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*Reimagining biophony and geophony materials. Commentary of original composition portfolio  
2019-2023*

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# *Malay Sound Arts: Reimagining Biophony and Geophony Materials*

*Commentary of Original Composition Portfolio 2019-2023*

Submitted to the Department of Music, University of Bristol

In partial fulfilment of the requirements for the degree of Doctor of Philosophy

24<sup>th</sup> May 2023

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## Author's Declaration

I declare that the work in this dissertation was carried out in accordance with the requirements of the University's Regulations and Code of Practice for Research Degree Programmes and that it has not been submitted for any other academic award.

Except where indicated by specific reference in the text, the work is the candidate's own work. Work done in collaboration with, or with the assistance of others, is indicated as such.

Any views expressed in the dissertation are those of the author.

SIGNED: .....

DATE: 24.05.23

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## Abstract

This PhD takes the research theme of *Nada Bumi* or *Voice of the Earth*: exploring and accentuating hidden Malaysia biophonic and geophonic materials, for expressing self-cultural identity and narrative through sound arts practice. The portfolio and accompanying commentary present eleven sound-art works ranging from instrumental electroacoustic music to Web-Audio API based sound installation. The main idea for this portfolio research is to explore the association of folklore, tales, myths, legends and art cultural narrative of the Malay race and the ancestors of Malay (proto-Malay), with the selected hidden and unheard Malaysia natural soundscape, in producing new sound art works. Therefore, I proposed two major compositional themes each comprising several works; *Miroirs of Malay Rebab* (MiMaR), and *Seed of Life* (SoL). The works in *Miroirs of Malay Rebab* reimagine selected unheard biophonic and geophonic materials as mirrors of several Malay performing art-cultural narrative and their stories, such as *Makyung* theater dance, *Malay Gamelan* music dance, *Ulek Mayang* dance and their stories that I have been exposed to during my undergraduate music studies in Malaysia. The works in *Seed of Life* (SoL) take a similar approach but focused more on local Malay and proto-Malay folklores, tales, legends and myths associated with my childhood experience.

Furthermore, as I delved into the conceptual and compositional aspects of creating the *Miroirs of Malay Rebab* (MiMaR) set and *Seed of Life I* (SoL) set, I had the privilege to engage in an enriching journey of (self-) exploration through the creation of sound art within the vibrant Bristol soundscape with support from the local sound art community. This experience was part of my involvement in the *Hidden Bristol Soundwalks* project, which provided a unique platform for my creative endeavors. I have decided to include this project in this portfolio, which has similar compositional approach with *Seed of Life* (SoL). Both the major cycles, *Miroirs of Malay Rebab* (MiMaR) and *Seed of Life* (SoL), include Western classical music instrumentations with electronics; fixed media; and interactive media. This portfolio was composed and developed at the Studio One, Department of Music in the Faculty of Arts, University of Bristol; the Bristol Interaction Group (B.I.G.) Lab in the Faculty of Engineering, University of Bristol; and my home studios in Clevedon, UK, during the period of October 2019 until September 2022. The portfolio consists of scores, studio-audio production recordings, and several live performance recordings. The commentary comprises a set of

philosophical considerations about my compositions and intent for creation based on the *Nada Bumi* theme and sub themes. Further chapters are dedicated to compositional techniques, related traditions and piece-specific documentations. The portfolio is supplied as a set of digital media, containing pdf files of musical scores in notation, associated software or media components of the works, recordings of the studio-based music, and recordings of several live public performances made in mid-2022 after the period of covid-19 lock-downs.

## List of Compositions and Sound Works

Total Work Submission Duration: 1 hour, 35 minutes and 32 seconds

Note that *Miroirs of Malay Rebab* (MiMAR) set numbers II and IV are not included in the PhD submission, but are listed here for completeness of the *Miroirs of Malay Rebab* set.

TITLE	INSTRUMENTATIONS	DURATION min:sec	NOTES
<b><i>Miroirs of Malay Rebab</i> (MiMaR) set</b>			
• I: <i>Berlabuh</i>	Piano and Tape (Stereo)	5:26	Free Hand Piano Festival 2022 live audio recording
• II: <i>Menghadap Rebab</i>	Viola da Gamba and Tape (Stereo)	8:12	<i>not included for PhD</i>
• III: <i>Gajah Menangis</i>	Amplified Flute, Amplified Cello and Live Electronics (Stereo)	6:11	Hezarfen Ensemble Reading Session live audio recording
• IV: <i>The Paddy Spirits</i>	Flute, Clarinet, Violin, Viola, Cello, Harp, Percussions and Live Electronics (Stereo)	7:12	<i>not included for PhD</i>
• V: <i>San</i>	Fixed Media (Stereo)	12:45	Studio recording
• VI: <i>Titi</i>	Amplified Trombone and Live Electronics (Stereo)	5:22	UCSI Trombone Concert with Lance live audio recording

TITLE	INSTRUMENTATIONS	DURATION	NOTES
		min:sec	
<b><i>Seed of Life (SoL) set</i></b>			
• 1: <i>Ancestral Dance</i>	Fixed Media (Binaural)	11:37	New York City Electroacoustic Music Festival 2021 performance  Headphone listening for binaural recording playback
• 2: <i>The Travellers</i>	Fixed Media (Binaural)	13:52	Bristol University Loudspeaker Orchestra 2022 performance  Headphone listening for binaural recording playback
• 3: <i>Black Forest</i>	Amplified Percussions and Live Electronics (Stereo)	7:27	<i>No recording available</i>
• 4: <i>Rest and Shelter</i>	Fixed Media (Binaural)	11:27	Headphone listening for binaural recording playback
• 5: <i>Nada Sfera</i>	Interactive Media for Web Soundscape Installation & Binaural Streaming Device	open (3:49)	Video Demo
• 6: <i>The Source (Where The Mountain and River Sings)</i>	Amplified Voice, Amplified Cello and Live Electronics (8.1.1 Surround)	5:28	Bristol New Music Festival 2022 performance  Headphone listening for binaural recording playback

TITLE	INSTRUMENTATIONS	DURATION min:sec	NOTES
<b><i>Hidden Bristol Soundwalks set:</i></b>			
1. <i>Rail Tracks</i>	Interactive/ Fixed Media (Binaural)	1:17	Bristol Open
2. <i>Historic Medieval Harbourside</i>		5:24	Doors Festival 2021
3. <i>Pump, Push, Pull and Roll</i>		5:27	Headphone listening for binaural recording playback

## Introduction

My curiosity about sound art developed as the outcome from my lifelong interest in electroacoustic music, and the approach of building, creating, innovating sound-based objects as art since minoring in music technology during my undergraduate studies from 2008. The discovery of electricity led to the first invention of the first electronic music instruments, such the eponymous Theremin by Leo Theremin, and to the pioneering of electronic and electroacoustic music as one of the new music movements, through forms and styles such as *musique concrète*, soundscape music, spatial music and beyond. I had observed that this unique sound art field continuously fills the gap and bridged between science and art through sound, which is perceived through auditory experience and sound knowledge. Moreover, this art form is integrated with other visual, kinaesthetic and tactile mediums such as sculpture, paintings, moving images and more, in an innovative approach for expressing the artist's thoughts and feelings in either or both scientific and artistic perspectives, a fusion which provokes and nourishes my mind and soul, in their delight at combining knowledge and direct experience of the world around me.

I have always questioned what might be the value of this new self-encountered knowledge and experience not only to myself but to other parties and institutions. Will this investment be worth it to the wider community? A small step backward, away from traditional ideas of music and instead using *sound* as the fundamental keyword and as a tool to serve society, has shaped my thoughts on the topic and objective of my artistic research for the PhD programme and future undertakings. As a matter of self-motivation, I will never consider myself fully an 'expert' in a specific matter, because the gaining of knowledge is a lifelong process. Nevertheless, for professional visibility and in consequence to help serve my community, I will be charting my life as a subject-matter 'expert' in sound art. More specifically, my expertise is in relation to the self-culture that is being a modern Malay, using the 'unheard' Malaysian natural soundscape: biophonic and geophonic materials mediated through sound arts. I have noticed that many individuals, including those in modern Malay society, may not always give the due attention to their environmental sounds, including the rich tapestry of natural soundscapes. They are thus 'unheard' because we do not listen. They are 'hidden' because we do not notice them. At the same time, some soundscapes are more inherently hidden and thus unheard because they take place in unpopulated locations or in environments (such as underwater) that



are inaccessible to humans — unless purposefully revealed through recording, or figuratively in music, or in these things combined.

Soundscapes are composed of three fundamental elements, as elucidated by Bernie Krause; Biophony, Geophony and Anthropophony. Geophony refers to the sounds of the non-biological, natural world. It encompasses sounds like wind, water, and geological processes. Biophony pertains to the sounds produced by living organisms in an ecosystem. It includes the sounds of animals, insects, and plant life. Anthropophony, or anthropogenic sounds, encompasses human-made sounds, which can range from urban noise to industrial sounds. These are unexplored fields and subjects back in my home country. In my research, I place these concepts at the heart of my work to emphasize the interconnectedness of soundscapes and the environment. They help us understand the complex web of relationships between natural and human-made sounds within an ecosystem. While these categories provide a useful framework for understanding the sources of sound in an environment, it's important to acknowledge that in reality, there can be overlaps and blurred lines. For instance, human activity can influence both geophony and biophony.

In my doctoral research, and ongoing projects, I aim to produce new sound art works, which can be in any form that is in the sound domain and has aesthetic values which align with my research theme. Developing my own aesthetic voice, I had devoted myself to conceptual and theoretical inquiry into new and experimental music drawing on Western Art music traditions. I encountered the aesthetic of electroacoustic music during my Masters study at Birmingham Royal Conservatoire, UK, in 2011, from which later emerged my interest in sound art, particularly soundscape, as focus for my PhD studies. Beginning from the encounter with innovative elements and advanced graphic notation in new music compositions by Luciano Berio, Morton Feldman, Georges Aperghis and Jonathan Harvey, my journey took me towards a further understanding of how to listen and appreciate sound as music via the aesthetics of John Cage, Pierre Schaeffer and Karlheinz Stockhausen, and led me to experience the aesthetic of the art of sound in works by Alvin Lucier, Pierre Henry, R. Murray Schafer, Curtis Roads and particularly in soundscape composition by Hildegard Westerkamp and Chris Watson. These ‘masters of sound art’ inspired me to explore my own voice and style so as to represent myself, my cultural background, beliefs and thoughts and to reflect these in my compositional aesthetic, developed over the course of the PhD programme under the supervision of Neal Farwell and Michael Ellison.

How can I transport the listeners with my compositional ideas, aims, beliefs, and at least make it ‘interesting’ for them to follow and grasp until the final bar line or the end of audio transmission? The notion of ‘interesting’ may differ from one artist to another, and it interacts with each listener’s knowledge and experience of the sound culture in question. I believe we should try our best to make our work as ‘interesting’ to listeners as possible, without compromising our artistic originality and honesty. Every individual may not have the same sonic life-experience, but may nonetheless develop a similar sound cultural background and ‘common-sense’ in their sound knowledge, even perhaps identical; for example, a loud sound perceived as negative or signalling danger. To follow this simple analogy, imagine the sounding of a siren: what does it mean to you? Why is that particular sound used? And does everyone possess the same reaction towards the sound? Intuitively, a majority of ‘cultured’ society would agree with the sonic idea of this ‘man-made’ siren sound and express the same thoughts and feelings; yet it may be seemingly extra-terrestrial to an ‘uncontacted people’ and experienced differently. Is this ‘cultured’ siren sound a form of negative sonic act, in contrast to environmental sound, in the experience of these minorities? I think we need to find and start something with ‘common’ knowledge, intuitively, and ‘somehow’ gradually expose and assimilate this ‘uncommon’ sound knowledge and experience to different parts of the cultured societies. However, it might be seen as too easy or a ‘cheap’ move, and not original, for me to use the recorded natural environmental sound unmediated or as a given in my electroacoustic soundscape composition with minimal sound organising and editing. The question of ‘that sound, so what?’<sup>1</sup> is always lingering in my mind whenever I compose my music, as if it may display enough effort, thought, interest, complexity, appeal or brilliance. What is to be celebrated or recognised from it as expected and intended by the composer? Sound, a form of vibration energy that exists everywhere, cannot be perceived in a vacuum, and this ‘raw’ form of sounding material can be processed to create something that expressed my thoughts and beliefs. Using electroacoustic composition techniques, the creative potential is endless.

Identifying my listeners, and understanding their perceptions towards sound, can do a great deal to enable my aesthetic voice at least to be heard in this niche yet competitive field. The broader field of ‘sound studies’ connects the fields of composition, anthropology, and

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<sup>1</sup> Smith, Mark M. "Sound—So What?." *The Public Historian* 37, no. 4 (2015): 132-144. Accessed March 21, 2021. <https://doi.org/10.1525/tph.2015.37.4.132>.

philosophy, amongst others. A number of useful terms and concepts have emerged. The term acoustemology was coined by Steven Feld in 1992, conjoining the words ‘acoustic’ and ‘epistemology’, to bring focus on ‘knowing-with’ and ‘knowing-through’ audible mediums and subjects.<sup>2</sup> Tom Rice had managed to distinctively describe the inter-relationship between soundscape, acoustic-ecology, sonification and acoustemology.<sup>3</sup> Mirko M. Hall stated that ‘before the term acoustemology developed, Benjamin Walters had a philosophical concept and terminology on “dialectical sonorities” that is equivalent in its epistemological and metaphysical presuppositions to the constitutive properties of the dialectical image’. Walters proposed that ‘as a sensuous-intuitive, spatio-temporal, haptic-tactile, and historically concrete experience, sound’s materiality corresponds closely to that of the dialectical image: the aural thunderclap of sound parallels the visual lightning flash of the image’. Hall further commented on Benjamin's dialectical sonorities as ‘an opportunity for (re)articulating a new culturally transformative past and present—with an ear toward the future’.<sup>4</sup>

Nevertheless, these existing philosophical conceptions will be a guide to develop my own philosophical thought, rather than a method for my composition approach. In that approach, I believe, a certain degree of ‘ambiguity’ in the knowability of the composed sounds is essential to the making of the sound art as art.<sup>5</sup> This is distinct from the fundamental idea and function of ‘sonification’ as a method of enabling listeners to translate the perceived sounds as observable data and as changes of variable information within time and space; a separate matter from the sense of ‘musical’ or aesthetic form. Interestingly, in contrast, several sound artists are experimenting with the sonification approach within artistic contexts, to produce new ‘fresh’ sound art and appealing to the notion of ‘genre-busting’.<sup>6</sup> I will reflect further on this in the commentaries on my own works. My sound art works have a diverse audience, ranging from those with a passion for soundscapes to individuals interested in environmental awareness. While my PhD research has provided insights into how people may perceive and

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<sup>2</sup> Rice, Tom, and Steven Feld. "Questioning acoustemology: an interview with Steven Feld." *Sound Studies* 7, no. 1 (2021): 119-132. Accessed December 21, 2021.

<https://www.tandfonline.com/doi/abs/10.1080/20551940.2020.1831154>

<sup>3</sup> Rice, Tom. "Acoustemology." *The International Encyclopedia of Anthropology* (2018): 1-7.

<sup>4</sup> Hall, Mirko M. "Dialectical Sonority: Walter Benjamin's Acoustics of Profane Illumination." *Telos* 152, no. Fall (2010): 83-102. Accessed March 21, 2021. [http://www.arielaltman.com/kracauer/files/Hall\\_2010.pdf](http://www.arielaltman.com/kracauer/files/Hall_2010.pdf)

<sup>5</sup> Tormey, Judith Farr, and Alan Tormey. "Art and ambiguity." *Leonardo* (1983): 183-187. Accessed April 2, 2021. <https://www.jstor.org/stable/1574910>

<sup>6</sup> Novak, David. "New Waves of Noise in the 1980s and 1990s." (2020). Accessed April 2, 2021. <https://escholarship.org/content/qt44j9b8wm/qt44j9b8wm.pdf>

interact with my sound arts and their acoustic environment, it's important to note that attitudinal change is a complex process that may take time. My work contributes to the broader discussion on sound, culture, and environmental consciousness, and I hope that it sparks conversations and increased awareness, potentially leading to positive changes in the long run.

## *Miroirs of Malay Rebab (MiMaR)*

*Miroirs of Malay Rebab* (MiMaR) is a set of six (I-VI) electroacoustic soundscape compositions ranging from fixed media to instrumental live electronics. The idea of the cycle grew out from the title of a piano work that I had performed for my undergraduate recital, *Miroirs* by Maurice Ravel. Here, the five-movement suite for solo piano is improvisatory in character, reflecting Ravel's musical perspective vividly on his soundscape memories ranging from nocturnal animals, birdsong, the seascape and pastoral landscapes, with unusual musical colours and contrasting textures.<sup>7</sup> The narrative subject of each *Miroirs* movement is highlighted directly by Ravel in the title of the piece.

Following this model, I had decided to compose a set of works based on my re-imagination of selected unheard biophonic and geophonic materials, as mirrors of aspects of Malay performing-arts cultural and its associated stories. I had initially planned to composed a set of five works, with mutual contrast of instrumentation and selected natural soundscapes, and with features such as texture, articulation and dynamics adopting various degrees of tension-release based on the specific narrative subject reflected in each piece's title. For example, *Miroirs of Malay Rebab* I is based on reimagining the normally ignored or 'unheard' sounds of the Banyan tree (*Pohon Beringin*) with its rustling texture, flow and sparse character as the sonic canvas of the piece. In contrast, *Miroirs of Malay Rebab* II is composed with site-specific archival recordings of the echolocation sounds used by species of Malaysian bat (the Large False Serotine). Musically, these seem to have an improvisatory rhythmic character. *Miroirs of Malay Rebab* III is composed with musical instruments in bio-mimicry of elephant vocalisation, containing all sorts of unique functional noises such as snorts, squeaks and movement sounds.

Working on each piece sequentially according to the set number of each piece, from I to V, was quite challenging during Covid-19 lockdown with limited and unpredictable musical-technical resources and supports. As a result, I had to temporarily put aside some early planned *Miroirs of Malay Rebab* pieces, and move on working with other *Miroirs of Malay Rebab* pieces, and the date of each piece's start and completion varied from the programmatic order.

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<sup>7</sup> See Abramovitch, Ruti. "Maurice Ravel's *Miroirs* for piano." (2012). Accessed February 15, 2023. <https://core.ac.uk/download/pdf/213830889.pdf>

*Miroirs of Malay Rebab* II and IV were eventually not included in this PhD portfolio submission, due to performance and technical limitations during Covid-19 lockdown. Consequently, I added a sixth work to the planned five, *Miroirs of Malay Rebab* VI, to be workable and performable during the Covid-19 period. However, *Miroirs of Malay Rebab* II and IV will be reworked for future performance and recording opportunities.

## *Miroirs of Malay Rebab (MiMaR) I: Berlabuh* Piano and Tape (Stereo)

Composition Duration: 05 minutes 26 seconds

Composition Date: March 2022

*Berlabuh*, which translates to ‘Anchored’ in English, is a 5 minutes and 25 seconds music composition for Piano solo and tape. This work was specifically composed for the 2nd Free Hand Piano Festival program organised by the Malaysian Composers Collective (MCC), held on 25th June 2022, at the Institute of Music, UCSI University, Malaysia.<sup>8</sup> *Berlabuh* serves as a musical narrative of my personal experience bearing witness to the devastating flash floods that ravaged my home country, Malaysia, spanning from the end of December 2021 to the beginning of January 2022, while I was in Bristol, UK. Flash floods are no strangers in Malaysia, particularly along the East Coast of Peninsular Malaysia. However, what caught me off guard was that this time around, these flash floods were the most severe in a century. They swiftly took lives and wreaked havoc on property across the entire peninsular Malaysia overnight

Disappointingly and a cause for deep sorrow, the authorities did not give any form of clear early warnings about the impending flood disaster and made no initial preparations to mitigate its impact. Instead they merely declared that such a flood occurs once in a century, adopting a tone that portrayed it as a purely natural occurrence.<sup>9,10</sup> This assertion has been refuted by numerous independent groups, including academics and ecological researchers, who have provided compelling evidence indicating that these catastrophic flash floods were a direct consequence of irresponsible human actions, primarily driven by profit motives, such as rampant deforestation for development and plantation purposes, without due consideration for the long-term environmental consequences. Human activity can alter natural soundscapes, affecting both geophony and biophony, and, in some cases, creating entirely new sound environments. In my work *Berlabuh*, I aim to convey the complex relationships between these

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<sup>8</sup> *Miroirs of Malay Rebab (MiMaR) I: Berlabuh* was performed by Dr. Ho Su Han from UCSI.

