolo effects and timbral complexities described above. Secondly, the electronics served to both amplify subtle gestures performed with knitting needles or hands, and thirdly to manipulate the complex harmonic characteristics of the gongs themselves. Fourthly, the electronic processing served a practical purpose, providing segue between movements as setup changes took place. Prototyping, developing, and calibrating software with both performer and instrument was undertaken primarily using trial-and-error methodologies. The following paragraphs will outline the use of the combination of electronics in *Kinabuhi | Kamatayon* as they were conceived during the workshop process:

1) sine tone synthesis and additive synthesis
2) amplification, pitch shifting and microphone feedback
3) spectral processing
4) sampling and loop-based processing
5) granular synthesis.

The use of sine tones enabled emphasis of the unique tuning of individual gongs. The sine tones were always synthesized at frequencies derived from each gong and therefore function sonically in extending their sound, and creating a prolongation of their harmonics. Furthermore, as the natural tremolo effect of each gong interacts with a sine tone, more pronounced beating patterns emerge. Exploration of the beating patterns created by the interaction of electronically generated sine tones and acoustic instruments was brought to prominence in the music of Alvin Lucier, such as *Still and Moving Lines of Silence in Families in Hyperbolas* (1973-1974) and *Ever Present* (2002).[8] This phenomenon was also explored in an instrumental context by Giacinto Scelsi, and Phillip Niblock. In *Kinabuhi | Kamatayon*, multiple sine tones are also mixed together in combination (in other words, simple additive synthesis). Combinations of sine tones were used to further emphasise the beating patterns produced through the interaction of difference tones.

Amplification of the largest upturned gong, *reyong* [D], served to enhance the complex overtone series of this gong and several other gongs in the setup. Microphone feedback was also

used with pitch shifting to create a moving backdrop to this intimate sound world.[9] This process involved the performer as an active participant; the percussionist's gestures contributing to the interplay between the acoustic and electronic elements. The nature of feedback is such that the processing is not only applied to the original source sound, but also the processed material, producing a complex and evolving audio accompaniment.

The spectral processing incorporated a combination of spectral filters and delays. These were primarily applied to the unpitched or noisy sounds, such as stirring the knitting needles around the inner edge of the upturned gongs in movement three, or the outer edge in movement five. We sampled and looped these sounds into several layers to create complex spectral textures serving to accompany the live percussionist in some of the free sections of the work. Rather than use spectral processing as a means of exploring spectral composition,[10] these processes were used as a means of influencing the timbre quality of the acoustic instrument by a process of spectral re-synthesis, allowing the electronics operator to modulate the timbre quality of the sounds in real-time.[11]

In two sections of the work, electronic processing makes use of sampling in order to create fixed and finite loops of musical materials, that are each detuned and temporally stretched by ratios of 1:2, 1:4, 1:3, 2:3. These ratios allow these looping structures to loosely conform with the metrical and rhythmical underpinning of the work. The creative development of the layers of looping structures were developed in ProTools (shown below in Fig. 7), however all electronics were later further developed and implemented live using Max software.

Fig. 7. Initial experiments with the structure of the loop-based materials for the work in ProTools.

Finally, granular synthesis was also used in movement five to create a sustained, yet evolving shimmering chord to accompany the percussionist. This effect was achieved via the use of asynchronous granular synthesis, with a growing density of grains, and was implemented in Max.[12]

At times, the electronic processing contains layers of pre-determined rhythmic material with which the percussionist must synchronise their performance. A click track was used in conjunction with the score, however this was limited to short sections of the work. Although advantageous in many ways, the use of headphones simultaneously brings disadvantages. In this case, the barrier created by the headphones in one ear limits the performer's ability to hear subtleties of both the acoustic and electronic sounds. Movements one, three and five include improvisatory elements that require the performer to respond to the acoustic and electronic sounds produced in real-time. Movements two and four require strict alignment between rhythmic material and electronic processing. Thus, a click track was utilised only for movements two and four.