<sup>9</sup> Hassan, H. “Peninsular Malaysia Hit by ‘1-in-100-Year’ Rainfall, Govt Says amid Severe Flooding.” The Straits Times, December 20, 2021. Accessed March 8, 2022. <https://www.straitstimes.com/asia/seasia/malaysia-pm-ismail-mobilises-armed-forces-to-assist-with-flooding-more-rains-expected>.

<sup>10</sup> Zairi channel. “Banjir Di Malaysia 2021 | Floods in Malaysia 2021.” YouTube. January 4, 2021. Accessed March 8, 2022. <https://www.youtube.com/watch?v=plmb3kqVdDs>

sound categories and the environmental changes associated with the Anthropocene. By addressing the human impact on ecosystems, such as flash flooding, I hope to draw attention to the urgent need for preserving the delicate balance of sound in our natural world.

This event served as a catalyst in my quest to discover sound-inspired materials influenced by natural elements associated with flooding, distinct from direct human creations. These materials, linked to concepts such as wind, currents, water, canals, wood, drift, logs, mud, collectively shaped the sonic landscape for *Berlabuh*. In crafting the piano solo component, I drew inspiration from classical instrumental compositions intimately connected to natural aquatic elements, like water, rivers, oceans waves, and storms, as exemplified in works such as Jean Sibelius's *Oceanides* and synthetic water features like fountains, as found in Maurice Ravel's *Jexux d'eau*. Additionally, I delved into electroacoustic compositions, notably *Riverrun* by Barry Truax, which served as primary reference for shaping the gesture cells of tape sounds and instrumental musical phrases.<sup>11</sup>

The title *Anchored* came to me as I watched several videos of major flash floods, where the powerful floodwaters swept away cars and debris, including wood waste resulting from logging activities (Video 1.1 <http://surl.li/cjqma>), some objects drifted randomly, while others became trapped 'anchored', accumulating near water outflows. This obstruction impeded the release of floodwater, exacerbating the inundation in the affected areas. The chaotic, unpredictable movement of debris in the floodwaters served as my inspiration for integrating aleatoric techniques into the piano performance. This allowed for chance-based selection of musical cells, drawing inspiration from John Cage piece, *Concerto for Piano and Orchestra*. The cells consist of pre-composed musical gestures that interact with the recorded stimulus sounds. The flow and intensity of the floodwaters colliding with the discarded timbre waste are influenced by a range of environmental variables, prominently the direction and force of the wind.<sup>12</sup> This encouraged me to highlight the incorporation of diverse 'wind-inspired' sound textures, alongside their corresponding richness and vitality in the tape segment. These elements effectively steer and stimulate the pianist's creative choices when selecting successive gesture cells.

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<sup>11</sup> Truax, Barry. "Riverrun (1986)." RIVERRUN (n.d.). Accessed February 10, 2021. <https://www.sfu.ca/~truax/river.html>.

<sup>12</sup> "Ocean Currents." Ocean Currents | Ocean Tracks (nd.d). Accessed March 18, 2021. <https://oceantracks.org/library/oceanographic-factors/ocean-currents>.



The development of the piano musical gesture cells followed the refinement of the accompanying tape part. This tape component encompasses delicate audio manipulations, including the application of high-pass filters and audio compression of the geophonic sounds, like the whispering breeze through leaves and branches and howling sound quality. This results in a subtle yet occasionally haunting sound quality. The soundfield recording technique of rustling winds is very challenging because the wind changes the air pressure level and directly affects the sound pressure level on the microphone capsule diaphragm very significantly. This often leads to unwanted artefacts, such as distortion and muffled recordings, even when the microphone signal is set to a low level. To mitigate these issues, I employed specialised tools like windshield dampening blimps, along with body shielding techniques and parallel wind directional pickups. These measures effectively minimised noise interference and allowed for the capture of pristine stereo images of the geophonic wind sound.<sup>13</sup>

Within the tape composition, these textural geophonic wind sounds intermingle with the resonant echoes of Aeolian harp drones, sourced from my collection of sonic materials curated during the creation of *Hidden Sounds of Spike Island: Historic Medieval Harbourside* soundwalks, which I crafted for the Bristol Open Doors Festival in 2021. These ethereal drones are meticulously returned to harmonise with the piano's sound world, forming an integral part of the piece's auditory landscape. The wind sound works as a main canvas for the piece's soundworld. The wind sounds serve as the foundational canvas upon which this sonic tapestry unfolds, evoking memories of my encounters with a traditional Malay cultural story. These experiences stirred recollections of the symbolic significance of the *Pohon Beringin* tree leaf (Banyan Tree), a leaf deeply embedded in archipelagic art traditions, including traditional Malay art forms like the shadow puppetry, batik fabric patterns, motifs found in woodcarvings on musical instruments, and even local architectural designs (Figure 1 and Figure 2). Moreover, the dense, lush and large banyan tree that thrive in the wilds of Asian tropical forest have long been recognised as symbols of shelter and protection, both in Hinduism and Buddhism.<sup>14</sup> This cultural appreciation inspired me to envision the wind rustling through the leaves of the banyan trees, directing the dynamics and the flow of floodwaters, washing away the remnants of

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<sup>13</sup> Smith, Ian. "Technical Field Recording 12: Recording the Wind." Vimeo, March 10, 2021. Accessed March 12, 2021. <https://vimeo.com/522052688>.

<sup>14</sup> ABDULLAH, AHMAD HAKIM, Yuhanis Ibrahim, and Raja Iskandar Raja Halid. "Analisis intrinsik simbol budaya Melayu dalam karya catan moden terpilih Jalaini Abu Hassan dan Fatimah Chik." *International Journal of Creative Future and Heritage (TENIAT)* 9, no. 1 (2021): 52-68. Accessed January 11, 2022. <http://journal.umk.edu.my/index.php/teniat/article/view/398/270>.

inundation. Initially, I had envisioned articulating the wind's direction through artificial hyper-panoramic spatialisation, employing an octophonic ring of loudspeakers in stereo pairs for the tape component. However, that intention could not be followed, as the technical resources of the performance venue at UCSI for this work were limited to stereo audio systems. Additionally, the Covid-19 pandemic was also a barrier, preventing me from returning home to record the sound of geophonic rustling winds in local banyan trees. Consequently, I worked with available geophonic sources in Clevedon, UK where I resided during the composition of this piece, and re-contextualising the field recordings from one location to represent another.



*Figure 1 Pohon Beringin (Banyan Tree) tree leaves.<sup>15</sup>*

When it comes to re-contextualising field recordings from one location to represent another, I believe it is a creative choice that offers a unique perspective on the way we perceive sound. While there may not be strict rules in this practice, it certainly warrants some words of reflection. One notable example of such re-contextualisation can be found in the work of Luc Ferrari, who sometimes misattributed the origins of his field recordings, almost playfully misleading his listeners.<sup>16</sup> This approach adds an intriguing layer of ambiguity and invites the audience to question their preconceived notions about the source of sounds. It is a method that can be both thought-provoking and artistically engaging. In the realm of film sound design, this practice is indeed quite common. As Michel Chion discusses in “Audio Vision,” the concept of indexicality becomes less significant, and sounds can take on new causal

<sup>15</sup> (Image) Suwiji, Nabila Shaffana Zhafira. “Pohon Beringin (Ficus Benjamina): Karakteristik, Manfaat Dan Mitos.” Forester Act, February 26, 2022. Accessed March 12, 2022. <https://foresteract.com/pohon-beringin/>.

<sup>16</sup> Kim-Cohen, Seth. *In the blink of an ear: Toward a non-cochlear sonic art*. A&C Black, 2009. 177-185. Accessed May 20, 2023. [https://lucferrari.com/wp-content/uploads/2017/04/Seth-Kim-Cohen\\_In-the-Blink-of-An-Ear\\_2009.pdf](https://lucferrari.com/wp-content/uploads/2017/04/Seth-Kim-Cohen_In-the-Blink-of-An-Ear_2009.pdf)

relationships in the context of the film.<sup>17</sup> This highlights how sound can be a flexible and malleable source, capable of creating emotional and narrative connections beyond their original sources. In my own work, I have explored this re-contextualisation of field recordings as a means of expanding the sonic palette and offering fresh perspectives on the world around us. It is a method that allows for endless possibilities and invites the audience to explore the intricate interplay between sound and perception.



Figure 2 Kelantan shadow puppet based on Pohon Beringin leave motive.<sup>18</sup>

The piano segment commences with an initial cell gesture comprising three distinct pitch notes: G4, Eb5, and D6, meticulously arranged in an ascending broken chord. Each note within this cell played roughly in the duration of five seconds, spaced proportional for a harmonious flow. I believe these particular notes resonate with the essence encapsulated in the title of this composition, *ber-la-buh*. Building upon this micro-motif foundation, I ventured into improvisation, continually harnessing these pitch sets to craft diverse gesture cells, each distinguished by variations in density and spacing (Figure 3). To convey the intricate

<sup>17</sup> Chion, Michel. *Audio-vision: sound on screen*. Columbia University Press, 2019.

<sup>18</sup> (Image) User, S. "Pohon Beringin." Perbadanan Muzium Negeri Kelantan – Utama (n.d.). Accessed March 12, 2022. <https://muzium.kelantan.gov.my/index.php/ms/allcategories-ms-my/22-wayang-kulit/89-maharisi>

movements of water within the composition, I drew upon a rich palette of rhythmic and intervallic gestures, drawing inspiration from established composition works inspired by water body. This included employing embellishment techniques like broken chords, arpeggios, trills and acciaccaturas, drawing on an insightful analysis by James Evans.<sup>19</sup>

Furthermore, I recognised the profound significance of silence, or musical rest, as a pivotal component in the composition. These moments of musical silence are themselves conceived as distinct cell gestures, capable of introducing tension or granting a welcome release. These restful moment play an integral role in shaping the piece's overall structure. In the crafting of subsequent cells, I retained the original five seconds duration of the initial cell gesture, using it as both the starting and concluding point for the entire composition. This temporal anchor not only facilitated a sense of cohesion but also served as a reference point for the proportional durations of other gesture cells throughout the work.

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<sup>19</sup> Evans, James E. "Fluid Dynamics: Representations of Water in Music." (2021). Accessed March 12, 2021. [https://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1193&context=music\\_etds](https://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1193&context=music_etds).

The figure displays a musical score for piano, featuring various cell gesture motifs and annotations. The score is organized into several systems, each containing multiple staves. Key annotations include:

- Senza Misura**: Indicated at the top left.
- !! repeat P4 higher or lower any time**: A red dashed box highlights a specific motif.
- repeat 8ve higher or lower any time**: An orange dashed circle highlights a motif.
- repeat M3 higher or lower any time**: A purple dashed box highlights a motif.
- repeat M2 higher any time**: A green circle highlights a motif.
- repeat P4 or octave higher any time**: A red dashed box highlights a motif.
- repeat mi2 higher any octave any time**: A red dashed box highlights a motif.
- repeat P4 lower any time**: A red dashed box highlights a motif.
- repeat M3 higher or lower any time**: A purple dashed box highlights a motif.
- repeat mi2 higher or lower any time**: A purple dashed box highlights a motif.
- repeat P4 higher or lower any time**: A red dashed box highlights a motif.

The score includes dynamic markings such as *ppp*, *p*, *mf*, *mp*, *ff*, and *fff*, as well as performance instructions like *delicato*, *ad lib.*, and *silent cluster white keys*. The notation includes treble and bass clefs, key signatures, and various musical symbols like notes, rests, and accidentals.

Figure 3 Cell gesture motive development based on the first cell and other cell gesture relationship or variation at top left first page score.

Drawing upon my experience as a Western classical pianist since childhood, I seized the opportunity within this composition to grant the pianist an active role in shaping the piece anew with each performance. In the context of piano pedagogy, I envisioned engaging the pianist in expanding the cell gestures through harmonic transposition (Figure 4). This approach empowers the pianist to delve deep into the nuances of each cell gesture, offering a comprehensive exploration of the pitch elements. It bestows upon the pianist both autonomy and creative freedom, allowing them to decide whether to introduce variations to the sonic landscape based on the prompts and cues emanating from the accompanying tape component.

Moreover, this approach imparts insights into how the motifs embedded within these cell gestures can undergo development through the straightforward technique of harmonic transposition, a fundamental concept commonly taught in Western music theory.

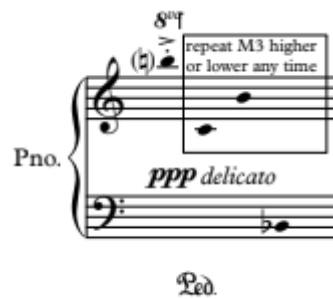


Figure 4 An example of a harmonic transposition technique for cell gesture variation to be performed by the pianist.

## *Miroirs of Malay Rebab (MiMaR) III: Gajah Menangis* Amplified Flute and Cello with Live Electronics (Stereo)

Composition Duration: 6 minutes

Composition Date: February 2021

*Gajah Menangis* (The Weeping Elephant) is an instrumental electroacoustic composition based on narrative material about current issues regarding elephants, and the symbolism of elephants in folklore as well as in cultural and traditional activities of the old and modern Malay world. The flute and cello symbolically represent the body and soul of an elephant. This work metaphorically narrates the life story of an elephant that roams freely in the tropical forests of Malaysia – an imagined story that draws on my appreciation of elephant wildlife and the ecology of their habitat through general readings and media references. The impetus to write this work came when I remembered reading about the tragic story of a pregnant female elephant who was killed by hunters in Kerala, India in 2020, for invading villagers' gardens and eating their garden crops.<sup>20</sup> What hurts me is that the elephant was brutally and inhumanely killed: the elephant and its calf died after eating a bait made from a pineapple filled with explosives.

I do not wish to be a nature activist and do not intend to take advantage of news events to draw public attention to my creative work. Instead this news material is a source of inspiration to my artistic study to explore the hidden sounds of the Malaysian natural soundscape. The symbolism of elephants in Malay culture can be traced from ancient to modern times.<sup>21</sup> For example, elephants are ridden as vehicles by Malay kings and sultans; elephant movement style influences traditional Malay dance choreography; elephant physical figures inspire traditional Malay arts and crafts; and today elephants are used as the official animal for the coat of arms of the State of Pahang in Malaysia (Figure 5). Therefore, I am interested to know about the hidden sound world of an elephant in Malaysia that can be used as the composition material for this work.

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<sup>20</sup> Gupta, Swati, and Nectar Gan. "Elephant in Kerala Dies after Suspected Firecrackers Hidden in Fruit Exploded in Her Mouth." CNN. Cable News Network, June 4, 2020. Accessed January 12, 2021. <https://edition.cnn.com/2020/06/04/asia/india-elephant-death-intl-hnk-scli/index.html>.

<sup>21</sup> De Danaan, Llyn. "The blossom falling: Movement and allusion in a Malay dance." *Asian Theatre Journal* 3, no. 1 (1986): 110-117. Accessed January 12, 2021. <https://www.jstor.org/stable/1124583>





Figure 5 Top and bottom left photo shows that elephants were once used as a transport for the royals and rulers in the Malay kingdom and bottom right is the Pahang state coat of arms with crossed elephants' tusks.<sup>22</sup>

My intended sound materials included the elephants' vocalisation as well as the sounds of their habitat environment. There are three living elephant species around the world and the elephant species in Malaysia is known as the Asian elephant (*Elephas maximus*). Although the Asian elephant and African elephant (*Loxodonta africana*) have slight different physical appearances from each other, they do share similar sociality, with defined social structure.<sup>23</sup> According to Smita Nair and Rohini Balakrishnan (2009), the spectral and temporal qualities of the four elephant vocalisation and nasal call types, namely trumpets, roars, rumbles and chirps were similar between Asian and African elephants.<sup>24</sup> However, Angela S. Stoeger and Paul Manger

<sup>22</sup> (Images) muip.gov.my (top and bottom left) and jagadita.com (bottom right).

<sup>23</sup> De Silva, Shermin, and George Wittemyer. "A comparison of social organization in Asian elephants and African savannah elephants." *International Journal of Primatology* 33 (2012): 1125-1141. Accessed March 12, 2021. <https://link.springer.com/article/10.1007/s10764-011-9564-1>

<sup>24</sup> Nair, Smita, Rohini Balakrishnan, Chandra Sekhar Seelamantula, and R. Sukumar. "Vocalizations of wild Asian elephants (*Elephas maximus*): structural classification and social context." *The Journal of the Acoustical Society of America* 126, no. 5 (2009): 2768-2778. Accessed January 12, 2021. <https://asa.scitation.org/doi/abs/10.1121/1.3224717>



(2014) stated that high-pitches and repetitive chirps, squeaks and squeals are typically absent in the African elephant species. Moreover, some sounds that are not primarily social were observed in captive Asian elephants, which are trunk squelching sounds, croaking, creaking and humming sound or whistling sounds.<sup>25</sup>

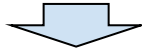
Given the constraints of Covid-19, the data collection of elephant vocalization sounds could only be retrieved through archival research methods: I drew these from the Elephants Voices website.<sup>26</sup> The site publishes the results of intensive African elephant research activities, and what makes this interesting is that the researchers have tried to interpret and categorise the types of acoustic communication contained in the elephant vocalisations based on observed behaviour in the animals' savannah habitat. I obtained permission to use these sounds from Petter Granli, President & CEO of ElephantVoices through several e-mail exchanges. However, the African elephant recordings are only used as stimulus to creating instrumental motives and gestures and are not used literally in the electronic audio portion, to avoid copyright issues. I have arranged the collections of elephant sounds to fit the narrative storyline of this work in seven parts: an Introduction, and parts A – F. A short description of the narrative atmosphere and expression for each part is given in Figure 6. The acoustic gestures of the elephant's vocalization ethogram are metaphorically imitated by the instrumental flute and cello.

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<sup>25</sup> Stoeger, Angela S., and Paul Manger. "Vocal learning in elephants: neural bases and adaptive context." *Current Opinion in Neurobiology* 28 (2014): 101-107. Accessed January 12, 2021. <https://www.sciencedirect.com/science/article/pii/S0959438814001263>

<sup>26</sup> Derrick. "Introduction." ElephantVoices. Accessed January 12, 2021. <https://www.elephantvoices.org/elephant-ethogram/introduction.html>.

**Intro:** Jaunty, where the elephant is roaming freely, eating leaves and fruits, and playing around. Trumpeting and snorting sound quality by flute. Light, short and jaunty sound gestures by cello.



**Part A:** Agitated: the elephant has heard and sensed the presence of humans and is feeling restless. Repetitive squeaks, chirps and squeals sound quality by cello<sup>27</sup>.



**Part B:** Furious: the elephant is attacked and harassed by humans. Wide leap, suggesting the elephant trunk sound and defensive actions. Tremolo gestures mimicking ear and tail flapping.



**Part C:** Torment: the elephant is injured by human attacks and in pain. Sustained high pitches and harmonics, suggesting whistling sound of elephant trunk nasal vocalisation during stress, numbness and pain.



**Part D:** Despair: the elephant is in grief and holding back pain as a result of injury. High pitches at arpeggio gestures by flute represent the modulated whistling tone of the elephant trunk and unstable breathing towards the end.



**Part E:** Lullaby: the elephant is tired and hungry, then sleeps; deep grief and pain. More lyrical tone by flute and sparse gestures of harmonics by Cello<sup>28</sup>.



**Part F:** Lament: the elephant cries and then her spirit flies and left the cruel earth.

*Figure 6 Programmatic narrative for Gajah Menangis soundworld.*

Elephants are known for their huge physical body size, and are often associated with the sound of a brass instrument used to mimic the sound of the elephant's trunk blowing. My compositional style and artistic principles aim to avoid the use of clichéd material. Therefore, I decided to explore using the flute and cello to mimic the elephant's soundworld, both literally

<sup>27</sup> Sandor, Ashley. *Extended techniques for string instruments as applied to selected twentieth-century cello repertoire*. University of Cincinnati, 2004.

<sup>28</sup> Fallowfield, Ellen. "Extended Techniques For Cello." Accessed January 15, 2021. <https://pdfcookie.com/documents/extended-techniques-for-cello-zmlygn5d7yl0>

– but avoiding a simplistic brass ‘trumpeting’ – and metaphorically. I have studied the types of extended flute techniques that can produce a trumpet sound that is similar to the sound quality of the elephant’s vocalisation sound gesture, and that can reflect the spirit and soul of the elephant in the narrative of the work. I found that the end-blown technique, using trumpet embouchure at the end of the flute body with the head joint removed, is more effective in producing such sounds as snorting, hissing, buzzing and trumpeting compare to blowing at the embouchure hole.<sup>29,30</sup> Figure 7 shows a small selection of these techniques from the first page of *Gajah Manangis*.

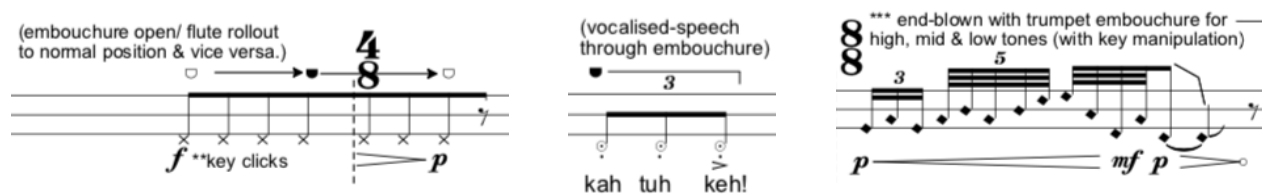


Figure 7 Three examples of flute extended techniques in *Gajah Manangis*, with a combination of embouchure - voice - key clicks manipulation for imitating the elephant’s vocalisations and other bioacoustics in relation to the programmed narrative. The first two examples are from the first system of the score; the third example is from the third system.

Un-pitched flute key clicks were also introduced to suggest the percussive sounds of twigs, wooden sticks and rocks being played with and stepped upon by the elephant. The flute is used to express the elephant's large body movements with relatively broad leaping gestures, and warmer and denser tone color, as opposed to the typical airy, light and hollow flute sound. To fit the narrative sequence of moods depicted in Figure 6, a variety of tempo and coherent rhythm, articulation, texture and dynamics of the instrumental sounds and contrast between each part, plays an important role in revealing and articulating the expression of the storyline. For the pitch systems in this work, I have used the Slendro Bb pitch scale, but with alterations and augmentations that dissociate it from the customary pentatonic soundworld and style of Malay Slendro Gamelan.

The duration of this work was required not to exceed six minutes, as part of the conditions of the commission for the Malaysian Philharmonic Orchestra (MPO) ‘Three Nations Concert:

<sup>29</sup> Rogier de Pijper. “Flute Colors - Extended Techniques Instructive Videos.” YouTube. YouTube, 2012. Accessed January 15, 2021. <https://www.youtube.com/playlist?list=PL3YP1V0PPTm8aFX4NHDH8buEn-mWrfUAE>.

<sup>30</sup> Moorhead, Kathryn Emma. "A performer's perspective on the evolution and realisation of extended flute techniques: a portfolio of recorded performances and exegesis." PhD diss., 2012. Accessed January 12, 2021. <https://digital.library.adelaide.edu.au/dspace/handle/2440/90333>

Malaysia, Singapore and Korea', organized by the Malaysian Composers Collective, which took place on 22 July 2022. After discussing this work with the MPO musicians and resident conductor through a zoom meeting in March 2022, I received feedback for revision of the score. Major and significant changes are in the Cello part, as requested by the cellist, to reduce and simplify rapid gestural passages that alternate pizzicato and arco (see for instance the end of the third and start of the fourth systems in the score).

Initially, the work was scored *senza misura* without metres and barlines, to give a sense of free musical gestures like an elephant roaming in the forest. Due to the unfamiliarity of the cellist with such a score, I added the dotted barlines with metric meter. However, one month later, I was informed by the organiser that the MPO players did not have enough time to prepare this work for the performance and this work was replaced with my previous work that had been played by them, *Fragments I* for trumpet duo. Nonetheless, *Miroirs of Malay Rebab* (MiMar) III: *Gajah Menangis* was given the opportunity to be performed during a reading session by the Hezarfen Ensemble organized by Michael Ellison in conjunction with the Bristol New Music Festival 2022.<sup>31</sup> I had a very fruitful discussion with the players in guiding and confirming the soundworld that I wanted as notated in the score. When the work was played from beginning to end, I was fascinated and rewarded to hear the work as a whole being played smoothly and accurately by the Hezarfen musicians.

The live electronics part serves as a catalyst to the sound world of this work. I have used the collection of sound recordings of the tropical rainforest environment which I recorded in Bukit Kepong, Forest Research Institute of Malaysia (FRIM), in July 2020. This environmental sound is set out as a canvas and container for the sounds of the live electronics and the instruments. The live electronics are programmed using an open source audio platform, Pure Data (Pd). Flute and cello live sound-gestures feed into two main audio effects, namely grain delays with triggered panning and reverbs. Reverb is emphasized in the cello part to express the idea of a sparse, transparent, thin and light soul spirit, while a set of grain delays with triggered panning is used to articulate the flute gesture to metaphorically mimic the physical movement of the elephant's body.

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<sup>31</sup> The Hezarfen Ensemble musicians for this piece are Ozan Tunca (Cellist), Cem Öner Türk (Flutist) and Cemi'i Can Deliorman (conductor).

The grain-delay architecture consists of multiple grain delays, implemented by recording instrumental sounds with a cycle duration of every 5000ms through the [delwrite~] and played back by [delread4~] or [vd~] with delays of 100ms, 300ms and 500ms which are selected randomly by the Markov Chain patch. The playback size (or time) of this recorded audio grain is controlled by the duration of the envelope amplitude that I had fixed. This Markov Chain patch uses the Pd Markov Chain example from the Git-Hub Pure Data library by Miller Puckette.<sup>32</sup> (Figure 8). For triggering the stereo panning of the grain delay, I use the [fiddle~] object, where the amplitude fluctuation detected from the instruments' dynamic changes playing causing changes on the grain delay panning position of each grain delay unit between -1 (far left) 0 (center) and 1 (far right) ( Figure 9).

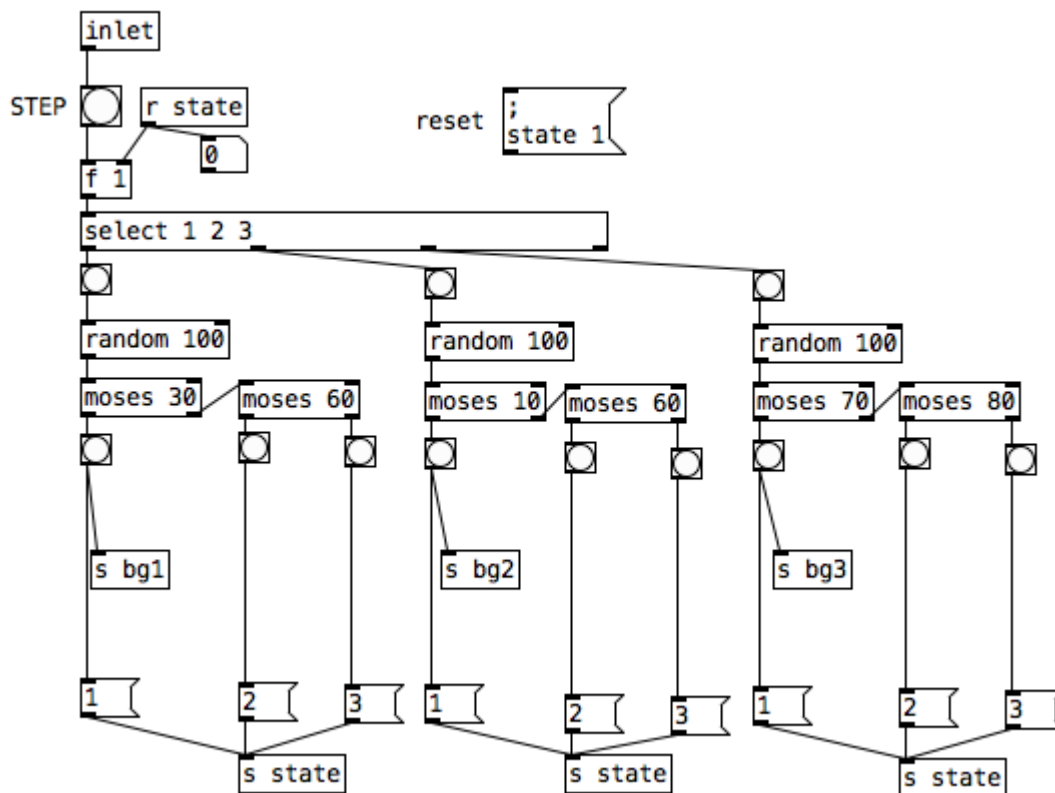


Figure 8 Pd Markov Chain object application by Puckette M. to trigger and change the grain delays parameters such as grain duration length or size, delay length and more.

<sup>32</sup> Puckette, Miller. "Pure-Data/Pure-Data: Pure Data - a Free Real-Time Computer Music System." GitHub. Accessed December 11, 2020. <https://github.com/pure-data/pure-data>.

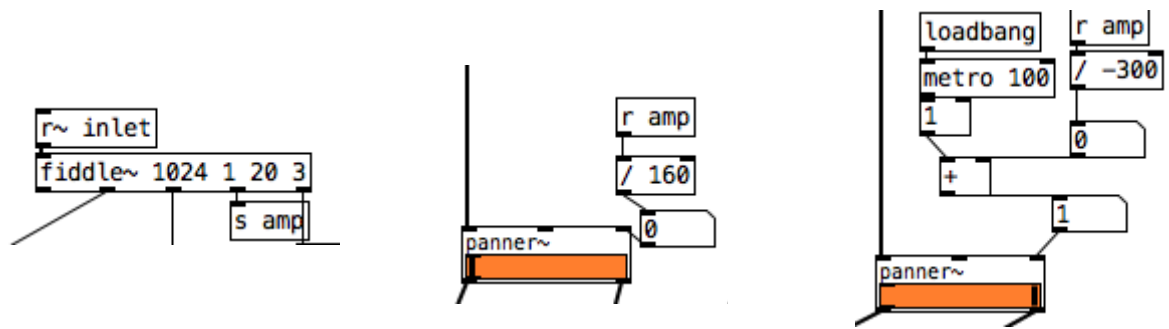


Figure 9 Fiddle Pd object amplitude outlet (distributed via the `[s amp]` and `[r amp]` pairs) is used to change the stereo panning according to the amplitude envelope (dynamics and articulation) of the notation being played.

## *Miroirs of Malay Rebab (MiMaR) V: San* Fixed Media (Stereo)

Composition Duration: 12 minutes 45 seconds

Composition Date: August 2021

The states of the East Coast of Peninsular Malaysia are rich in myths, fables and local legends that feature deity characters and mystic elements in the form of natural figures such as animals, stones, hills, and trees. Often these tales serve to highlight the majesty of the rulers and of the institutions of local kings. *Miroirs of Malay Rebab (MiMaR) V: San* invites listeners to imagine the world of hidden and otherwise unheard natural sounds, through the medium of an electroacoustic soundscape composition based on a legend from a small local fishing village in Rantau Abang, Dungun, Terengganu: the *Batu Penyu* legend. This legend relates to the Batu Penyu stone figure located on Bukit Che Hawa, Rantau Abang, Dungun (Figure 10). As recounted by Ganutalgia (n.d.), the story is as follows:



Figure 10 Left image is a Batu Penyu stone artifact that seems to resemble the head and body of a turtle in Rantau Abang, Terengganu.<sup>33</sup>

According to the local legend, there was a pair of male and female sea turtles walking along the coast of Terengganu waters. On asking a pufferfish where they were, the fish informed them that they had arrived at Rantau Abang Beach, and there was a beautiful garden on the top of the hill on the mainland of the beach. The puffer fish stated that they were lucky to be able to go ashore to see for themselves the beauty of the park. Excited, they went up to the beach; but they were scolded by a crab. After explaining that they wanted to go to the park,

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<sup>33</sup> (Images) Ganutalgia (left), <https://www.inournaturemag.com/all/tag/sea+turtles> (right).

the crab warned them not to drink the water in the park for fear of the curse that existed there. The female turtle was concerned for their safety and wanted to cancel the trip, but the male turtle was still excited to see the park. In addition, male turtles do not believe in curses. They separated and the female turtle waited for the return of the male turtle on the beach.

After walking up the hill, the male turtle finally arrived at the park. After wandering around, he felt thirsty and ignored the crab's warning to drink water in the park. When he had finished drinking, the sky began to darken, rain fell and lightning struck. The male turtle felt dizzy and his limbs began to stiffen and could not move until all his limbs turned to stone. The news was conveyed by a seagull to the female turtle, who saw the presence of a turtle-shaped stone at the edge of the park's pond. Feeling sad and disappointed, the female turtle left Rantau Abang Beach. Since then, the descendants of the two turtles have landed on Rantau Abang Beach to lay their eggs and to remember the story of their ancestors who were turned to stone. When laying eggs, turtles will cry because they remember the fate of their ancestors.<sup>34</sup>

In response to this legendary story, I got the idea to record the geophonic sounds of large rocks being hit by the stormy waves along the coast of Rantau Abang, around the turtle sanctuary area which is located not far from the Turtle Marine and Ecosystem Center (TUMEC). By using a semi-professional Aquarian Audio H2A hydrophone,<sup>35</sup> submerged in a large stone sea salt water reservoir, I was able to capture strange and unique sounds such as water splashing and fuzzy sounds resulting from the turbulent water of the waves hitting the rocks. A Zoom H6 was used as portable audio recorder (Figure 11). The sound is similar to the bubbles of the washed waves around the coast but with more percussive and accented texture. A 'plop-plop' biophonic sound was also recorded, produced by several small dark fishes the size of corn grains, that are trapped and hovering in the water reservoir on the rocks. In addition, when there are no strong sea waves hitting the rocks, there is a rather eerie sound like a high pitched drone,

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<sup>34</sup> Self-translation from Bahasa Malayu to English. Ganutalga. "Legenda Batu Penyu." Ganupedia. Accessed June 18, 2021. <https://ganupedia.com/?p=943p>.

<sup>35</sup> H2A hydrophone. Accessed January 10, 2020. <https://www.aquarianaudio.com/h2ahydrophone.html>.



with a subtle and somewhat resonant and hollow sound quality. This sound reminds me of radio telescope sound recordings of a Jupiter's ice-water moon, Europa.<sup>36</sup>



*Figure 11 Geophonic recording of sea waves crashing on rocks. The rocks are encrusted with shells, as well as having natural shallow pools on the rock surface as a result of wave erosion.*

I tried to record the sounds of the wind blowing in the cracks of the rock as well as the acoustic reflection of environmental sounds from the surface of the rock to get a signature site-specific sound quality (Figure 12). The percussive sound and noise of stormy waves on the beach are taken in a stereo image, and the sound of the waves is layered and happens at a distance, balancing self-consistency and internal random change, with a clear undulation between the left and right of the stereo image. The rhythmic sound of the waves also triggered in my mind an image of the turtle's legs moving rhythmically during their climb to the sandy land around the coast. The fuzzy and splashing sounds of the crashing sea waves recorded through the hydrophone, in the water pool on the coastal rocks, gave me the idea to use it as a sound to welcome and celebrate the rise of the turtles to the land.

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<sup>36</sup> "What Europa Sounds like." YouTube. YouTube, May 9, 2017. Accessed July 18, 2021. <https://www.youtube.com/watch?v=PzHF7NxlpIQ>.



Figure 12 Environmental sound recording of storm sea waves and wind blowing on the surface and crevices of rocks around Rantau Abang, Terengganu.

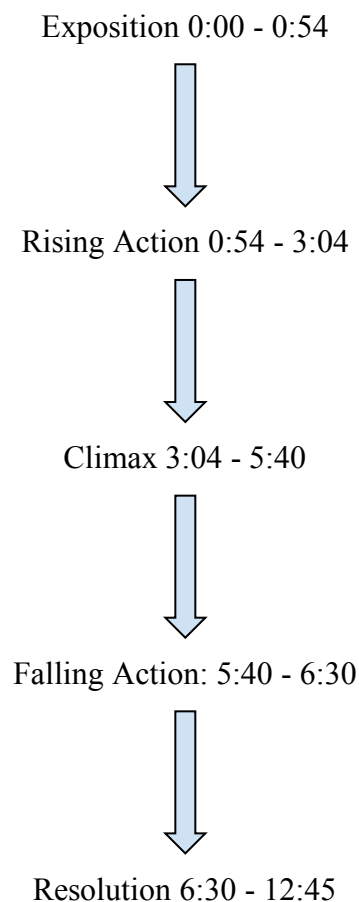
Soundscape composition typically takes an 'observational' stance, and it is less common to encounter these kinds of recorded sounds being used to tell an 'extra-musical' or 'extra-sonic' story. Taken to an extreme, an overt narrative could have the sounds just acting as signs for elements in the story, and no longer being heard for their own specific qualities nor as markers of the environment and place they were recorded. What they say about a particular place would be lost. In *San* I wanted to keep both perspectives: the soundscape of a Malay location, and the evocative flow of the local Malay legend. To mediate between these two positions and help keep them in balance, I have adopted an abstract idea of narrative form. Coined by the German novelist Gustav Freytag in 1863, 'Freytag's Pyramid' – to borrow a pithy definition that is in wide circulation on the internet – 'describes 'the five key stages of a story, offering a conceptual framework for writing a story from start to finish'.<sup>37</sup> Freytag's Pyramid continues to be referenced or adapted in later work on narratology,<sup>38</sup> and features frequently in informal or educational material directed at aspiring writers.<sup>39</sup> Music itself has many recognised formal

<sup>37</sup> See for instance Sean Glatch, "The 5 Stages of Freytag's Pyramid: Introduction to Dramatic Structure," Writers.com, July 30, 2021, Accessed May 24, 2023. <https://writers.com/freytags-pyramid>.

<sup>38</sup> See for instance Hansen, Per Krogh, John Pier, Philippe Roussin, and Wolf Schmid, eds. *Emerging vectors of narratology*. Berlin/Boston: de Gruyter, 2017.

<sup>39</sup> For example, Alexander, Bryan. *The new digital storytelling: Creating narratives with new media--revised and updated edition*. Abc-clio, 2017.

designs, familiar from the common practice era and later; and form also emerges from the act of composing. It is not obvious that a theory of dramatic structure originated for plays and novels should map easily into a musical composition. However, because I am working with sound materials that are not characterised by the usual parameters of music, and because Freitag's Pyramid seemed to fit the shape of the Batu Penyu legend, I found it a useful way to regulate the shape and pacing of the soundscape composition. The five stages are illustrated, with the corresponding time-points in *San*, in Figure 13.



*Figure 13 San programmatic narrative plot structure.*

I have tried to create several parts of the sound world that reflect the main idea of this work, based on the legendary story of the turtle stone; and also the slow, consistent and calm physical movement of the turtle. In the 'exposition', storm sea-waves, that have several sets of variations in texture and dynamic intensity, and were recorded in a straight path along the seashore in stereo, are introduced from the first minute until 6:20. In this exposition, the 'rising action'



begins to appear with a horn sound pitch of C#4 at 0:45. This is a synthesised sound, to mimic the sound of a blown conch shell. It symbolically calls the turtles to rise to the surface, and appears repeatedly like a lighthouse beacon beam, and sometimes with a blurry haze-like quality. The sound of a howling wind from 1:55, gives an impression of the 'resurfacing' experience; the coolness of the wind blowing on the skin of the body that is wetted with salty seawater. At 2:40, an alteration of the horn sound appears, now with a pitch of C4, to indicate the occurrence of something unwanted and unwelcome which is followed by the 'climax' part beginning at 3:04 with the appearance of the Kenong nipple-gong sound. This Kenong gong sound is drawn from a personal collection of audio samples which I recorded with a Malay gamelan set. The use of Kenong also suggests the location, as Malay gamelan was established and developed around 1892 in Istana Kolam, Terengganu.<sup>40</sup>

This anthroponic gamelan sound with a pitch of E5 with a lower partial on G4, repeating irregularly like a sparse pedal point, symbolically portrays the existence of human activity. The sound of the Kenong gong appears on the left side of the listener's stereo image to give the impression that the threat of human activity is close to the listener, as if 'whispering in the ear', with our listening perspective being that of the turtles.<sup>41,42</sup> At 3:51, there is a descending melodic phrase E4-D4-C4 which further emphasizes the anthroponic quality, and which is followed with a stronger, more harsh and energetic howling wind sound, overlaid with the Kenong gong sound at pitch E5. The atmosphere of this 'climax' becomes more tense with the sound of splashing waves that are increasingly lively, restless and seemingly dangerous, depicting the atmosphere in the legendary story at the moment of the curse taking effect. Nonetheless, the audible presence of the Kenong is deliberately understated. It points to 'danger' and artifice within the story, by alluding to human presence. Yet the story itself does not involve human activity, and I want the aural focus to remain on the natural-world sounds. At the end of the 'climax' section, the same Kenong descending melodic cue reappears, with a different wind texture that suggests a change in wind direction, and leads to the 'falling action'

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<sup>40</sup> D'Cruz, Marion. "Joget Gamelan—The Royal Dance of the Pahang and Terengganu Courts." In *Sharing Identities*, pp. 1-23. Routledge India, 2020. Accessed July 12, 2021. <https://www.taylorfrancis.com/chapters/edit/10.4324/9780367818029-1/joget-gamelan-royal-dance-pahang-terengganu-courts-marion-cruz>

<sup>41</sup> Sea turtles appear to hear best between 200 and 750 Hz, around pitch G#3 until F#5 (equal-temperament) and do not respond well to sounds above 1,000 Hz. "How Do Sea Turtles Hear?" *Discovery of Sound in the Sea*, January 7, 2020. Accessed July 12, 2021. <https://dosits.org/animals/sound-reception/how-do-sea-turtles-hear/>.