Notation

Developing a practical notation system is an inevitable process when creating a new percussion work comprising either untuned or unconventional instruments. The lack of a standardised notation

system for untuned contemporary percussion repertoire has been a subject of debate and scholarship since the earliest solo percussion works emerged in the mid-twentieth century.[13] That there is no standardised notation system can be attributed in part to the fact that there is no standard instrumentation in a multiple percussion work, thus questions of notation are inevitably raised when it comes to committing new compositional ideas and performance practices to paper. Various forms of altered traditional western notation, line notation, pictographic, text-based and hybrid forms are used across the percussion repertoire. Although a dominant form of notation has not emerged, what has become standard is the development of notation uniquely suited to the technical, physical and musical demands of any given new work. As workshops progressed it became clear that *Kinabuhi / Kamatayon* required the development of a comprehensive notation system specific to the creative and practical demands of the work. Both Devenish's and James' research areas have involved the development and performance of new forms of graphic, altered, and hybrid forms of notation for music that blend improvisation and fixed material, and previous research was drawn upon for this work.[14]

Extensive discussions surrounding the readability and practicality of various forms of notation for each movement took place throughout the entire development of the work. Early drafts were notated to clarify and separate different functional layers of musical material in order to demystify the structural impetus of the work. This notation was ideal at the composition stage, highlighting the relationships between pitches and musical structure. James' desire to arrange gongs of similar pitch together for compositional reasons created a setup that was not in ascending or descending pitch order. This setup informed the development of notation, as it demanded various techniques and performance practices.

Readability of the score from the performer perspective influenced the approach used to notate the composed work. In order to avoid conflicts between the notated and physical layout of the instruments, a form of tablature notation was applied. As shown below in Fig. 8, this notation was relative to the position of each gong in the setup. Separating the score into two staves to differentiate between material played by the right or left hand significantly improved the readability of the ten-line stave. Spaces above and below each line allowed for specifying when the performer should play off-centre or on the underside of the gong, and different noteheads representing the striking implement or percussive gesture as shown in Fig. 9. The final score included both fixed notation depicting rhythms and pitches, and indeterminate notation serving as a mnemonic aid depicting attacks only. This is not uncommon in percussion repertoire that simultaneously demands fixed notated material together with improvised material.

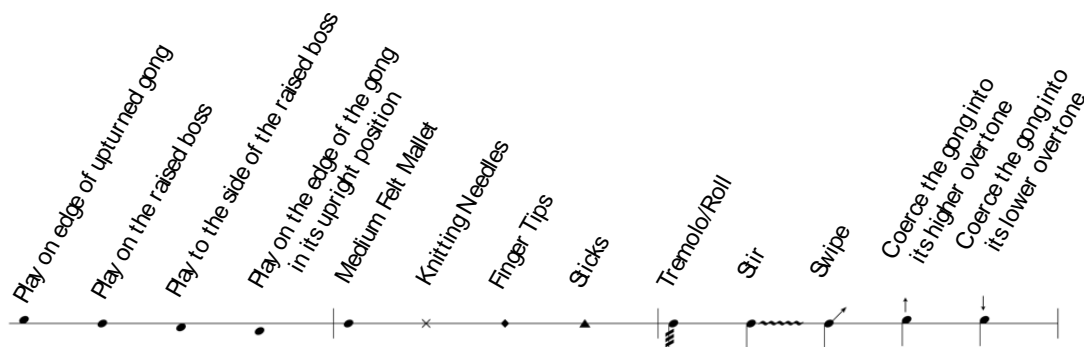Fig. 8. The stave layout for *Kinabuhi / Kamatayon*.

Fig. 9. *Kinabuhi | Kamatayon* notation key showing different noteheads for each implement and gesture.

Compositional Realisation

In some studies of gamelan ensemble tuning, one gong, tuned slightly higher, is thought of as the "inhale," and the other, slightly lower, is called the "exhale."[15] When the inhale and the exhale are combined, beating is produced. The beating frequencies, known as *ombak*, are meant to represent the beating of the heart, or the symbol of being alive. This symbolism is reflected in many ways throughout the work. The title comprises *Kinabuhi* and *Kamatayon*, both Visayan words meaning Life and Death respectively, and the overarching structure of the work is concerned primarily with a pushing and pulling of time-based structures, again the symbolism of "inhale" and "exhale."[16] The program note alludes to these associations:

> The essence of energy consists of the cycles of life and death. The sun, the moon, the tides, the planets, the seasons, the oscillation of wings. The essence of human life is the breath, the contraction and expansion of the lungs. Similarly, the essence of sound is the compression and rarefaction of kinetic energy passing through air. The work *Kinabuhi | Kamatayon* is both a celebration of life and death, and is itself concerned with the compression and rarefaction of time. The work progressively transitions from a compression and rarefaction across an entire movement to transitions between consecutive bars in movements one and five respectively. The work explores different time scales, sometimes in parallel or in series.[17]

The work is comprised of five movements in an arch-like structure. The first movement serves as an introduction, and functions in providing a context for the sound world; that is establishing the link between gongs and electronics. The movement is in ternary arch-form, and has some overriding palindromic relationships. Representing an expansion as mentioned in the program note above, the first section is performed freely. The middle section, the compression, is a little faster, followed by the return of free material. An exploration of the initial attack and decay of each musical event creates a sense of prolonging that characterises the first movement. The movement references Morton Feldman's minimal scores such as *Vertical Thoughts 1* (1963) where the decay of each sound event becomes a primary focus of the listening experience.[18]
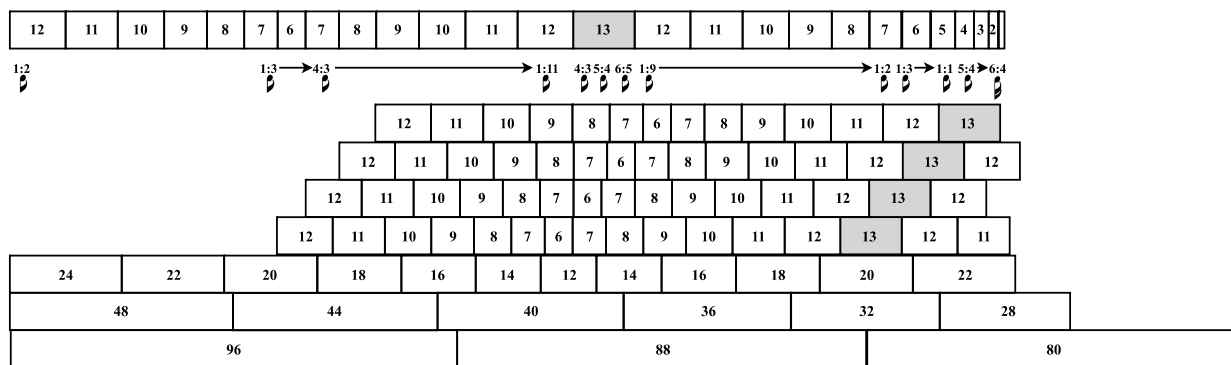
Fig. 10. Graphic representation of the structure of movement two.

This sense of prolongation is further developed in movement two through the insistent and repeated articulation of various gongs. A sense of slowly unfolding sound and continual transition is maintained, here in an explicitly articulated rhythmic framework. This is outlined in Fig. 10. Whilst the movement begins with elongated minimalist-like figurations,[19] the structure of the musical materials become increasingly compressed until arriving at dense, linear-based musical material influenced by percussive gestures inherent to the setup. The audio processing further elaborates on this structural foundation via the live sampling of the gongs, and a series of tape-like processes that slow and detune the samples by specific ratio amounts. Audio delay effects applied to these rhythms serve to create further rhythmical and melodic counterpoint.

Movement three introduces spectral processing, a new element in the sound world. It elaborates on concepts introduced in movement one, with the exploration of miniature sounds, while simultaneously drawing on the linear sticking patterns and structures found in movement two.