<sup>42</sup> Papale, Elena, Shritika Prakash, Shubha Singh, Aisake Batibasaga, Giuseppa Buscaino, and Susanna Piovano. "Soundscape of green turtle foraging habitats in Fiji, South Pacific." *PloS One* 15, no. 8 (2020): e0236628. Accessed June 18, 2021. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0236628>

section from around 5:15. In this section, the rhythmic activity and the dynamic energy of the soundscape are getting lesser, however, in a gradually paced reduction to around 6:20.

The long resolution starts from 6:20 continuing until the end of the piece at 12:45. This final part takes the listener (the turtles) back into the vast blue sea, a deep, warm, floating and calm environment, away from the anthrophonic man-made sounds like Kenong gongs that appear at the climax part. Here, the sound is much calmer, giving the impression of a safe atmosphere without the sound of harsh and sharp gusts of wind. However, in the final moments of the resolution section, the threat is still there and resurfaces, bringing the listener slowly ashore near a dense pine forest rimmed by thick white sands, decorated with the background sounds of animals that live around. However, the previous soundworld, with some remnants of splash sounds from under the sea, is adapted to this new dry-land soundworld, reminding the turtle to keep surviving.

## *Miroirs of Malay Rebab (MiMaR) VI: Titi* Trombone Solo, Tape and Live Electronics (Stereo)

Composition Duration: 5 minutes 25 seconds

Composition Date: March 2022

*Titi* means bridge in English. The sixth of the *Miroirs of Malay Rebab* (MiMaR) series of electroacoustic compositions, it is written for solo trombone, tape and live electronics. This work takes the listener into the soundworld of a stage performance mixed with euphony and cacophony. They co-exist in a dynamic balance, as a result of the interaction between the geophonic soundscape of the seaside and beach, and the anthrophonic soundscape of the concert performance. The physical environment of the concert hall, and the real-time nature of the live performance, become a bridge that connects the two categories of sonic events. This work was composed for Malaysian trombonists, upon invitation for the concert ‘Modern Malaysia & Mussorgsky’ presented by pianist Melody Quah with guest trombonist Lance Low at the Institute of Music, UCSI University Malaysia in July 2022. The concert was organised by the Malaysian Composers Collective (MCC) Society. The organisers set the requirement for a duration of less than 6 minutes.

I got the inspiration for this work from revisiting the sound material of *Miroirs of Malay Rebab* (MiMaR) V: *San*, and the narrative idea of that composition. The composed soundscape material of *Miroirs of Malay Rebab* (MiMaR) V has been reworked as secondary music material for live electronics. It functions as a catalyst to the musical ideas for the solo instrument and is developed and controlled through the interaction of the instrumental player with live electronics, and through manipulation of the parameters of the programmed audio signal, performed by me as a live improvisation on stage. As before, *Miroirs of Malay Rebab* (MiMaR) V uses the geophonic soundscape material that I had the chance to record in 2020 from the coastal sounds around Rantau Abang. The location is a small fishing village in Terengganu, Malaysia, which used to be known for its leatherback sea turtle nesting site, and the location has become a Turtle Conservation and Information Center. It also has a connection with the legend of the stone turtle.

When listening again to *Miroirs of Malay Rebab* (MiMaR) V: *San*, I recalled impressions and experiences from my location recording: the white-brown beach sand grains, washed by the

small bubbles of the shallow sea waves; the cooling sensation of the ocean waves that wet my feet along with the wind, blowing on my wet skin; the smooth monotone wind sound and the clear blue sky, with a ray of sunlight that warmed the skin of my feet while I stood making the soundscape recording. Thinking about the idea of *Miroirs of Malay Rebab* (MiMaR) VI: *Titi* and recalling that set of sense impressions, especially the wind blowing, I had pictured a conch shell and the sound of it being blown. This is a sound that I had heard during my research in the music of the Kavadi Thaipusam ritual ceremony, performed by Malaysian Hindus, in 2016.

This led me to the history of the early proto-Malay civilization which was once influenced by Hindu-Buddhist culture and religion. Muhammad Termizi Hasni et al. (2007), in their article 'Decline in Hindu-Buddhist Influences in Kedah: Analysis on Politics and Culture', mentions the results of excavations in Gua Bewah cave in Terengganu, Malaysia which have been carried out by a group of archaeologists from the National University of Malaysia and the State Museum Department Terengganu around 1996 to 2009. It was found that some of these locations were the burial places of the Malay community during the Hoabinh period (c. 10,000 - 2,000 BCE), which were found together with human skeletons and materials from Hindu-Buddhist funeral rituals, including conch shells that were used as burial decoration for the deceased.<sup>43</sup> The conch shell is an ancient musical instrument,<sup>44</sup> and is associated with Hindu-Buddhist religious symbolism.<sup>45</sup> However, I believe that the use of conch shell musical instruments for my own work is not very practical in terms of instrumentation resource and the consistency of sound quality. Instead, I have used the trombone, which is (inherently!) much easier to find for a trombonist. Moreover, the trombone's sound production, tone and pitch

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<sup>43</sup> Hasni, Muhammad Termizi, Muhamad Shafiq Mohd Ali, and Zuliskandar Ramli. "MEROSOTNYA PENGARUH HINDU-BUDDHA DI KEDAH TUA: SATU ANALISIS POLITIK DAN BUDAYA (DECLINE IN HINDU-BUDDHIST INFLUENCES IN KEDAH: ANALYSIS ON POLITICS AND CULTURE)." *Asian Journal of Environment, History and Heritage* 1, no. 2 (2017). Accessed April 23, 2022. <http://spaj.ukm.my/ajehh/index.php/ajehh/article/view/37>

<sup>44</sup> Fritz, Carole, Gilles Tosello, Guillaume Fleury, Emmanuel Kasarherou, Ph Walter, Francis Duranthon, Pascal Gaillard, and Julien Tardieu. "First record of the sound produced by the oldest Upper Paleolithic seashell horn." *Science Advances* 7, no. 7 (2021): eabe9510. Accessed April 12, 2022. <https://www.science.org/doi/abs/10.1126/sciadv.abe9510>

<sup>45</sup> Aye, Khin Than. "The vehicles of god and goddess (Hindu religious)." *Journal Myanmar Academy Arts Science* 16, no. 7 (2018): 175-187. Accessed April 12, 2022. Aye, Khin Than. "The vehicles of god and goddess (Hindu religious)." *Journal Myanmar Academy Arts Science* 16, no. 7 (2018): 175-187. [http://maas.edu.mm/Research/Admin/pdf/12.%20Khin%20Than%20Aye%20\(175-188\).pdf](http://maas.edu.mm/Research/Admin/pdf/12.%20Khin%20Than%20Aye%20(175-188).pdf)

relate to the tube length of the resonating air column, which is a similar mechanism of sound production to that of the blown conch shell.<sup>46,47</sup>

Going further into the site-specific history in relation to my musical idea for this composition, the Malay gamelan performance was documented around 18th century in Terengganu Palace, Istana Kolam. The Sultanate of Terengganu received the first set of Malay Gamelan musical instruments as a wedding gift from the Riau-Lingga court of Java and, since then, Malay Gamelan music has developed with its own musical style.<sup>48</sup> Judith Becker (1981) states that the gamelan ensemble in Java is used to play accompanying music for the performance of Hindu-Buddhist epic dance-dramas such as Ramayana and Mahabharata.<sup>49</sup> Malay Gamelan and Javanese Gamelan share a playing style that is more sparse, with minimal interference beating, and lively — compared to the Balinese Gamelan which is more dense, with high interference beating, and agitated.

This has led me to incorporate gamelan elements in the piece in composing the trombone melody, using a pitch set based on the Malay Slendro Gamelan scale (pentatonic) with a nucleus pitch of Bb and followed by the ascending pitches C, D, F and G (1, 2, 3, 5, 6 – these numbers refer to the Slendro scale degrees). The trombone's melodic intervallic relationships that suggest the sound world of Slendro were used little, to avoid elements of cliché and obviousness, and were intertwined with a contrasting pentatonic scale of Eb, E, F#, Bb, B (1, 2, 3, 5, 6 – these numbers refer to the Pelog scale degrees) derived from a Javanese Pelog Gamelan scale (heptatonic) by omitting A and C# (4 and 7) (Figure 14). Although there are seven notes in Javanese Pelog Gamelan scale, only a subset of five notes are used in their traditional repertoire. The trombone melodic relationship between neighbouring pitches was slightly encrypted, to blur the Slendro soundworld, by incorporating long notes with microtonal

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<sup>46</sup> Prasad, M. G., and B. Rajavel. "Acoustics of chants, conch-shells, bells and gongs in hindu worship spaces." *MS Narayanan's memorial lecture, New Delhi, India* (2013). Accessed April 12, 2022. [https://www.academia.edu/download/58246808/Acoustics\\_of\\_Chants...pdf](https://www.academia.edu/download/58246808/Acoustics_of_Chants...pdf)

<sup>47</sup> Taylor, Lisa R., M. G. Prasad, and R. B. Bhat. "Acoustical characteristics of a conch shell trumpet." *The Journal of the Acoustical Society of America* 95, no. 5 (1994): 2912-2912. <https://asa.scitation.org/doi/abs/10.1121/1.409263>

<sup>48</sup> Amin, Razali Md, Mohd Yusaidy, Mohd Yusoff, and Ab Samad Kechot. "Komunikasi Instrumentasi dan Seni persembahan Gamelan Melayu dan Jawa." *Jurnal Melayu Isu Khas 2017* (2017). Accessed 14 April 2022. <http://journalarticle.ukm.my/11904/1/22705-65542-1-SM.pdf>

<sup>49</sup> Becker, Judith. "Hindu-Buddhist time in Javanese gamelan music." In *The Study of Time IV: Papers from the Fourth Conference of the International Society for the Study of Time, Alpbach—Austria*, pp. 161-172. Springer New York, 1981. Accessed 15 April 2022. [https://link.springer.com/chapter/10.1007/978-1-4612-5947-3\\_13?noAccess=true](https://link.springer.com/chapter/10.1007/978-1-4612-5947-3_13?noAccess=true)



pitch fluctuation, articulations such as wide vibrato shake, embouchure-vowel, multiphonic voice singing and so on (Figure 15).<sup>50,51,52</sup>

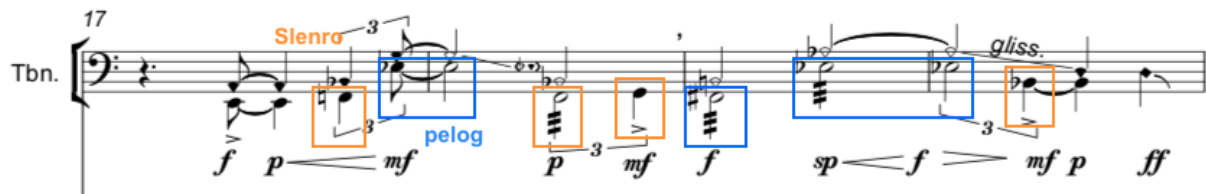


Figure 14 An example of a melodic line with Slendro and Pelog scale.



Figure 15 An example of trombone extended techniques to blur the Slendro scale melodic relationship.

I had the chance to communicate through e-mail and online meetings with the Malaysian trombonist, Low Wen Hong (Lance), who is currently Bass Trombonist for the Oulu Symphony Orchestra, Finland, to discuss trombone playing techniques required to perform *Titi*. Although many aspects of timing, in rhythm and in the patterning of dynamics and articulation, are composed to give the feeling of spontaneity in *Titi*, there are also several repetitions of rhythmic motives and melodic phrases, either with undefined or defined pitch, which aim to make it easier for the listener to connect with the musical ideas through their recall of previous instances, and enable musicians to practice and read the music with greater ease.

For the central compositional idea of a 'bridge', I explored spatial interaction between two sounding bodies, namely the electronics projected through a pair of loudspeakers, and the acoustic trombone. This setup is practical for most concert events in terms of technical

<sup>50</sup> Vicaria, Rodrigo. "Christian Lindberg - Luciano Berio Sequenza V." YouTube. YouTube, March 25, 2022. <https://www.youtube.com/watch?v=OnfApTtzJmk>.

<sup>51</sup> Webb, Barrie. "Performing Berio's Sequenza V." *Contemporary Music Review* 26, no. 2 (2007): 207-218. Accessed March 25, 2022. <https://www.tandfonline.com/doi/abs/10.1080/07494460701295358>

<sup>52</sup> Dempster, Stuart. "The Modern Trombone. Berkeley." (1979).

resources. The idea of exploring spatial behaviors through acoustic projection of the musical instrument is not something new to 20th century avant-garde Western experimental composers; and I have done this previously in my own work, in the composition *Fragments I* for trumpet duo (2014). In *Titi* I focus on the possibilities of instrument and electronics together, in spatial interaction. The spatial stereo of the loudspeakers is manipulated live and controlled via improvisation, using Pd patches which are specially programmed to manipulate audio processing parameters such as Sub-patch Multi-grain Delay, with Markov Chain triggers and Stereo Panning. This element of spatial interaction is transient throughout the music structure of *Miroirs of Malay Rebab* (MiMaR) VI, and is used for 3-dimensional texture variations as well as to affect listeners' tension and attention.

Since this piece was completed after the lifting of Covid constraints, I had the opportunity to perform it, with myself on electronics and with the live trombonist, on stage in Malaysia. With live electronics, I gain much control of spontaneity and fluidity in the soundworld, influenced by the trombonist's performance energy and hall acoustic feedback (Figure 16). The tape part is adapted from *Miroirs of Malay Rebab* (MiMaR) V: *San*, with some addition of anthrophonic sounds such as Tibetan singing bowl, Tibetan finger cymbals and Gamelan samples. These work as sectional cues to introduce several processed sounds as notated on the score.



Figure 16 Live performance and setup of MiMaR VI: Titi at UCSI University, Malaysia, July 2022.<sup>53</sup>

<sup>53</sup> (Images: Lance Low). UCSI, 2022.

The Pd patch was adapted from my patch for *Miroirs of Malay Rebab* (MiMaR) III: *Gajah Menangis*, which features the Grain Delay effects based on Markov Chain and acts on the sound of the live trombone captured via a close microphone. This extends the trombone composed soundworld and influences the trombonist's performance energy and interpretation of the piece. To add a fresh sound and contrast the Pd patch, I decided to use my do-it-yourself (DiY) modular synthesisers to extend the Pd patch sound effects and their resulting soundworld. The synthesiser modules are housed in a briefcase-sized DiY Eurorack and consists of; 1) Behringer Brains synthesiser module;<sup>54</sup> 2) DiY double chain digital reverb based on PT2399 IC Chip with both adjustable dry-wet and feedback;<sup>55</sup> 3) DiY buffered four mono channels mixer;<sup>56</sup> 4) DiY Low Frequency Oscillator Control Voltage (LFO CV) generator;<sup>57</sup> 5) DiY passive mono signal multiplier of 4(1x3); 6) DiY mono mute for 6 channels and; 7) DiY passive linear-signal attenuator for four mono channels. I have been developing these synthesisers gradually over the span of the PhD. Its modules are my own adaptations of designs circulating in the 'maker community', informed also by my interactions with the group called Building Instruments led by Joshua Taylor and Peter Bennett at the University of Bristol. I repay this collaborative learning by publishing details of my own creations on my website.

The DiY modified double chain PT2399 reverb circuit is warm, sounds fuller and bigger and has a unique character (with more random feedback, yet controllable) compared to the one in Pd Reverb patches [rev2~] and [rev1~]. I have used this to processed both Pd and my other modular synthesizer with my four channel active mixer module. The Behringer Brains module is controlled by the DiY LFO CV generator, and the Behringer Brains output is patched into the DiY mute-attenuator and further patched into the DiY multiplier for additional processes or mixed out into the DiY buffered four-channel mixer. The sound outputs from Pd, amplified Trombone, and DiY eurorack were summed out to the front of house (FOH) stereo speakers and stage wedge monitors via a Focusrite Sapphire Pro 40 audio interface. The DiY digital LFO CV generator is inspired by the Doepfer A-149-4,<sup>58</sup> which was modified with DiY VACTROL (resistive opto-isolator) and programmed in an Arduino Nano microcontroller. It provides seven types of DC 0-5V wave forms; saw 1, saw 2 (inverted), sine, triangle, square

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<sup>54</sup> Ltd., Magnolia International. "Product: Brains." Behringer. Accessed June 9, 2021. <https://www.behringer.com/product?modelCode=P0E6H>.

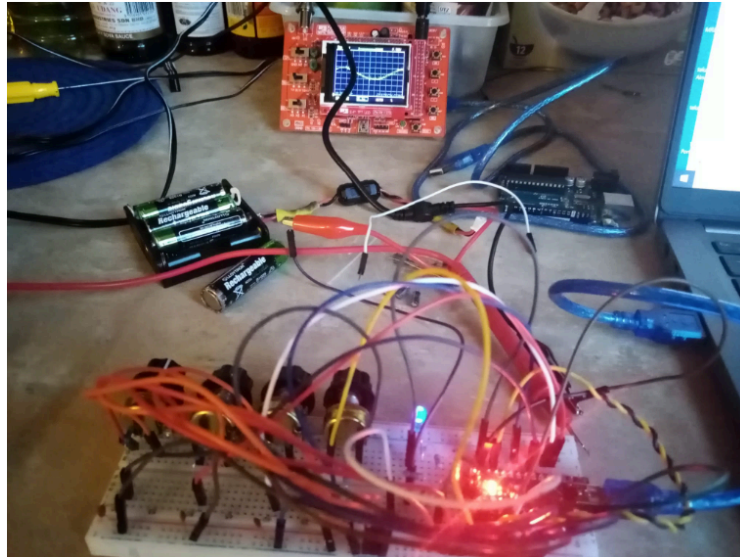
<sup>55</sup> See <https://ainolnaim.wordpress.com/digital-delay-effects-pt2399-ic/>

<sup>56</sup> See <https://ainolnaim.wordpress.com/4-ch-mono-mixer-dc-ac/>

<sup>57</sup> See <https://ainolnaim.wordpress.com/multi-lfo-cv-with-external-clock-sync/>

<sup>58</sup> A-149-4. Accessed July 11, 2021. <https://doepfer.de/a1494.htm>.

(pulse), random form (noise), and constant (Attack-Sustain-Release), with additional wave forms such as concave saw, convex saw, inverted concave saw and inverted convex saw. Other DiY modules were inspired by Doepfer A100 series (Figure 17).<sup>59</sup>



*Figure 17 Digital LFO CV prototyping.*

To avoid overpowering the other sound materials from the tape, Pd-Trombone and unprocessed Trombone (i.e. unprocessed except for reverb effects), I have imposed a constraint by choosing only two types of synth model out of 25 in Behringer Brains: 1) Grains-Formant frequency timbre, and 2) Rain-Rain grain density timbre. These two models were selected that for their interesting sounds that give me the figurative impression of sparkling beads of white sands and splashing sea waves. These sounds were triggered randomly by me, and their parameters – such as Grain frequency between formant 1 and 2, and Rain amount of pitch randomization – were improvised. These are therefore not notated in the score, and I would leave it to other performers to decide what is needed based on their interpretation and interaction influenced by the tape part, trombonist's performance and hall acoustic feedback.

The piece is not intended to be performed solely with tape, as it requires spontaneity and fluid expression from both the trombonist and live electronic part. The piece can be performed by others if they use similar synthesizer module sound effects, either off-the-shelf devices such as Behringer Brains or Mutable Instruments Plaits, or appropriate custom systems

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<sup>59</sup> A-100 do it yourself page. Accessed July 11, 2021. [https://doepfer.de/DIY/a100\\_diy.htm](https://doepfer.de/DIY/a100_diy.htm).

A cue to inform the trombonist when the piece is approaching its end is heard in the composed tape. This cue includes the sound of the gong and stronger wind of the storm waves. To end this piece, a classic form of fade and dying away *morendo* gesture is applied for both trombone and electronic parts with lessening variation of sound gestures. It is as if one is being washed away by the waves towards the deep blue sea and getting further away from sight.