In movement four, what may be conceived as representing the dramatic peak of the work, all of the previous structural ideas explored appear combined. Bars are grouped in irregular sequences of irregular time signatures, ensuring that when different versions of the performance are sampled and layered, strong downbeats never occur simultaneously. In canonic writing, specifically tempo canons, this process would be said to have no convergence point.[20] Throughout the movement, accents in the percussion part are syncopated in triple- or quadruple- stroke sticking patterns, where one hand of the sticking pattern is always interrupted, resulting in lilting rhythmic phrases. As in movement two, tape-like processes involve the stretching and detuning of phrases are recorded, and these are introduced canonically in playback throughout the movement. Rhythmic phrases performed by the percussionist are sampled and detuned to produce longer polyrhythms, and these loops are played back canonically. This movement is essentially an iterative canon, and the rhythmic cells of 7/8 at the beginning of the movement reappear in the electronics when the percussionist shifts to their rhythmic cells of 5/8. The key point of difference in the electronic processing is that the rhythms are at half-speed and the sounding pitches have been transposed down one octave. When the 5/8 cells begin in the half-speed version in the electronics, the 7/8 cells in the quarter-speed version commence, and this process continues to repeat. In the acoustic part there are also further metric modulations into dotted time, followed by double dotted time. Remnants of the original tempo are still evident in the electronics, however their metric relationships are altered.
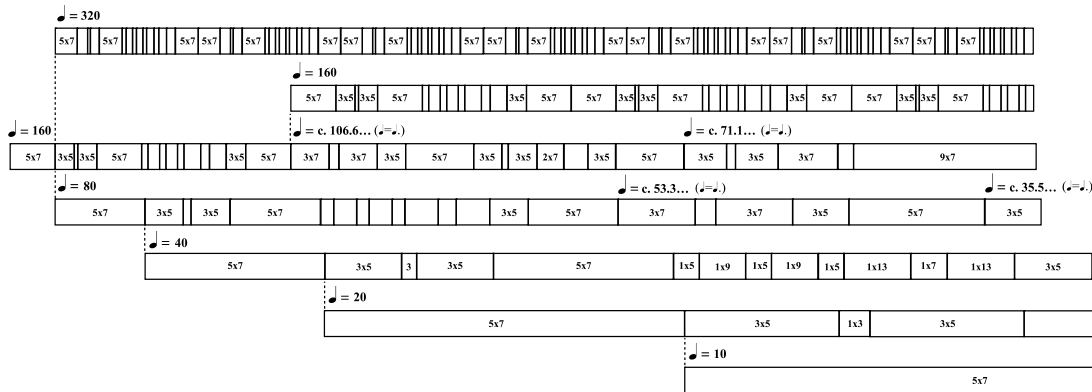
Fig. 11. Graphic representation of the structure of movement four.

Movement five is based around the most linear shapes presented in the work—namely a series of continuous lateral patterns suggestive of arpeggios within the pitch set. The compressions and rarefactions occur in each phrase, representing by accelerating and decelerating of each pattern. The use of granulation here creates a growing, shimmering backdrop to this unfolding process. Finally, as the audio processing dies away, the movement returns to a recapitulation of movement one, here performed with all gongs facing upward. The sine wave that is used is a harmonic of the larger gong [4] that was previously upturned, but now its relationship presents a sense of consonant resolution (resolving a major 3rd higher).

Conclusion

This research enabled the exploration of the pitch relationships between a range of small Indonesian bossed gongs, development of new acoustic sounds through extended techniques, and an expansion of the sonic palette of these instruments through various electronic processes. Composer-performer collaboration was a key part of the research process, primarily undertaken through creative workshops designed to develop methods of effectively unifying these elements. This offers a new method for using acoustic instruments and electronics that enables the extension and diversification of the sound world of these instruments that may be applied to others in the future. *Kinabuhi | Kamatayon* is one of a handful of spectral works for solo percussionist in the Australian repertoire such as Peter McNamara's *Amplitude* (2013) and Stuart James' *Particle I* (2011), and has also contributed to studies James has undertaken in spectral processing, particularly timbral and spectral spatialisation.

Kinabuhi | Kamatayon currently exists in two versions: the original version with all electronics performed live, and a touring version with much of the electronics pre-recorded to create a virtual tape part that can be executed by a sound technician without extensive knowledge of Max. It has been studio recorded and released on *Music For Percussion and Electronics*.[21]

Endnotes
All URLs accessed Aug 2018.

[1] In this study, contemporary percussion is "a practice characterized by the exploration of sounds produced via the striking, shaking or stroking of instruments and objects. It is a process of experimentation that draws on influences from world music, improvisation and visual arts from a western classical perspective." Louise Devenish, *…And Now for the Noise: Contemporary Percussion in Australia, 1970-2000*, doctoral thesis (Perth: University of Western Australia, 2015), p. 1, available online at https://research-repository.uwa.edu.au/en/publications/and-now-for-the-noise-contemporary-percussion-in-australia-1970-2.

[2] Some examples include Sharon E. Kanach, ed., *Performing Xenakis* (New York: Pendragon Press, 2010); Kevin Lewis and Gustavo Aguilar, eds, *The Modern Percussion Revolution: Journeys of the Progressive Artist* (New York: Routledge, 2014); Steven Schick, *The Percussionist's Art: Same Bed, Different Dreams* (New York: University of

Rochester Press, 2006); Louise Devenish, *Global Percussion Innovations: The Australian Perspective* (London: Routledge, 2018).

[3] See Stephen Adams, "Stroke 4: Louise Devenish—*Electroacoustic Music for One Percussionist*," podcast (Sydney: Australian Broadcasting Corporation, 2015), http://www.abc.net.au/classic/new-waves/louise-devenish-electroacoustic-music-for-one-percussionist/9742794.

[4] Wayne Vitale, "Balinese Kebyar Music Breaks the Five-Tone Barrier: New Composition For Seven-Tone Gamelan," *Perspectives of New Music*, 40.1 (2002): 5–70.

[5] In acoustics, beating is an interference pattern between two sounds of slightly different pitch. This interference results in a variation in volume due to the constructive and destructive interference of both sounds.

[6] Two primary scales of non-standardized pitches exist in Indonesian traditional music: *sléndro* and *pélog*. *Sléndro* comprises five tones relatively equally spaced in the octave, whereas *pélog* is an unequally spaced pentatonic scale comprising seven tones per octave, although only five are ever used.

[7] Lyndon Blue, "Louise Devenish—*Electroacoustic Music For One Percussionist*," *Cool Perth Nights* (18 September 2015), http://www.coolperthnights.com/lyndon-blue/2016/5/29/louise-devenish-electroacoustic-music-for-one-percussionist-astor-lounge-wednesday-sept-17.

[8] Andrea Miller-Keller, ed., *Alvin Lucier: A Celebration* (Middelton, CON: Wesleyan University Press, 2012).

[9] Audio feedback is an acoustic phenomenon that occurs when sound played by a loudspeaker is received by a microphone to create a persistent loop through a sound system. See Seunghun Kim, Graham Wakefield, and Juhan Nam, "Augmenting Room Acoustics and System Interaction for Intentional Control of Audio Feedback," *Proceedings of the International Computer Music Conference* (2015): 334-7; Dario Sanfilippo and Andrea Valle, "Feedback Systems: An Analytical Framework," *Computer Music Journal*, 37.2 (2013): 12–27.

[10] Nicholas Papador, "Spectral Composition and Percussion: Contemporary Concepts of Timbre and Time," *Percussive Arts Society*, 54.1 (2016): 46–51.

[11] Zack Settel and Cort Lippe, "Real-time Timbral Transformation: FFT-based Resynthesis," *Contemorary Music Review*, 10 (1994): 171–179.

[12] Curtis Roads, "Asynchronous Granular Synthesis," in Giovanni De Poli et al, eds, *Representations of Musical Signals* (Cambridge: MIT Press, 1991), pp. 143–185.

[13] Steven Schick, *The Percussionist's Art* (NY: Rochester UP, 2006); Catherine Betts, *Reading the Signs. Assessing the Salience of Percussion Symbols For Use in Percussion Notation*, masters dissertation (Perth: University of Western Australia, 2010), reproduced on https://research-repository.uwa.edu.au/en/publications/reading-the-signs-assessing-the-salience-of-percussion-symbols-fo; Cat Hope, "Wording New Paths: Text-Based Notation in New Solo Percussion Works by Natasha Anderson, Vanessa Tomlinson and Erik Griswold," *Contemporary Music Review,* 36 (2017): 15-35.

[14] Lindsay Vickery, Stuart James and Louise Devenish. 'Expanded Percussion Notation in Recent Works by Stuart James and Lindsay Vickery," *Contemporary Music Review,* 36 (2017): 1–2.

[15] Andrew Clay McGraw, *Radical Traditions: Reimagining Culture in Balinese Contemporary Music* (Oxford: Oxford University Press, 2013).

[16] Using Visayan language for the title of the work is a personal reference to James' wife.

[17] Stuart James, program notes, *Electroacoustic Music for One Percussionist* (Perth: Tura New Music, 17 September 2015).

[18] Morton Feldman, *Vertical Thoughts 1,* score (New York: Edition Peters, 1963).

[19] K. Robert Schwatrz, *Minimalists* (London: Phaedon Press, 1961).

[20] Jonathan Kramer, *The Time of Music: New Meanings, New Temporalities, New Listening Strategies* (New York: Schirmer Books, 1988).

[21] Louise Devenish, *Music For Percussion and Electronics,* CD (Sydney: Tall Poppies, 2017).