## Seed of Life (SoL)

*Seed of Life* (SoL) is a set of six electroacoustic soundscape compositions comprising fixed media, interactive media, and instruments with live electronics. The idea for these works originated during my field recording trip to a natural mangrove forest in Kukup Island, Johor, Malaysia in July, 2020. During the trip, I ear-witnessed a mass of peculiar percussive sounds and was surrounded by a chaotic mixture of subtle popping and loud snapping sounds that emerged underneath around the mangrove trees roots. I discovered that those sounds are from Mangrove snapping shrimp (*alpheus spp.*), known by locals as pistol shrimp, that live in burrows around the mangrove tree roots.<sup>60,61</sup> The dominant mangrove species in Pulau Kukup (*rhizophora apiculata*),<sup>62</sup> which is known as *Bakau Minyak* in Malay, reproduces through two methods: viviparity (a seed that germinates into a seedling before being shed from the parent plant); and wind dispersal.<sup>63</sup> Another species, the Cannonball mangrove (*Xylocarpus granatum*), known as *Nyireh Bunga* in Malay, produces large fruits with seeds that explode once ripened.<sup>64</sup> The mangrove forest plays a vital role in sustaining a healthy natural ecosystem by providing habitat and refuge to a wide array of flora and fauna, while contributing to nature-based economies.<sup>65</sup> These contexts inspired me to come up with a thematic title for the set of six works: *Seed of Life* (SoL).

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<sup>60</sup> Wan Juliana, W. A., M. S. Razali, and A. Latiff. "Distribution and rarity of Rhizophoraceae in Peninsular Malaysia." *Mangrove Ecosystems of Asia: Status, Challenges and Management Strategies* (2014): 23-36. Accessed April 11, 2021. [https://link.springer.com/chapter/10.1007/978-1-4614-8582-7\\_2](https://link.springer.com/chapter/10.1007/978-1-4614-8582-7_2)

<sup>61</sup> Coast, Queensland. "Leaf-Cutting Snapping Shrimps." Leaf-cutting Snapping Shrimps, January 1, 1970. Accessed April 11, 2021. <http://queenslandcoast.blogspot.com/2017/11/the-unreported-importance-of-snapping.html>.

<sup>62</sup> Azman, Amelia, Kevin-Kit-Siong Ng, Chin-Hong Ng, Chai-Ting Lee, Lee-Hong Tnah, Nurul-Farhanah Zakaria, Suhaila Mahruji et al. "Low genetic diversity indicating the threatened status of *Rhizophora apiculata* (Rhizophoraceae) in Malaysia: declined evolution meets habitat destruction." *Scientific Reports* 10, no. 1 (2020): 1-12. Accessed April 11, 2021. <https://link.springer.com/content/pdf/10.1038/s41598-020-76092-4.pdf>

<sup>63</sup> "NParks: *Rhizophora Apiculata*." National Parks Board. Accessed April 11, 2021. <https://www.nparks.gov.sg/florafaunaweb/flora/3/2/3265#:~:text=A%20long%2C%20cylindrical%20seedling%20emerges,condition%20is%20known%20as%20viviparity.&text=Occurs%20on%20deep%2C%20soft%20and,permanent%20freshwater%20input%20is%20preferred>.

<sup>64</sup> Wati Haron, N., and R. Mat Taha. "Taxonomy, distribution and propagation of *Xylocarpus* species at Carey Island-the heritage Island of Malaysia." In *II International Conference on Landscape and Urban Horticulture* 881, pp. 997-1004. 2009. Accessed April 12, 2021. [https://www.actahort.org/books/881/881\\_166.htm](https://www.actahort.org/books/881/881_166.htm)

<sup>65</sup> Jusoff, Kamaruzaman, and Dahlan Taha. "Managing sustainable mangrove forests in Peninsular Malaysia." *Journal of Sustainable Development* 1, no. 1 (2008): 88-96. Accessed April 23, 2023. [https://www.researchgate.net/profile/Kamaruzaman-Jusoff/publication/41892453\\_Managing\\_Sustainable\\_Mangrove\\_Forests\\_in\\_Peninsular\\_Malaysia/links/53ea2cd30cf2dc24b3cb114c/Managing-Sustainable-Mangrove-Forests-in-Peninsular-Malaysia.pdf?\\_sg%5B0%5D=started\\_experiment\\_milestone&origin=journalDetail](https://www.researchgate.net/profile/Kamaruzaman-Jusoff/publication/41892453_Managing_Sustainable_Mangrove_Forests_in_Peninsular_Malaysia/links/53ea2cd30cf2dc24b3cb114c/Managing-Sustainable-Mangrove-Forests-in-Peninsular-Malaysia.pdf?_sg%5B0%5D=started_experiment_milestone&origin=journalDetail)



The works in *Seed of Life* (SoL) take inspiration from local Malay and proto-Malay folklores, tales, legends, and myths which I had grown up with from my childhood, markers of self-culture and identity, in contrast to *Miroirs of Malay Rebab* (MiMaR), whose works developed from Malay performing arts materials. I planned to composed a set of six works contrasted in instrumentation, performance settings, and their selection of several unheard or hidden natural soundscapes that had the potential to stimulate my reimagination and creativity for composing the works, based on a specific narrative subject suggested in each piece's title. For example, *Seed of Life* (SoL) 1: *Ancestral Dance* is based on the hidden natural soundscape of the Mangrove forest, including the mudskipper fish living in their burrows, that has been associated with a popular Malay folktale, the *Devouring Rock*.<sup>66</sup> *Seed of Life* (SoL) 1 has percussive sounds with energetic dynamics, a rhythmic, demonic-chaotic character that features the mudskipper vocalisations and the shrimps' biomechanical snapping sounds.<sup>67</sup> In contrast, *Seed of Life* (SoL) 2: *The Travellers* has a more subtle, tranquil, and gradually evolving soundworld. *Seed of Life* (SoL) 2 features hidden underwater soundscape (aquascape) of the second largest natural freshwater lake in Malaysia, Tasik Chini Pahang. The recordings were composed with minimal mediation to invoke the sense and spirit of the place<sup>68</sup> which I had reimagined based on the local legends of a mysterious dragon and sunken ancient Khmer Empire city in Tasik Chini.<sup>69</sup> Continuing the cycle, *Seed of Life* (SoL) 3: *Black Forest* recalls a similar soundworld to *Seed of Life* (SoL) 1, but this time extended with amplified percussion and live electronics. It contrasts with *Seed of Life* (SoL) 4: *Rest and Shelter*, which features ambient sounds of the Gua Tempurung limestone cave in Perak, Malaysia, with minimal mediation of the recorded soundscape. To conclude the cycle, I have come up with two contrast works *Seed of Life* (SoL) 5: *Nada Sfera* for web soundscape installation with binaural streaming device; and *Seed of Life* (SoL) 6: *The Source (Where The Mountain and River Sings)* for amplified voice, cello and live electronics. *Seed of Life* (SoL) 5 is a pilot project to provide the

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<sup>66</sup> Sgfilmlocations. "Batu Belah Batu Bertangkup / the Devouring Rock (1959)." Singapore Film Locations Archive, February 3, 2015. Accessed April 11, 2022. <https://sgfilmlocations.com/2015/02/03/batu-belah-batu-bertangkup-the-devouring-rock-1959/>.

<sup>67</sup> Montealegre-Z, Fernando, Carl D. Soulsbury, and Damian O. Elias. "Evolutionary Biomechanics of Sound Production and Reception." *Frontiers in Ecology and Evolution* 9 (2021): 788711. Accessed December 12, 2021. <https://www.frontiersin.org/articles/10.3389/fevo.2021.788711/full>

<sup>68</sup> InkSpotFilms. "Chris Watson - Spirit of Place." Vimeo, November 25, 2022. Accessed December 12, 2022. <https://vimeo.com/105004521>.

<sup>69</sup> Fadzillah, Fathiah Izzati Mohamad, JAMILAH BEBE MOHAMAD, and Jamal Rizal Razali. "PAHANG STATE FOLKLORE BASED ON THE LEGEND OF CHINI LAKE DRAGON." *International Journal of Humanities Technology and Civilization* (2022): 22-25. Accessed May 12, 2022. <https://journal.ump.edu.my/ijhtc/article/view/7471>

opportunity for web visitors to compose their own soundscape by exploring and manipulating live streaming audio capture from a DiY (Do it Yourself) *Nada Sfera* self-contained binaural streaming device. It captures hidden and unexplored soundscapes sourced from the locations used in *Seed of Life* (SoL) 1-4, and others locations such as Gunung Ledang, also known as Mount Ophir (associated with the legend of *Puteri Gunung Ledang*). Web visitors also able to visually monitor the sonic activities of the live streaming soundscape via live spectrogram analysis. *Seed of Life* (SoL) 6 is composed based on several audio recordings of rivers, streams and rainforest soundscapes, which recalls the mangrove forest ‘seed of life’ idea in a meditative and mystical soundworld, emphasised through the use of throat singing tones and a fluid texture.



## Seed of Life (SoL) 1: *Ancestral Dance*

### Electroacoustic Soundscape for Fixed Media (Binaural)

Composition Duration: 11 minutes 37 seconds

Composition Date: October 2020

*Ancestral Dance* is an electroacoustic soundscape composition and served as the first movement for the *Seed of Life* (SoL) artistic research project. The ‘unheard’ found soundscapes were archived and preserved for future reference and appreciation by making them available on my personal webpage.<sup>70</sup> *Ancestral Dance* was composed from processed in-situ audio recordings. In this case, the recordings are of the natural soundscapes of two mangrove forests inhabited by the Seletar, a Proto-Malay indigenous sea nomad community in Johor Bahru along the southern coastline of Peninsular Malaysia. These two mangrove forests have contrasting geographical landscapes that contribute contrasting geophonic and biophonic qualities; one is on the mainland cape known as Tanjung Piai, and the other is on the island Pulau Kukup.

The *Ancestral Dance* composition idea had developed prior to my literature research on the sites’ landscape, history and ecological background, and during my first visit to both mangrove forests for data collection via audio field recordings. This visit took place in July 2020 during the Covid-19 pandemic movement controls in Malaysia.<sup>71</sup> I observed and recorded various bird vocalisations round the mangrove forest, during the bright sunny noontime. The local mangrove forest is also inhabited by distinctive site-specific aquatic animals such as mudskipper and snapping shrimp.<sup>72</sup> In the piece, I had emphasised the Rufous-Winged Philentoma bird vocalisation in Tanjung Piai that sounds ‘whee-wheep’. Its distinctiveness marks the sound's origins from the Malay archipelago region.<sup>73</sup> As a tool to sharpen my aural analysis of the elements of this soundscape, I made a staff-notation transcription of a recorded segment, as shown in Figure 18.<sup>74</sup> I had managed to record the snapping shrimp ‘clamp’ sound with my portable audio recorder before high tide in Pulau Kukup mangrove forest. However,

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<sup>70</sup> See <https://ainolnaim.wordpress.com/>

<sup>71</sup> During that time, academic research field work activities were allowed by the Malaysian government, subject to specific Covid-19 pandemic guidelines.

<sup>72</sup> Friends of Mangrove - Welcome to the 'Friends of Mangrove' website! Accessed January 10, 2020. <http://www.friendsofmangrove.org.my/>.

<sup>73</sup> “Rufous-Winged Philentoma - Ebird.” Accessed August 23, 2020. <https://ebird.org/species/ruwphi2/>.

<sup>74</sup> Azizol, Ainolnaim. “Tanjung Piai Mangrove Forest Soundscape.” YouTube. YouTube, January 11, 2021. <https://www.youtube.com/watch?v=wsdi200jya0>.

due to limited field-work time, no mudskipper stridulation sound was observed, nor was it captured in the recordings I made in each mangrove forest.<sup>75,76</sup> Nonetheless, I still wanted to source this sound. The mudskipper in Malay is known as *Ikan Tembakul* which reminded me of a local Malay folklore that I heard when I was a child, *The Devouring Rock*, that highlights the *Ikan Tembakul* as part of the story line.<sup>77</sup> This led me to the quest of retrieving the ‘unheard’ mudskipper via archival research. I chose the sounds of a newly discovered soniferous mudskipper species, discovered and documented by a team of evolutionary scientists led by Gianluca Polgar.<sup>78</sup> The species is known as *Periophthalmodon Septemradiatus* and was found in Tanjung Piai mangrove forest swamp. With the permission of the study’s authors, I have used recordings from their data set.

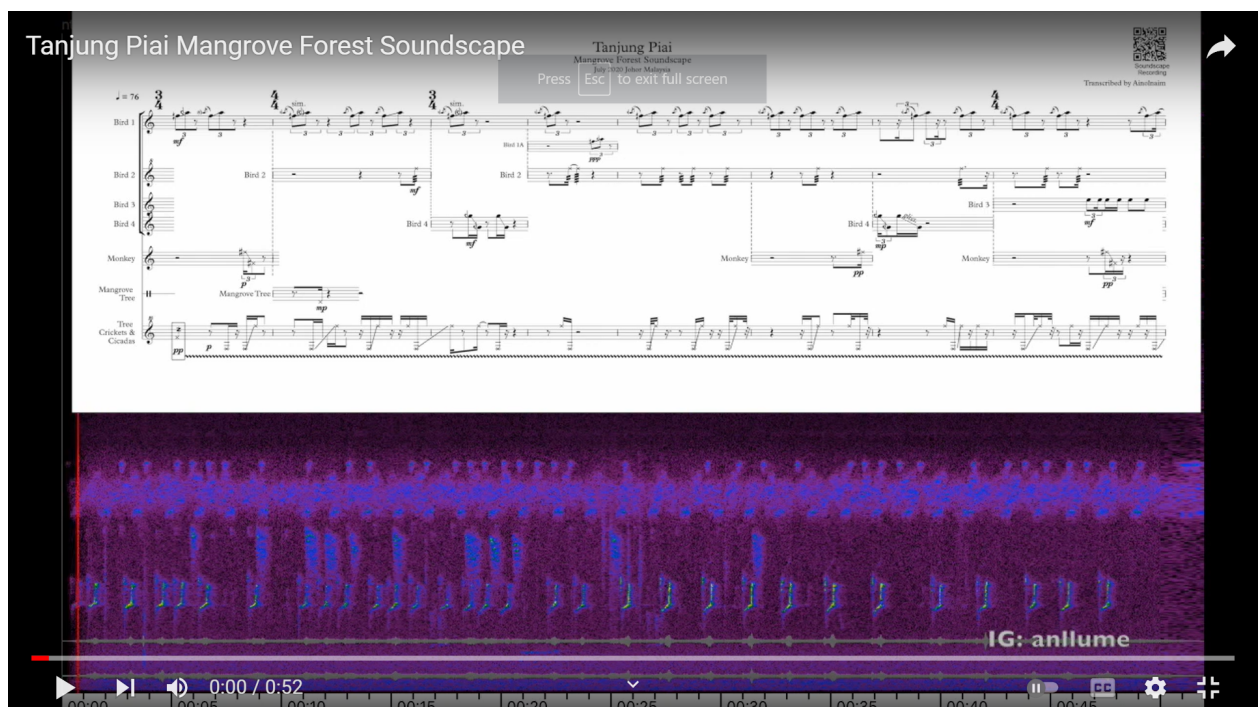


Figure 18 Tanjung Piai natural soundscape transcriptions, highlighting the Rufous-Winged Philentoma bird vocalisation that sounds ‘wheep-wheep’ and can only be found in Malay archipelago region.

<sup>75</sup> See below for technical discussion of the recording equipment and techniques.

<sup>76</sup> “Mudskippers Scream at Each Other - but How They Do It Is a Mystery.” Practical Fishkeeping, April 17, 2019. <https://www.practicalfishkeeping.co.uk/fishkeeping-news/mudskippers-scream-at-each-other-but-how-they-do-it-is-a-mystery/#:~:text=sound%20produced%20by%20two%20hard,their%20body%20as%20a%20transducer.>

<sup>77</sup> “Tale of the Devouring Rock.” Esplanade Offstage. Accessed January 10, 2020. <https://www.esplanade.com/offstage/arts/tale-of-the-devouring-rock>.

<sup>78</sup> Polgar, Gianluca, Stefano Malavasi, Giacomo Cipolatto, Vyrion Georgalas, Jennifer A. Clack, and Patrizia Torricelli. “Acoustic Communication at the Water’s Edge: Evolutionary Insights from a Mudskipper.” PLOS ONE. Public Library of Science. Accessed August 9, 2020. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0021434>.

Certain local mangrove seeds species are dispersed by water: when the mangrove fruit is ripe, it explodes and scatters the seeds, which float away on the sea.<sup>79</sup> These explosive events biophonically suggest the re-birth of nature, though their an organised, almost ritualistic quality. The sonic strangeness of the event, at the abrupt culmination of the ripening process, sits in the zone of tension between real and unreal sound worlds. I have also utilised an excerpt of anthrophony material of the 'unheard' Seletar people's voice, which I intend to symbolically present their culture and existence within the Pulau Kukup and Tanjung Piai mangrove forest ecosystem through my composition. The audio was extracted from a found video footage made by Norsila Ahmad in February 2021 and was used as a secondary soundscape material at the end of the piece.<sup>80</sup> The geophonic materials recorded underwater at Pulau Kukup encapsulated the 'ambient' tone of the aquatic space. These were subject to abstract transformation through audio synthesis techniques, shaped to suggest newly 'biomorphic' qualities and alluding to the idea of origin and evolution. The approach, methods, and techniques for materialising the thoughts and expressions of the *Ancestral Dance* soundworld are discussed further below

The Pulau Kukup and Tanjung Piai mangrove forests have high biodiversity, and provide habitats for many species of fish and important stopover sites for migratory waterbirds. They represent a rare or unique natural or near-natural wetland in this geographical region, with sub-systems such as the aquatic – mudskipper, music lobsters, fiddle crabs, tree-climbing crabs – and non-aquatic – snails, birds, cicadas, crickets – to list just a few of the inhabitants.<sup>81,82</sup> Accordingly, varied biophony with a broad spectral range including ultrasound may be encountered within the field recordings. In preparation for my field work, I studied existing Pulau Kukup and Tanjung Piai field recordings. These were mostly only available on the internet, as part of video documentaries (by amateurs and professionals). I examined these to determine the types of sound and their surrounding environments, and to identify the 'unheard' soundscapes.

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<sup>79</sup> Wati Haron, N., and R. Mat Taha. "Taxonomy, distribution and propagation of *Xylocarpus* species at Carey Island-the heritage Island of Malaysia." In *II International Conference on Landscape and Urban Horticulture 881*, pp. 997-1004. 2009. Accessed April 12, 2021. [https://www.actahort.org/books/881/881\\_166.htm](https://www.actahort.org/books/881/881_166.htm)

<sup>80</sup> Azizol, Ainolnaim. "Seletar People at Kampung Simpang Arang, Johor Malaysia." YouTube. YouTube, March 23, 2021. <https://www.youtube.com/watch?v=paLKTrUvk3w>.

<sup>81</sup> "Pulau Kukup - Johor National Parks." Accessed January 5, 2020. <https://johornationalparks.gov.my/pulau-kukup/>.

<sup>82</sup> "Tanjung Piai - Johor National Parks." Accessed January 5, 2020. <https://johornationalparks.gov.my/tanjung-piai/>.

Pulau Kukup and Tanjung Piai are part of Malaysia National Park, and permission to conduct the sound field recording was granted by the Johor National Parks Corporation Research and Conservation Department according to their opening days and visiting hours. The recording was made on a sunny breeze day approximately from 3.30 pm to 5.30 pm in Tanjung Piai on 15th June 2020 and in Pulau Kukup on 8 July 2020. Due to Covid-19 movement controls, the field recording sessions were kept short and adopted a 'capture and go' method, whereby the duration of each session at a specific walkable path was limited between 4 to 12 minutes.

Furthermore, three distinct microphone configurations were recorded simultaneously, using the Zoom H6 six-track portable recorder,<sup>83</sup> to allow for creative choices later in the compositional process: (1) stereo matched pair of Oktava MK012 cardioid condenser microphones, mounted either side of a baffle modeled on the 'Jecklin disk', serving as an A-B spaced array; (2) Zoom XYH-6 stereo microphone, as supplied with the H6 recorder, providing a coincident X-Y array; and (3) mono Rode NTG-4 shotgun microphone.<sup>84</sup> All the microphones were placed in-line and as near as possible to one another, to minimize filtering effects due to time-of-flight differences when different microphone feeds are mixed in post-production. The recordings were made at 44.1 kHz sample rate and 24-bit resolution.

The established literature on stereo microphone techniques (see for instance works by Bartlett,<sup>85</sup> and Plewa and Kleczkowski.<sup>86</sup>), confirmed by personal experience, suggests that an A-B array, using cardioids spaced 0.2 – 0.25 metres apart, provides a near 'natural-ambient' listening experience; but it lacks the directional clarity and precision provided by an X-Y coincident array. The difference is exaggerated if omnidirectional mics are used in the A-B array<sup>87</sup>; but localization is improved if spaced cardioids are combined with a baffle positioned between them. The system adopted is essentially a 'Head-Spaced Parallel Barrier Array'

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<sup>83</sup> Zoom. "H6 Audio Recorder." ZOOM. Accessed December 15, 2020. <https://zoomcorp.com/en/jp/handy-recorders/handheld-recorders/h6-audio-recorder/>.

<sup>84</sup> Microphones, RØDE. "NTG4: Versatile Shotgun Microphone." RØDE. Accessed May 18, 2020. <https://rode.com/en/microphones/shotgun/ntg4>.

<sup>85</sup> Bartlett, Bruce. *Stereo microphone techniques*. Boston, MA: Focal Press, 1991.

<sup>86</sup> Plewa, Magdalena, and Piotr Kleczkowski. "Choosing and configuring a stereo microphone technique based on localisation curves." *Archives of Acoustics* 36, no. 2 (2011): 347-363. Accessed March 20, 2020. [http://acoustics.ippt.gov.pl/index.php/aa/article/viewFile/183/pdf\\_225](http://acoustics.ippt.gov.pl/index.php/aa/article/viewFile/183/pdf_225)

<sup>87</sup> Christ Watson consistently favored the utilisation of omnidirectional microphones as his primary choice for microphone polar patterns in ambient spatial recording. Accessed April 23, 2020. <https://chriswatson.net/category/releases/>

(Figure 19).<sup>88</sup> Its recordings reproduce well on headphones for binaural listening, but are also adaptable for other production approaches. Recordings from the X-Y pair can be manipulated in stereo direction and width as part of controlling their contribution to perceived localization. The mono feed from the shotgun microphone provides enhanced focus to sound on its forward axis, which can be re-spatialised through panning techniques. The different microphone types also have slightly different frequency responses and ‘colour’, which provides for a different (but co-dependent) set of creative options. In practical terms in the field, the usual approaches were taken with windshields, shockmounts and handling, to minimize unwanted noise. Audio examples Audio 1(a), (b) and (c) illustrate a comparison between the different microphones for the same source scene.



*Figure 19 A-B stereo microphone recording setup using a home-made 'Jecklin disk' unit like between two matched cardioid microphones with wind shields.*

Audio 1 Tanjung Piai audio quality recording comparison from different microphone model and sound-field setting.

a. Zoom XYH-6 microphone:

[https://drive.google.com/file/d/1yBBP3QOgGOG5CIV1p7OkM\\_uTlbL9pb0t/view?usp=share\\_link](https://drive.google.com/file/d/1yBBP3QOgGOG5CIV1p7OkM_uTlbL9pb0t/view?usp=share_link)

b. Oktava MK012 microphone: [https://drive.google.com/file/d/1fWO3lBxzhQNG0nn\\_wU-G9MJEvaoBC7Qp/view?usp=sharing](https://drive.google.com/file/d/1fWO3lBxzhQNG0nn_wU-G9MJEvaoBC7Qp/view?usp=sharing)

c. NTG4 Shotgun microphone: [https://drive.google.com/file/d/1fWO3lBxzhQNG0nn\\_wU-G9MJEvaoBC7Qp/view?usp=sharing](https://drive.google.com/file/d/1fWO3lBxzhQNG0nn_wU-G9MJEvaoBC7Qp/view?usp=sharing)

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<sup>88</sup> “Stereo Microphone Arrays for Ambient Field Recording.” MinnesotaSoundscapes.com. Accessed April 23, 2020. [https://www.trackseventeen.com/mic\\_rigs.html](https://www.trackseventeen.com/mic_rigs.html).

Additionally, an omnidirectional hydrophone Aquarian Audio H2A,<sup>89</sup> is used to record the mangrove forest underwater soundscapes, which serve to explore the 'unheard' aquatic soundscapes and soniferous aquatic life. The single omnidirectional hydrophone audio signal is also captured with the Zoom H6 portable recorder. The aquatic soundscape recordings were made during high tide at Pulau Kukup island. The H2A hydrophone was submerged underwater below a walking path and placed near to the mangrove roots. Unwanted sounds picked up by the H2A from the vibrating cables, caused by the wind and by footsteps on the walkway, are reduced by cloth padding around the XL cables to prevent direct contact with the walking path floor; setting the XLR cable short enough to increase the cable's tension; and isolating the recording site approximately five meters away from possible human activities. Due to Covid-19 movement restrictions, there were no human visitors observed during the field recording activities in Pulau Kukup and Tanjung Piai, which helped to minimise the unwanted sound printed in the recordings.

As noted above, no mudskipper sounds were captured in my own field recordings, and instead these were derived from the work by Polgar et al. Polgar's team recorded the 'unheard' mudskipper stridulation using the H2A omnidirectional hydrophone dipped into shallow mud water near the mudskipper habitat space. The recording is made during the mudskippers out of water for a competitive feeding for bio-communication observation in a controlled environment water tank. To gain acoustical and musical insights from an acoustemology point of view, I again made a transcription in staff notation (Figure 20). From this analysis, a repeated set of steady low monotonous tones in regular pulsating beats, sometimes started with a glottal speech-like tone (uh-oh oh, oh, oh) and ended with an accented high tone cadence (Uh!) derived from a low pitch slide, is observed progressing similarly to a Gamelan music colotomic structure cycle (See "Mudskipper Vocalisation (Musical Insights).").<sup>90,91</sup> Nevertheless, the mudskipper stridulation is not audible in natural human listening conditions and I observed that

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<sup>89</sup> H2A hydrophone. Accessed January 10, 2020. <https://www.aquarianaudio.com/h2a-hydrophone.html>.

<sup>90</sup> Azizol, Ainolnaim. "Mudskipper Vocalisation (Musical Insights)." YouTube. YouTube, January 14, 2021. <https://www.youtube.com/watch?v=G1BbEdt15NM>.

<sup>91</sup> 'The term *colotomic* was coined by the ethnomusicologist Jaap Kunst, to describe rhythmic patterns used in gamelan music. In a colotomic structure, specific instruments (such as nipple gongs) mark the beginnings and ends of rhythmic cycles that run at different speeds, usually slowest for the bass instruments and fastest for the treble'. "Colotomic Structure." Oxford Reference. Accessed April 11, 2021. <https://www.oxfordreference.com/view/10.1093/acref/9780199578108.001.0001/acref-9780199578108-e-10153#:~:text=Term%20coined%20by%20the%20ethnomusicologist,and%20fastest%20for%20the%20treble>.



many field recordists were surprised to discover that the mudskipper is a soniferous being, i.e. able to produce sound, when I presented this soundscape artistic project in Acoustic Commons Creative Technical Workshop #2 January 2021.

Due to limited resources and Covid-19 pandemic restriction, the found sound of the Seletar Proto-Malay peoples' 'voices' is retrieved from a found video recording footage of the Seletar villagers interview session, delegated by personal associates in Johor, Malaysia. Based on the video recordings, the Seletar language (also known as Malayic language) is very similar to Malay language and may be counted as a dialect of that language through cultural assimilation.<sup>92</sup> However, the speaking population is unknown but is likely in the range of a few thousand. Not many in-depth and serious measures are observed in conserving the knowledge of the Seletar language and for these reasons, the language is considered severely endangered by UNESCO and listed for UNESCO Atlas of the World's Languages in Danger.<sup>93</sup>

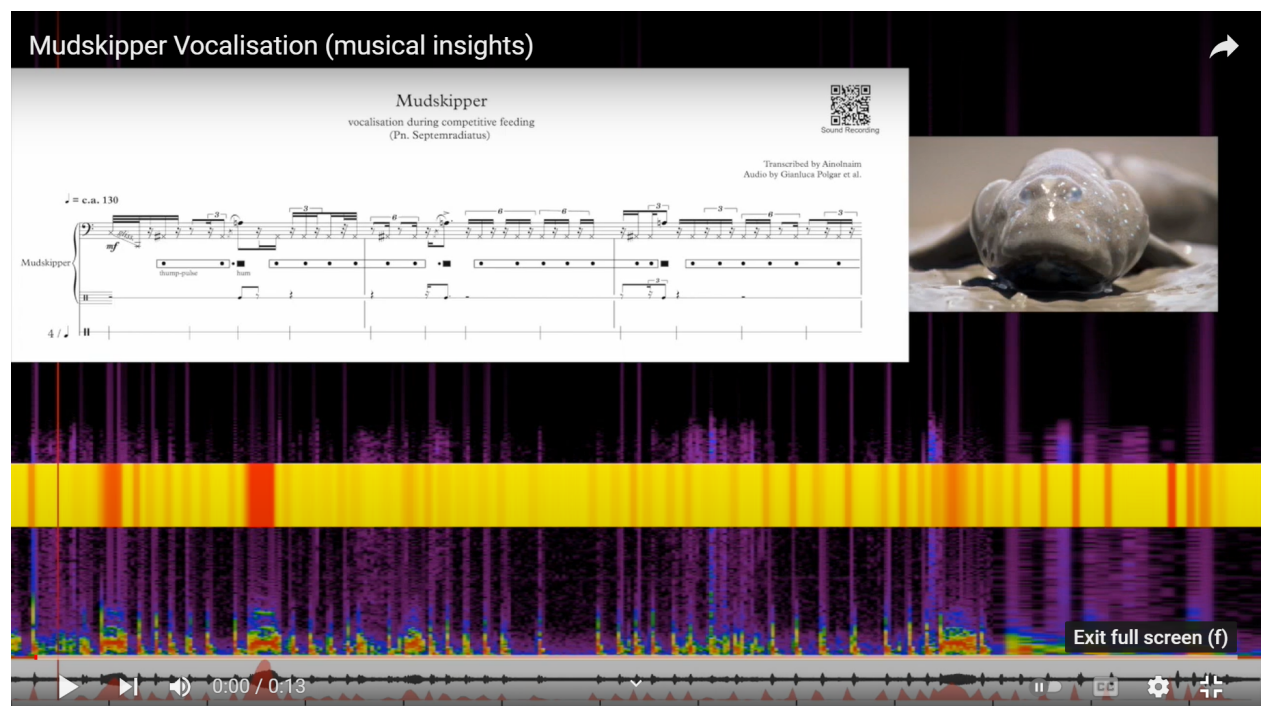


Figure 20 An audio transcription of Mudskipper (*Periophthalmodon Septemradiatus*) stridulation during competitive feeding.

<sup>92</sup> BENJAMIN, Geoffrey. "Singapore's 'other' Austronesian languages: What do we know?(Full version)." Accessed 12, July 2021.  
[https://www.academia.edu/download/64725747/Benjamin\\_Singapore\\_s\\_other\\_Austronesian\\_languages\\_full\\_version.pdf](https://www.academia.edu/download/64725747/Benjamin_Singapore_s_other_Austronesian_languages_full_version.pdf)

<sup>93</sup> Moseley, Christopher, ed. *Atlas of the World's Languages in Danger*. Unesco, 2010.

The collection of mangrove forest soundscapes field recordings are auditioned in stereo multi-tracks; 1) ZOOM0002\_LR audio file from X-Y Zoom XYH-6 microphone and; 2) ZOOM002\_Tr12 audio file from A-B Oktava MK012. Each stereo recordings is duplicated and layered below the original track with re-equalised settings; slightly different audio filter-sculpturing shapes from original tracks to highlights the biophonic frequencies printed across the multi-bands such as sounds from birds, cicadas, monkey and so on. The same approach is applied to the rest of the soundscapes with different audio filter-sculpturing shapes for different microphone models due to the individual microphone's frequency response characters. Again, the raw recordings and modified recordings are compared throughout the process to minimise the 'natural-original' soundscapes sonic discoloration aiming to preserve the authentic sounds of Seletar's environment while forging a profound, heartfelt connection between the Seletar individuals and their surroundings. This connection transcends mere physical or sensory encounters with a place; it strives to encompass the cultural, spiritual, and emotional essence of that location. To illustrate this concept, we can draw a parallel with Steven Feld's work, *Aesthetics as Iconicity of Style, or 'Lift-up-over Sounding': Getting into the Kaluli Groove*, which explores the Kaluli people of Papua New Guinea. The Kaluli people engage with their environment, traditions, and sense of place through highly structured musical activities that involve verbal, visual, and choreographic performances. These activities are explicitly linked by the Kaluli to the acoustic ecology of the rainforest, showcasing an interwoven relationship between aesthetics and ecological evolution.<sup>94</sup>

Similarly, the Seletar community shares a similar connection to their environment. They often mimic animal vocalizations using handcrafted bamboo whistles when hunting game deer, bringing nature and culture into harmony. Additionally, the Seletar express their bond with the natural world through their performance art known as *Tarian Ketam Bangkang* or the *Giant Mud Crab Dance*.<sup>95</sup> In this dance, the choreography mirrors the movements and gestures of the Giant Mud Crab, which inhabits the mangrove forest—a beautiful demonstration of how Seletar culture and the environment coalesce in their artistic expressions. Following this, the minimal mediated field recordings, works as a canvas or 'sonic key' throughout the

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<sup>94</sup> Feld, Steven. "Aesthetics as iconicity of style, or 'lift-up-over sounding': Getting into the Kaluli groove." *Yearbook for Traditional music* 20 (1988): 74-113. Accessed 15 May, 2023.

[https://sites.unimi.it/gpiana/dm13/feld/feld\\_aesthetics\\_as\\_iconicity\\_of\\_style.pdf](https://sites.unimi.it/gpiana/dm13/feld/feld_aesthetics_as_iconicity_of_style.pdf)

<sup>95</sup> "Tarian Orang Asli Seletar - ketam bangkang." Accessed November 6, 2023.

<https://pemetaanbudaya.jkkn.gov.my/culture/dis/213>.



composition and intertwined with the peculiar-unheard, energetic and random like of processed mangrove seeds explosion sound and birds call vocalisation into a demonic-chaotic character that reflects the *devouring rock* tales.

Capitalising on the qualities of the A-B recordings, the work is mixed for the immersive experience of binaural listening on headphones. It enables the soundscape to be poised between two perspectives, one the perception of ‘being there’, the other awareness of the constructed story-telling. I have also reworked the piece for octophonic loudspeaker reproduction, an alternative surround-sound format suitable for an audience to share together.

## Seed of Life (SoL) 2: *The Travellers*

### Electroacoustic Soundscape for Fixed Media (Binaural)

Composition Duration: 13 minutes 47 seconds

Composition Date: January 2021

*The Travelers* takes listeners on a journey to explore the aquatic-soundscape or ‘aquascape’ around the 12,565-acre (5,085-hectare) Lake Chini. Better known locally as Tasik Chini, it is the second largest freshwater lake in Peninsular Malaysia and is made up of a series of twelve smaller bodies of water. I recorded the aquascape sounds during a field trip in July 2020. Figure 21 shows the location. The recorded sounds were examined for any significant biophony and geophony soundprints. I applied a minimum of processing in the audio studio so as to maintain the ‘neutral’ original sound quality, in order to give the listeners a strong sense of presence and the ‘soul’ of the place.



Figure 21 Tasik Chini map by The Department of Wildlife and National Parks Pahang. Audio field-recordings were made at the Jetty.<sup>96</sup>

Elements of the aquascape with unique biophony or geophony were organised along the track timeline, and sometimes overlapped to produce a variety sound texture with a sense of natural

<sup>96</sup> (Image: Ainolnaim Azizol) Tasik Chini Map, 2020.

sound quality and promote a sense of remoteness, in which to evoke the core spirit of the Chini Lake history. The lake shore is inhabited by the Jakun branch (proto-Malay) of the Orang Asli aboriginal people, and the lake offers a serene and quiet setting rich with legends and mysteries. Some mysteries remain to this day: according to Orang Asli folklore, the lake is home to the Naga Seri Gumum (also known as ‘Malaysia's Loch Ness Monster’), a lake serpent or dragon; and at the bottom of the lake, there is thought to be an ancient sunken Khmer city.<sup>97,98</sup> This local cultural narrative contributes to the search for the location’s hidden aquascape and inspired the soundworld composed in *The Travellers*.

The ‘raw’ aquascape recordings were made with an underwater microphone, the Aquarius Hydrophone H2A, together with the Zoom H6 portable recorder. This semi-professional hydrophone microphone utilizes a piezoelectric transducer to detect sound pressure waves underwater. It is claimed by the manufacturer to have a usable frequency response from infrasonic to ultrasonic (approximately 10Hz to 100KHz), which theoretically offers a great sonic window for observing (and recording) the underwater lake ecosystem. The microphone has a standard omnidirectional polar pattern, and the underwater field recording was made in mono. Fine weather with a low wind speed permitted a degree of control in avoiding unwanted sound pickup, such as microphone cable vibration excited by the wind, cable handling noise, and water churning and flow turbulence caused by strong currents.

An abandoned concrete jetty near the lake shore was chosen as the hydrophone recording station, for its proximity to areas of aquatic plants such as lotus; facing an ait (small island) at the middle of the lake, formed by deposit of sediment in the water and aquatic weeds; and surrounded by mangrove forest land (Figure 22 & 23). The location was promising for retrieval of diverse and rich biophony sounds from nearby aquatic animals. As a benefit of the Covid-19 pandemic, no noise interference from human-machine activities such as tourist motorboats and forest clearance was observed during the recording session. The only human interaction came when we bumped into and made new friends with a local old couple from a nearby village, who were fishing for their dinner and for stock to dry and preserve, at another jetty (Figure 24).

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<sup>97</sup> Tasik Chini - rebirth of the sacred lotus. Accessed April 20, 2020. <https://www.ecologyasia.com/html-loc/tasik-chini.htm>.

<sup>98</sup> Peter van der Helm: Orang asli, Tasik Chini, map of Tasik Chini and other facts. Accessed December 2, 2021. <https://ppw.kuleuven.be/apps/research/petervanderhelm/srigumum/doc/tasikchini.html>.



Figure 22 Tasik Chini view from the concrete jetty as the hydrophone recording station.



Figure 23 Small ait in the middle of the Tasik Chini lake stream across from the concrete jetty with dense and tall Screwpine (*Pandanus artocarpus*, locally known as Mengkuang) growing on the ait, and Indian Lotus plant (*Nelumbo nucifera*) covering the Tasik Chini shore.<sup>97</sup>

<sup>99</sup> “JPNP Akan Terus Tanam Pokok Di Tasik Chini - Wacana.” Accessed April 20, 2020. <https://wacana.my/jpnp-akan-terus-tanam-pokok-di-tasik-chini/>.





*Figure 24 With my wife saying hello to an elderly couple from a nearby village, exchanging fishing skills and talking about ourselves and what each of us were doing here in the Tasik Chini during the Covid-19 pandemic lockdown.*

The depth of the hydrophone was determined by initially submerging the microphone capsule to the lake floor, and reading its depth from the cable which is prepared with tape markings at 0.2 meter spacing. This enables the hydrophone to be submerged at one-third to one-half of the depth from the surface, for optimum omnidirectional underwater acoustic-space coverage (Figure 25) and to minimise the sound above the water surface from being picked up and transmitted by the submerged cable.<sup>100</sup> Moreover, the on-surface hydrophone cable was damped with the body of the Zoom audio recorder to reduce transmission of cable vibrations from handling, floor vibration and wind turbulence. These pragmatic solutions were in response to hydrophone recording tests I made before going out in the field. I have subsequently developed a proof-of-principle prototype of a cable-noise-free hydrophone rig. It is made out of pipe insulation foam, approximately 0.2m in outer diameter, securely clamped with galvanised metal hose clips around the cable between a self-made buoy and the submerged cable, and it acts like a damper. It is combined with a 3-D printed water-stream turbulence damper cage, to reduce unwanted resonance noises reaching the hydrophone microphone capsule. This is inspired by the hydrophone protection cage from Cetacean Research Technology (Figure 26).<sup>101</sup> This method was applied in a hydrophone recording session of the

<sup>100</sup> This configuration is documented for hydrophone use in ocean conditions, e.g. in Richardson, W. John, Charles R. Greene Jr, Charles I. Malme, and Denis H. Thomson. *Marine mammals and noise*. Academic press, 2013. But I found it also to be a good rule of thumb in shallow-water conditions.

<sup>101</sup> Joseph R. Olson - Cetacean Research Technology with assistance from Diane Allen, Artemis Computing. Cetacean Research Technology. Accessed April 21, 2020. <https://www.cetaceanresearch.com/accessories/hydrophone-protection-cage.html>.

acquascape around Spike Island, recorded for the Building Instruments research project and a sound walk produced in conjunction with Bristol Open Doors Festival 2021.

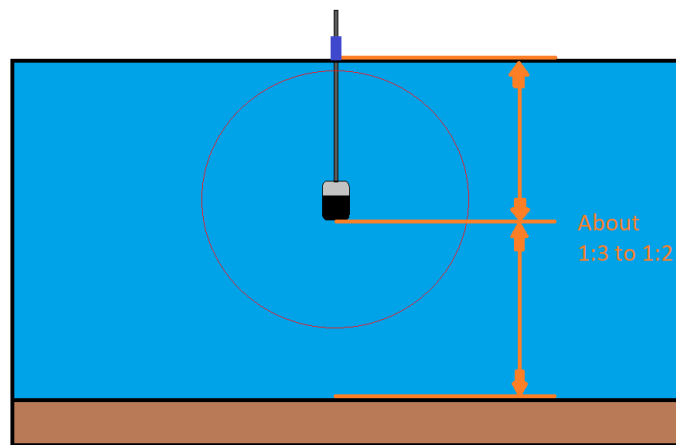


Figure 25 Optimum underwater aquascape recording at the right hydrophone microphone capsule depth positioning.



Figure 26 Pilot test of a self-made hydrophone damper-buoy rig and hydrophone microphone capsule turbulence flow damper, around Spike Island river, Bristol UK.

Sound propagates much faster in dense and elastic mediums such as water (around four times faster than in air).<sup>102</sup> This affects aural perception of directionality, from reductions in both interaural time difference (ITD) and interaural level difference (ILD).<sup>103</sup> Several researchers have proposed that we perceive sounds underwater via bone conduction (Figure 27), and studies have been carried out in understanding the perception of sounds underwater including acoustic spatial cues, for instance in emulating the way we perceive sounds in the air through

<sup>102</sup> Zach Poff. Accessed April 20, 2020. <https://www.zachpoff.com/resources/choosing-a-hydrophone-for-field-recording/>.

<sup>103</sup> Elert, Glenn. "Intensity." The Physics Hypertextbook. hypertextbook. Accessed April 20, 2020. <https://physics.info/intensity/>.

hydrophone soundfield technology.<sup>104</sup> A hydrophone array of this complexity was not practical for my fieldwork, and in *The Travellers* a stereo image was artificially created from the mono hydrophone audio recordings (Figure 28). It gives a sense of natural spatial gestures that imitate the listener's 'point of hearing' in relation to what they might see visually through an aquascope (Figure 29). The mono hydrophone recording was panned to a stereo position, and then this repeated for multiple selections from the recording, each panned to a different position. These were carefully layered across multiple tracks, with slow fade-in and fade-out slopes, to create the sense of a 'cruising view' across multiple underwater scenes in the aquascope, as if seen at different points in the lake during a boat cruise.

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<sup>104</sup> Hydrophone arrays for underwater acoustic localisation and 3-D sensing have been researched for instance by Bountourakis, Vasileios, Leo McCormack, and Ville Pulkki. "Spatial post-filter for linear hydrophone arrays with applications to underwater source localisation." *JASA Express Letters* 2, no. 8 (2022): 084802. Accessed April 21, 2020. <https://asa.scitation.org/doi/abs/10.1121/10.0013753>. But such a system was impractical for my own field recordings.

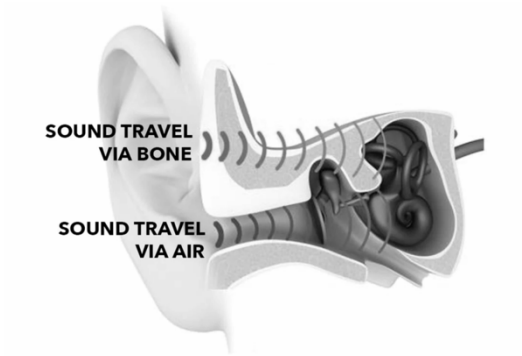
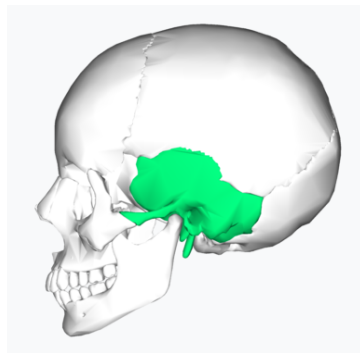


Figure 27 Sound wave propagation transmitted through temporal bones to ear-bone (top).<sup>105,106</sup>



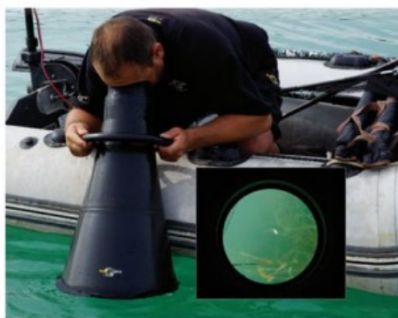
Figure 28 Ambient 5.1 Hydrophone Rig system for surround underwater sound recording (bottom).<sup>107</sup>

<sup>105</sup> (Image) “Category:Human Temporal Bones.” Wikimedia Commons. Accessed April 21, 2020. [https://commons.wikimedia.org/wiki/Category:Human\\_temporal\\_bones](https://commons.wikimedia.org/wiki/Category:Human_temporal_bones).

<sup>106</sup> (Image: Colin Toh). “Are Bone Conduction Headphones Safe?” Headphonesty, April 21, 2020. <https://www.headphonesty.com/2021/03/bone-conduction-headphones-safe/>.

<sup>107</sup> (Image) “Directivity Sphere Web - Download.ambient.de.” Accessed April 21, 2020. [https://download.ambient.de/Sonar%20Surround/Datenblatt\\_DS.pdf](https://download.ambient.de/Sonar%20Surround/Datenblatt_DS.pdf).





*Figure 29 Artificial stereo image audio track from a mono audio of hydrophone recording in multitracks, emulating stereoscopic vision of an aquascope with multiple cruise perspective point of view concept (left).<sup>108</sup>*

I had been aiming to make a nocturnal recording of this lake aquascope, in the hope of capturing a more vibrant biophony and geophony; but due to safety concerns in the remote area and travelling without a guide, I decided to end the recording session two hours before sunset, just enough time for us to regain the main road and head towards a nearby small town. During the final hour of the recording session, several distinctive toad vocalisation sounds – a gradual glissando croaking sound from mid-soft to low-loud tone – and cicada biomechanical sounds – a prolonged high hissing-rattling reminiscent of maracas – were captured by the hydrophone. These had come across from the ait and the opposite shore, traveling about 800-600 metres to the jetty.

To end the recording session, I took the opportunity to capture the sounds of the environment above the surface of the lake for several minutes. This included the sound of the wind in the leaves of fan-palm trees, which grew around the foot of the hill near the jetty (Figure 30). The sounds were recorded using the Zoom Recorder, with an X-Y stereo microphone in a windshield blimp, fitted with its fur cover, and with the microphone capsule pointed away from the wind direction to reduce the amount of rumbling distortion caused by the direct impact of wind on the microphone diaphragm.

<sup>108</sup> (Image) “Aquascope Carp Spirit Water Scan.” Carptour. Accessed April 24, 2020. <https://www.carptour.fr/en/tools-and-accessories/1121-aquascope-carp-spirit-water-scan-3000000004289.html>.



Figure 30 Site-specific geophony source recording of rustling and wavering leaves from several bunch of fan-palm trees species (top left) including *Pinanga disticha* (top right) and *Johannesteijsmannia magnifica* (bottom).<sup>109</sup>

In my mobile audio studio, I sliced and catalogued the recorded soundscapes according to soundscape elements (biophony-geophony) and relative tone register (high-mid-low), and made notes on the cultural narrative and types of biophony or geophony. For example: 'TasikChini\_June2020>Raw>Biophony>High (note: Various fresh water fish species vocalisations were observed indicates healthy and sustainable ecosystem. Fishing is one of the main forest hunting practice of the Jakun indigenous community<sup>110</sup>.' Beginning the

<sup>109</sup> (Image - bottom) Admin. Rimbun dahan, May 28, 1999. Accessed December 12, 2021. <https://rimbundahan.org/palms/>.

<sup>110</sup> Omar, Mustaffa, Zanisah Man, and Ishak Yussof. "STRATEGI TRADISIONAL KOMUNITI JAKUN TASIK CHINI, PAHANG MENGURUS SUMBER SEMULAJADI SECARA LESTARI (The Jakun

composition itself, I started with aquascape recordings still in their ‘aquascope’ perspective (i.e. the constructed stereoscopic vision). In this introductory part, small gestures of ‘plob’ and ‘creak’ sounds sparsely start to emerge behind the water sounds of Tasik Chini, with their (figuratively) murky brownish-green tints underwater, and the sonic canvas of spray-bubble-fizzle caused by windblown ripples on the water surface.

The ‘plob’ and ‘creak’ sounds in my hydrophone recordings have a very short individual duration and are sparse, with silent gaps. This has similar characteristics to several fish vocalisation and biomechanical sounds recorded in the kelp beds off La Jolla Shores, California, by Ana Širović, an oceanographer at the Marine Bioacoustics Lab at Scripps Institution of Oceanography, who is trying to find out what sounds fish make.<sup>111</sup> Annotating the Tasik Chini freshwater habitat based on bioacoustics has never been done. However, the similarity of sound suggests fish may also be the sound-makers in Tasik Chini. Dominant fish species in the lake include Lady Carp, Beardless Barb Carp, and Bronze Featherback,<sup>112</sup> and it is tempting – but speculative – to suggest these may be the sources of my captured sounds

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Traditional Strategy in Managing Natural Resource Sustainably Surrounding Tasik Chini Basin, Pahang)." *e-BANGI* 6, no. 2 (2011): 239. Accessed December 12, 2021. <https://core.ac.uk/download/pdf/11490640.pdf>

<sup>111</sup> Trageser, Claire. "What Sound Does a Fish Make? Scripps Scientist Wants to Know." KPBS Public Media, March 7, 2018. Accessed April 23, 2019. <https://www.kpbs.org/news/evening-edition/2018/03/07/what-sound-does-fish-make-scripps-scientist-wants>.

<sup>112</sup> Kutty, Ahmad Abas, Mohd Shuhaimi Othman, Mohd Barzani Ghasim, and Sambau Dugat. "Kepelbagaian Ikan Di Tasik Chini, Pahang, Malaysia." *Sains Malaysiana*, May 31, 2019. Accessed June 10, 2021. <http://mymedr.afpm.org.my/publications/70433>

A variety of ringing definite-pitch sounds were captured by the hydrophone, which turned out to be caused by resonances of the microphone capsule, excited by the strong turbulence from the high underwater current. These soothing ringing sounds were included in the work. They have a unique whispering voice-like quality and ethereal tone. In juxtaposition with the sense of place that is shared in the Lake Chini aquascape, they connect me to a personal memory of a very different sound and place: the long whistling howling tone that I always heard in the 11th floor meeting room building at my old workplace. The bulging yet soothing ringing sound of this hydrophone is found in a series of location recordings around the lake, with a slightly varying pitch quality. Some of these sounds have been put through layers of audio process, such as band and notch filters and the subtle use of saturation, to emphasize the water current texture articulation and increase the energy of the sound to help it stand out from the aquascape backdrop.

These prolonged sounds also have a natural downwards glissando from high to low tone, resulting from varying energy in the water current, as if the water figuratively migrates from high to low places. I was intrigued by this subtle, natural whisper-silky tone; and my sense of intrigue reminded me of a figure in Greek mythology, the Sirens, dangerous creatures resembling the combination of woman and bird, who enticed sailors to shipwreck on their island's rocky coast with their tempting melody and their song's ability to enchant the winds. Tasik Chini does not share the same mythology, yet the spirit of belief is still alive, among the community today, for the mythical sea serpent creature Tasik Chini, Naga Seri Gumum.

These sounds are accordingly treated rather as human 'voices', using vocal editing techniques such as fade in and out including stitched cross-fade, and sometimes overlapped with each other forming a harmonisation as if by a chorus of voices in a dyad harmonic over a short period of time. The use of dyads creates vertical harmonic images, and shifts aural focus onto abstract qualities such as intervallic stress and implied consonance and dissonance. This constructed but simple pitch space gives listeners of varied musical experience the opportunity

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<sup>113</sup> Reference summary - baird, I.G., V. Inthaphaisy, P. Kisouvannalath, B. Phylavanh and B. Mounsouphom, 1999. Accessed December 12, 2021. <https://fishbase.org/references/FBRefSummary.php?ID=30857>.

<sup>114</sup> Projects, Contributors to Wikimedia. Wikimedia Commons. Wikimedia Foundation, Inc. Accessed December 12, 2021. [https://commons.wikimedia.org/wiki/Main\\_Page](https://commons.wikimedia.org/wiki/Main_Page).

<sup>115</sup> "File:Notopterus notopterus46.Jpg." Wikimedia Commons. Accessed December 12, 2021. <https://commons.wikimedia.org/w/index.php?curid=18240703>.

to appreciate the uniqueness of the primitive, natural-origin harmonies. *The Travellers* soundscape comes to the end of its journey by taking the listener back to dry land, through the sounds of the bush forest by the lake and interspersed with the sounds of the wind blowing tree leaves, preparing or ‘tuning’ the listener for the next composition in the cycle, *Seed of Life* (SoL) 3: *Black Forest*.

## Seed of Life (SoL) 3: *Black Forest*

### Percussions and Live Electronics (Stereo)

Composition Duration: 7 minutes 27 seconds

Composition Date: Jan 2021 & April 2022

*Seed of Life (SoL) 3: Black Forest* is a live electroacoustic soundscape work for one percussion musician that reached its present form in April 2022. Originally, this composition was written for four percussion musicians playing traditional Korean percussion instruments and drums for the SORI reading session ‘Percussion 2021’, held online via zoom video performance.<sup>116</sup> During the reading session, the live electroacoustic soundscape part could not be realised due to technical constraints of the virtual venue. In 2022, the situation of the Covid pandemic in the UK improved, normal life gradually returned, and there were various social activities including concert performances which became active again. The biennial Bristol New Music (BNM) Festival returned and was held around 5-8 May 2022 in collaboration with the Department of Music, University of Bristol (UoB) UK.

The festival programme included a fringe concert organized by the postgraduate composition students of the UoB music department. The concert took a theme of time and distance, where the elements of spatiality are highlighted in new music performances. This gave me the opportunity to realize the live electroacoustic soundscape of *Black Forest*. Given a limited budget and volunteer musicians, I was only able to have one percussionist to play the piece. Therefore, I processed and compressed the texture of the original version of the composition and replaced the main traditional Korean percussion instruments with Western percussion instruments and general world music percussion instruments that are available in the UoB music department's percussion room such as Djembe (high tone) and Conga (low tone) that can mimic the sound quality of the traditional Korean percussion instrument Janggu, as well as Temple blocks and Wood blocks to replace the traditional Korean percussion instrument Moktak.<sup>117,118</sup>

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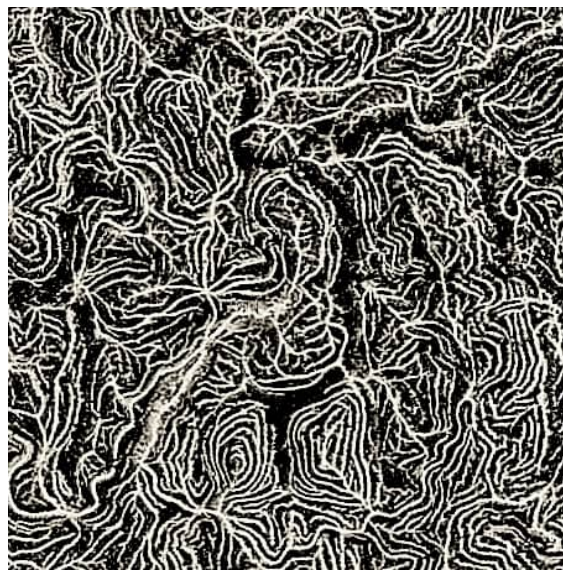
<sup>116</sup> “Sori Percussion.” SORI PERCUSSION. Accessed February 23, 2020. <https://www.sori-percussion.com/>.

<sup>117</sup> Ko Kyung Ja, Ji-Youn Kim, and Ji Yun Oh. "The effects of Korean double-headed drum janggu rhythm on the life forces for the elderly made by In-seok Seo." *CELLMED* 8, no. 1 (2018): 3-1. Accessed June 12, 2020. <https://www.koreascience.or.kr/article/JAKO201815661857030.page>

<sup>118</sup> Hartenberger, Russell, ed. *The Cambridge companion to percussion*. Cambridge University Press, 2016.



The musical inspiration of this composition is based on the theme and objective of my research which is to mediate the hidden and unheard Malaysian natural soundscape in reflection of my self-culture, and of myself as a modern Malay who follows current global issues. While I was doing literature and archive research to find connections of the natural soundscape to Malay culture and its Proto-Malay origin, I had read several online newspaper clippings about the destruction of natural ecosystems, and of the settlements of the Proto-Malay community in Tasik Chini, Pahang, for the purpose of logging and oil palm plantations.<sup>119</sup> Although it is stated in the newspaper clipping that the local government agencies restricted any logging activities and clearing of natural forest during the Covid-19 Pandemic period, the latest satellite images included in the newspaper article show otherwise. One of the satellite images shows the contour lines of a hill (Figure 31), which used to be filled with the greenery of the forest but has now been cleared and turned into the color of the ground. The image of the hill's contour lines became my main source of inspiration and motivation in writing this work.



*Figure 31 Black and white rendition of Tasik Chini hill deforestation satellite image.<sup>120</sup>*

<sup>119</sup> Ashencaen Crabtree, Sara, and Jonathan Parker. "Report on Ethnographic Work at Tasik Chini." (2014). Accessed June 12, 2020.  
<http://eprints.bournemouth.ac.uk/21438/1/Report%20on%20Ethnographic%20Work%20at%20Tasik%20Chini%204th%20April%20copy.pdf>

<sup>120</sup> (Image) "Log into Facebook." Facebook. Accessed April 27, 2023.  
[https://www.facebook.com/PersatuanAktivisSahabatAlam/posts/tasik-chini-yg-diiktiraf-rizab-biosfera-oleh-unesco-sesungguhnya-kaya-dengan-kha/1203981573071456/?locale=es\\_LA](https://www.facebook.com/PersatuanAktivisSahabatAlam/posts/tasik-chini-yg-diiktiraf-rizab-biosfera-oleh-unesco-sesungguhnya-kaya-dengan-kha/1203981573071456/?locale=es_LA).

Relating these continuous contour lines with new music for percussion, the keyword ‘flux’ and the work of John Cage have inspired me. Cage exerted a particularly strong influence on the Fluxus movement in music, and I referred to several of his percussion works such as *Child of Tree* (1975) and *Branches* (1976).<sup>121,122</sup> As a proponent of chance music that operates in a state of flux, Cage felt that the idea of an organic, natural music with no man-made musical instruments was a powerful and persuasive concept.<sup>123,124,125</sup> In my work, however, I made a connection to organic and natural soundworld concepts through the quasi-aleatoric flow of sound events and percussion rhythms in the middle of the work. Furthermore, to make this work easier for musicians to practice and perform, I designed the formal structure to reflect the common Western classical Rondo form. In *Black Forest*, this is Intro(A)-B-A-C-A, with episodes contrasting in terms of instrumentation, rhythmic motifs, tempo modulation, textures, spatiality, and soundscape quality, as well as in behaviours of the live electronics.

I focused on creating a percussion soundworld that has a natural and organic quality, that flows and has a sense of spontaneity and unpredictability, interwoven within the canvas of the Malaysian soundscapes.<sup>126</sup> As a starting point, the soundworld alludes to the wind blowing on leaves that are covered in dew drops, which then drip on the rocks and seep into the ground producing subtle dripping sounds. This is metaphorically expressed through the sound of temple blocks and woodblocks. Later, in the revised version of the composition for one percussionist, I had introduced the sound of wind, air, sky and clouds that were expressed through textural materials on the suspended cymbal; the suspended cymbal is bowed with a double-bass bow, while the gong is played with soft mallet and friction ball. Heterophonic gestures of woodblocks are repeated throughout this work, however, the difference in sound

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<sup>121</sup> Husarik, Stephen. "John cage and lejaren hiller: Hpschd, 1969." *American Music* (1983): 1-21. Accessed June 15, 2020. <https://www.jstor.org/stable/3051496>.

<sup>122</sup> John Cage Complete Works. Accessed May 11, 2020. [https://johncage.org/pp/John-Cage-Work-Detail.cfm?work\\_ID=40](https://johncage.org/pp/John-Cage-Work-Detail.cfm?work_ID=40).

<sup>123</sup> Perloff, Marjorie, and Charles Junkerman, eds. *John Cage: Composed in America*. University of Chicago Press, 1994.

<sup>124</sup> "Fluxus Movement Overview." The Art Story. Accessed May 11, 2020. <https://www.theartstory.org/movement/fluxus/>.

<sup>125</sup> Wolf, Ella Lu. "Silence, sound and noise in the work of John Cage and its effects on the pre-Fluxus Avant-Garde in post-war Germany." (2015). Accessed May 15, 2020. [https://www.academia.edu/download/46887282/Ella\\_Lu\\_Wolf\\_silence\\_sound\\_and\\_noise.pdf](https://www.academia.edu/download/46887282/Ella_Lu_Wolf_silence_sound_and_noise.pdf)

<sup>126</sup> Flattely, Frederick William. "Rhythm in nature." *Science Progress in the Twentieth Century (1919-1933)* 14, no. 55 (1920): 418-426. Accessed May 15, 2020. <https://www.jstor.org/stable/43431585>



quality based on playing style and the instrument quality chosen by the player produces its own sound identity.

The woodblocks motif and its variations are formed by referring to the leaping gestural motif in the Rufous-Winged Philentoma bird vocalisation, which I extracted from the audio recording of the Tanjung-Piai mangrove forest soundscape used in *Seed of Life (SoL) 1: Ancestral Dance*. The motif is varied into a seesaw-like gesture with an interlocking quality between triplets and duplets forming a poly-rhythm, and this figure is constantly repeated and sometimes changed slightly to mimic the natural rhythm of the bird call, which is sometimes chaotic and sometimes orderly (see bar 5, beat 3-4). I found it artificial to seek a constructed ‘harmony’, so I did not use any mathematical metric formula, instead relying on intuitive through-composition. However, the phrase is sometime repeated completely and sometimes only in part, a half or a quarter of its length. This helps listeners to recall and be part of the musical event, and makes it easier for the musicians to practice and perform the piece.

The drum sound is treated as a metaphorical tone of the deforested land and soil where the pitch bend, reveals the movement and change of the forest soil landscape that is altering slowly and silently without the knowledge of the public. This pitch-bend technique is used in traditions such as African Yoruba drumming and Indian Urumi, and is commonly known as ‘talking drum’. The playing tries to mimic the rhythm quality, tone and prosody of human speech by changing the pitch of the drum through a direct change in the tension of the drum skins.<sup>127</sup> In *Black Forest*, the rhythm of this drum sound is diffused around the surround speakers to metaphorically express the density and mass of the land. It is moved spatially in a free improvised rhythm (with fast panning speeds and variation in the number of active loudspeakers) through Ableton Live software.<sup>128</sup>

The piece composed with a five part rondo Form; Intro(A)-B-A-C-A (in the score, this can be seen as intro>(A), A>B, B>A, A>C, C>A). The B episode begins at bar 33 and has a rhythmic

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<sup>127</sup> Akinbo, Samuel Kayode. "The Language of Gangan, A Yorùbá Talking Drum." *Frontiers in Communication* 6 (2021): 650382. Accessed May 12, 2020.  
<https://www.frontiersin.org/articles/10.3389/fcomm.2021.650382/full>.

<sup>128</sup> Settel, Zack, Nicolas Bouillot, and Michal Seta. "Volumetric approach to sound design and composition using SATIE: a high-density 3D audio scene rendering environment for large multi-channel loudspeaker configurations." In *15th Biennial Symposium on Arts and Technology, Ammerman Center for Arts and Technology at Connecticut College, New London*. 2016. Accessed May 8, 2020.  
<https://nicolasbouillot.net/papers/2016-Volumetric-SATIE-Connecticut.pdf>.

texture and sound quality that contrasts with part A. Preceding part A, there is a 17 bar-long intro section that introduces the main rhythm and sound motifs that will be processed and varied in the following parts. The main soundworld of part B emphasizes crotales and the quality of different soundscape textures. At the end of part B, I have introduced two bars (bars 41 and 43) that have ghost notes. This was inspired by Georges Aperghis' *Retrouvailles* (2013) — a work for two percussionists which has a theatrical element with a ghost note playing gesture.<sup>129,130</sup> This gesture metaphorically reflects the hidden hands that do the dirty work of clearing and destroying the forests around the Black Forest area.

Following this, a rhythmic improvisation section (bars 44-48) is quasi-aleatoric with an 'event score' approach. I have listed the specific musical instruments that need to be used with descriptive antiphonal call-response texture between percussion and live electronics. A fixed soundscape plays throughout this segment, becoming a canvas and reference point for the musicians, even though the live materials could be performed in potentially infinite ways. The aleatoric technique in these five bars further emphasizes the idea of a balance between chaotic and orderly natural rhythms, which symbolises a sense of 'being lost' and having uncertain direction. The acoustic instrument is also given spatial motion, where I have instructed the percussionist to move freely and randomly around the stage. It brings the physical hall into relationship with the sound, varying through time, an experience for both listeners and performers. This idea was sparked by the satellite image of a continuous and undulating hill contour line (Figure 31). It resonates with the flux concept, whereby musicians used a range of available musical materials, and a 'do-it-yourself' and 'let it flow' attitude to creative activity, often staging random and unpredictable performance outcomes.<sup>131</sup>

In the C episode of *Black Forest*, I was inspired by a piece that was performed by my colleague Max Reifer for the Malaysian Composers Series Concert 2019 at KL-Performing Arts Centre, Malaysia, entitled *Clash Music* and composed by Nicolaus A. Huber for the unique sound

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<sup>129</sup> "Video: 'Retrouvailles' (2013) - a Performance for 2 Percussionists by Georges Aperghis." YouTube. YouTube, January 21, 2016. Accessed May 5, 2020. [https://www.youtube.com/watch?v=0-3LFmAf\\_DM](https://www.youtube.com/watch?v=0-3LFmAf_DM).

<sup>130</sup> Theater percussion: Developing a twenty-first-century genre through the connection of visual, dramatic, and percussive arts. University of Northern Colorado. Accessed May 5, 2020. <https://search.proquest.com/openview/72ec4e53611208d51c2dd2e0d5eafd7b/1?pq-origsite=gscholar&cbl=18750>.

<sup>131</sup> Tate. "Fluxus." Tate. Accessed April 27, 2023. <https://www.tate.org.uk/art/art-terms/f/fluxus#:~:text=The%20Latin%20word%20Fluxus%20means,early%20twentieth%20century%20art%20movement>.

colour from the hand cymbal playing technique.<sup>132,133</sup> Here, I literally quote this technique to metaphorically express images of small sounds, floating around in the air like a small group of clouds, that seem to merge and form a bigger cloud of sound, with a sense of shamanistic summoning of rain. The soundscape moves more, changes and dominates the percussion. In part D, the sound of grain-rain in the synthesised material symbolically gives new hope and re-birth to the Black Forest. The idea of cultural image-sounds of shamanistic rituals to summon rain is not a foreign activity for the ancient, traditional and modern Malay community. In fact, those Malay who are Muslims also perform prayers to ask God for rain to fall or reject all unwanted disasters. In this part of the piece, I have avoided literal use of symbolic sound elements from Islamic religious culture, but rather have tried to invoke the ritual cultural activities that are in common or similar around the world. I respect the sensitivity of the religious culture in my country and do not want to create any conflict or misunderstanding.

The original idea of this composition was to use live streaming of Malaysian soundscapes, the approach developed in *Seed of Life* (SoL) 5: *Nada Sfera*. The idea of using a live streamed soundscape is to create a spontaneous and unexpected natural sound environment for the percussionist to interact with. Since the *Nada Sfera* project is functioning as a pilot, and a demo version was created and broadcasted in the United Kingdom during the Covid-19 pandemic, the soundscape sound sources for *Black Forest* at the BNM concert performance were pre-recorded. The source is a mixture of hidden and unheard Malaysian soundscapes from the natural wetland and the natural dryland, specifically from the dry landscape of Tanjung-Piai mangrove forest in Johor and Kepong reserved forest in Selangor, the aquascape of Tasik Chini Lake in Pahang, and the seascape of Rantau Abang turtle sanctuary beach in Terengganu. This mix of soundscapes symbolise the synergy of the earth's natural ecosystems that are closely related and influence each other, reflecting the *Black Forest* sound world.

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<sup>132</sup> Brindle, Reginald Smith. *Contemporary percussion*. Vol. 26. London; Toronto: Oxford University Press, 1970.

<sup>133</sup> "Lockdown Tapes #19 - Nicolaus A. Huber: Clash Music - Solo Für Ein Beckenpaar (1987)." YouTube. YouTube, June 11, 2020. Accessed June 11, 2020. <https://www.youtube.com/watch?v=Ttc4mSS7aMY&pp=ygUaY2xhc2ggXVzaWMgbmljaG9sYXMGY2xhdXM%3D>.

## Seed of Life (SoL) 4: Rest and Shelter

### Electroacoustic Soundscape for Fixed Media (Binaural)

Composition Duration: 11 minutes 27 seconds

Composition Date: May 2021

This electroacoustic soundscape composition conjures for the listener the unheard soundworld that may have existed in prehistoric times in one of Malaysia's oldest and largest limestone caves, Gua Tempurung, which consists of five breathtaking natural chambers and fine underground rivers. The cave may have a long history shared by ancient prehistoric civilizations and other living beings, by serving as a temporary or permanent shelter to carry out their daily life activities including ritual, meditation and belief practices. Tambun Cave in Perak, Malaysia which is located about 30 kilometres from Tempurung Cave, Perak has remnants of prehistoric painting motifs on the cave walls.<sup>134</sup> *Rest and Shelter* offers listeners the experience of a strong sense and spirit of place, through a state of rest and meditateness, induced by the composed sounds derived from in-situ field recordings and found sound samples. The latter suggest small natural creatures, timid or random in motion.

This work echoes my Ph.D. research question: what biophony and geophony sound sources in Malaysia are still hidden and have never been revealed, heard or reached by the public, especially the local community? After examining the list of Malaysia natural landscape locations that are associated with the history of ancient and modern Malay civilization, that may have unique biophony and geophony sound materials in reflecting their stories, I made a preliminary search for sound recordings from cave locations, through online archival research such as on the website of the National Archives, Youtube, Soundcloud, British Library Sound Archive, Library of Congress and others. From this research, conducted between 2018 and 2020, I discovered that there were no soundscape recordings of the Malaysian caves available in the public domain. This led me to return to a limestone cave soundscape recording that I had made in February 2019, at Gua Tempurung, National Park of Perak (Figure 32), before leaving Malaysia for my PhD study in the United Kingdom. The recording was made for the purpose

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<sup>134</sup> Tan, Noel Hidalgo, and Stephen Chia. "Current Research on the Rock Art at Gua Tambun, Perak, Malaysia." *Bulletin of the Indo-Pacific Prehistory Association* 31 (2011): 93-108. Accessed December 12, 2020. <https://journals.lib.washington.edu/index.php/BIPPA/article/view/9967>.

of preliminary data collection which I had planned to use during the early stage of my studies, following the outline in my research proposal paper.

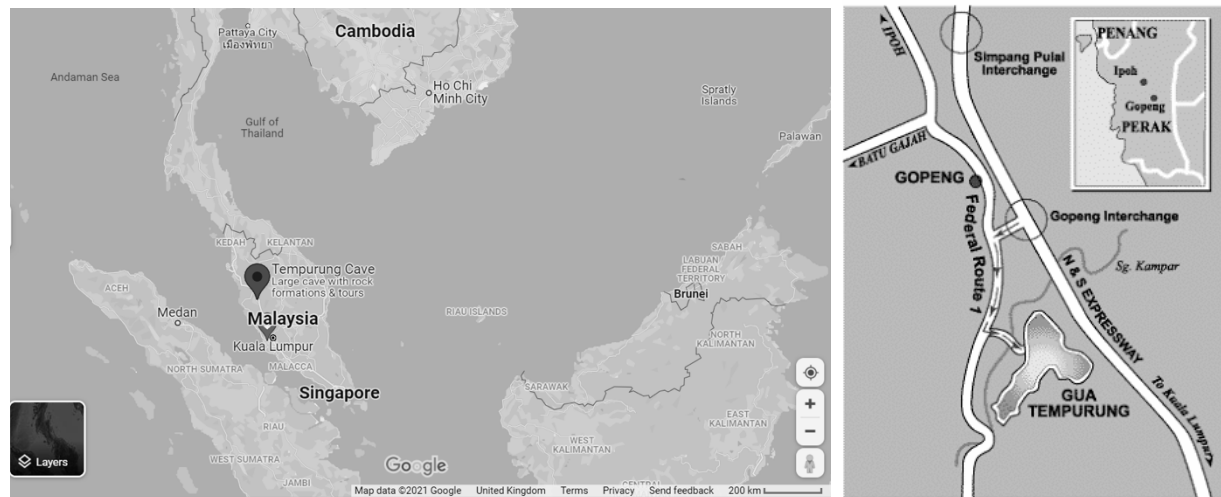


Figure 32 Location of Gua Tempurung, Perak National Park on Malaysia Map.<sup>135</sup>

Recalling the experience of exploring the cave, which had contributed its inspiration to the compositional soundscape, I noted that the cave was full of unwanted sounds made by the presence of tourists; and it was difficult for me to get ‘clean’ non-man-made sound recordings from the sites. I had decided to conduct the field recording session along a quarter of the cave route, starting from the ‘wind tunnel’ as shown in Figure 33, and head out within the last 30 minutes of the visiting hour. This was to achieve ‘clean’ recordings by ensuring all visitors had moved out earlier and would exit the cave route, via the main cave entrance-exit, ahead of us.

Access to the cave exploration route was only open as far as the wind tunnel area, due to maintenance work that was still in progress by the National Park manager. This wind tunnel route has a natural column chamber with the formation of mineral structures of stalactites and stalagmites. The bottom chamber of the wind tunnel is flooded with water from the underground river, which has unique acoustic fingerprints to be recorded in situ and later examined in the audio studio (Figure 34).

<sup>135</sup> (Image - Left) “Jelajah Gua Tempurung.” . Accessed November 17, 2020. <http://myfir2u.blogspot.com/2014/10/jelajah-gua-tempurung.html>.



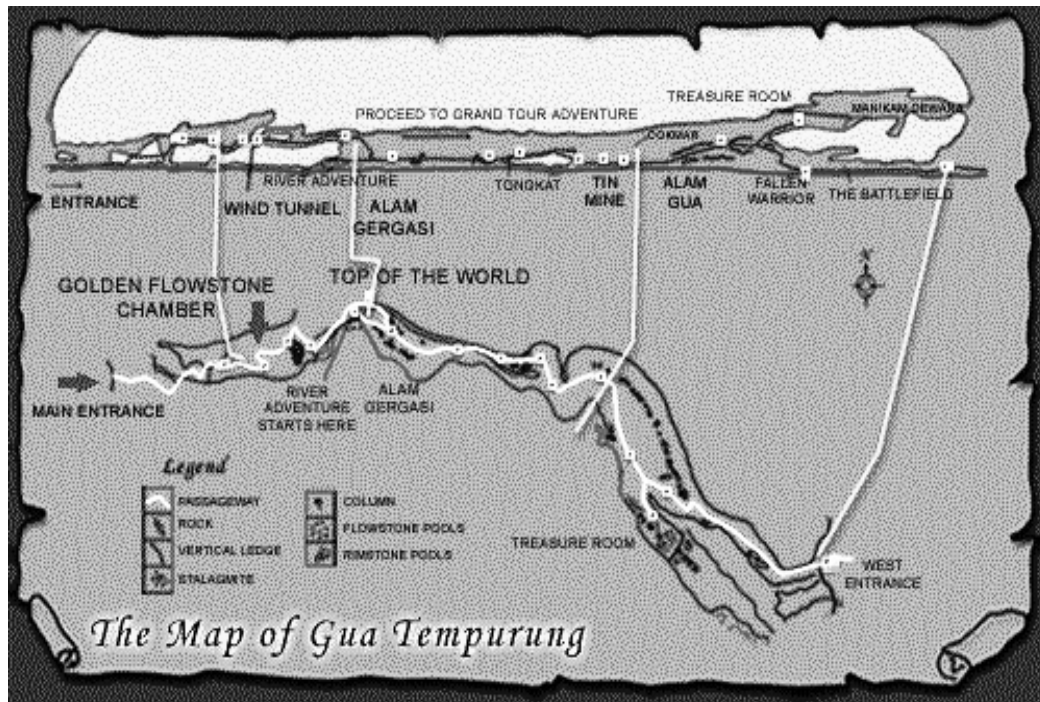


Figure 33 Gua Tempurung Cave route map with arrow points of entrance and primary soundfield recording spot.<sup>136</sup>



Figure 34 Room-tone and underground river stream soundscape field recording at Tempurung Cave, Perak Malaysia

<sup>136</sup> (Image: Johny Tang). Gua Tempurung - attraction Ipoh City. Accessed May 13, 2020. [http://www.ipoh-city.com/attraction/Gua\\_Tempurung/](http://www.ipoh-city.com/attraction/Gua_Tempurung/).

After completing the soundscape recording session, my wife, Balqis Zairul Nizam (acting as my recording assistant) and I made our way down to the ramps, heading for the cave main entrance-exit; and suddenly we were trapped in the middle of the cave path and left in pitch-black darkness as the National Park had turned off the path lights earlier than expected. We continued the 15 minute walk out with our phone lights on, walking down the metal ramps, listening to our echoing steps and breaths. As we approached the exit of the cave, we were stunned and felt relieved and safe when we saw the sunlight shining on the cave entrance wall and glittering, reflected by the minerals on the cave wall (Figure 35). We were lucky to find the cave entrance and exit gates were not yet locked, otherwise we planned to exit through the creek below the cave entrance. Recalling the sensory experience of the moment triggers the imagination of emotional as well as physical experiences that may have been experienced by the ancient inhabitants of the cave. This has contributed to the narrative of the sound world of the composition *Rest and Shelter*.



Figure 35 View of the main entrance-exit route of Tempurung cave, Perak Malaysia.

The raw audio materials were inspected through spectrogram analysis and edited through filtering, attenuating and removing unwanted sounds in the oscillogram editor. Then, these wanted sounds undergo several enhancement or synthesis processes through additive layering, and tuning or stretching modulations. Several sets of sonic materials are combined, with varieties of natural and artificially crafted gestures, textures, timbres, articulations and dynamics. These sonic materials were then organised and crafted to form an 'ambient' or quasi-soundscape texture, with minimal sonic changes in terms of spatio-temporality and tessitura.



The ambient atmosphere and organic quality of the gestural events is also shaped by the use of relatively random repetitive material, and prolonged slowly evolving spectral changes. My goal is to evoke for the listener an emotionally calm, meditative state, reflecting the title *Rest and Shelter*.

The music begins with a set of atmospheric field recordings of a rainy day in the afternoon, heard in a cave near the main entrance-exit gate. This musical material is the unexpected product of a recording made to record room-tone or acoustic-space tone, at the end of the cave path and near the cave door. I used the Zoom H6 portable recorder, with its XYH-6 stereo capsule: the coincident X-Y microphones at 120 degree angle capture a wide stereo image and detailed spatial cues to reflect the vastness of the cave acoustic space to the listener. The lower part of the audio recording spectrum (at around 30 Hz) is attenuated to give more relative prominence to the acoustic space-tones, especially longer cave reverberation effects for the rainwater droplets falling on the limestone surface, suggesting a wide, large, cold, dark, wet, damp and calm atmosphere (Figure 35).<sup>137</sup> For future work, the spatial image might be articulated more immersively using binaural or ambisonic recording, and combined with hydrophone recordings in the caves' enclosed aquascapes. It would be rewarding to explore all of Malaysia's important prehistoric caves. Related work has been done by Ian Whalley and colleagues at the University of Waikato, New Zealand, who also focus on the sounds and cultural significance of cave systems, although their research goal is to derive new digital performance instruments, and the cultural context is of Māori tradition.<sup>138</sup>

The sound of rain, recorded inside near the cave main entrance-exit gate, has a spectral quality similar to pink noise, reflecting the way we perceive loudness across the audible frequency range. The abrupt cut-transition of this sound emulates the lights being suddenly turned off, making the atmosphere dark and empty (Figure 36). This is intended to induce an 'ear-opener' effect, and promote a feeling of shock and suddenness to attract the listener's senses to be more

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<sup>137</sup> Fazenda, Bruno, Chris Scarre, Rupert Till, Raquel Jiménez Pasalodos, Manuel Rojo Guerra, Cristina Tejedor, Roberto Ontañón Peredo et al. "Cave acoustics in prehistory: Exploring the association of Palaeolithic visual motifs and acoustic response." *The Journal of the Acoustical Society of America* 142, no. 3 (2017): 1332-1349. Accessed November 20, 2020. <https://asa.scitation.org/doi/full/10.1121/1.4998721>.

<sup>138</sup> Whalley, Ian. "HIEMPA: Hybrid instruments from electroacoustic manipulation and models of pūtorino and aquascape." *Organised Sound* 13, no. 3 (2008): 259-267. Accessed December 12, 2020. <https://www.cambridge.org/core/journals/organised-sound/article/hiempa-hybrid-instruments-from-electroacoustic-manipulation-and-models-of-putorino-and-aquascape/D291432CDBBF211F080AA7F19AE4349E>

focused and sensitive to the next sonic events, just like someone who sees and focuses following a movement in the dark: when an individual moves into a dark space, the pupil of the eye will dilate to allow more reflected light to enter the eye.

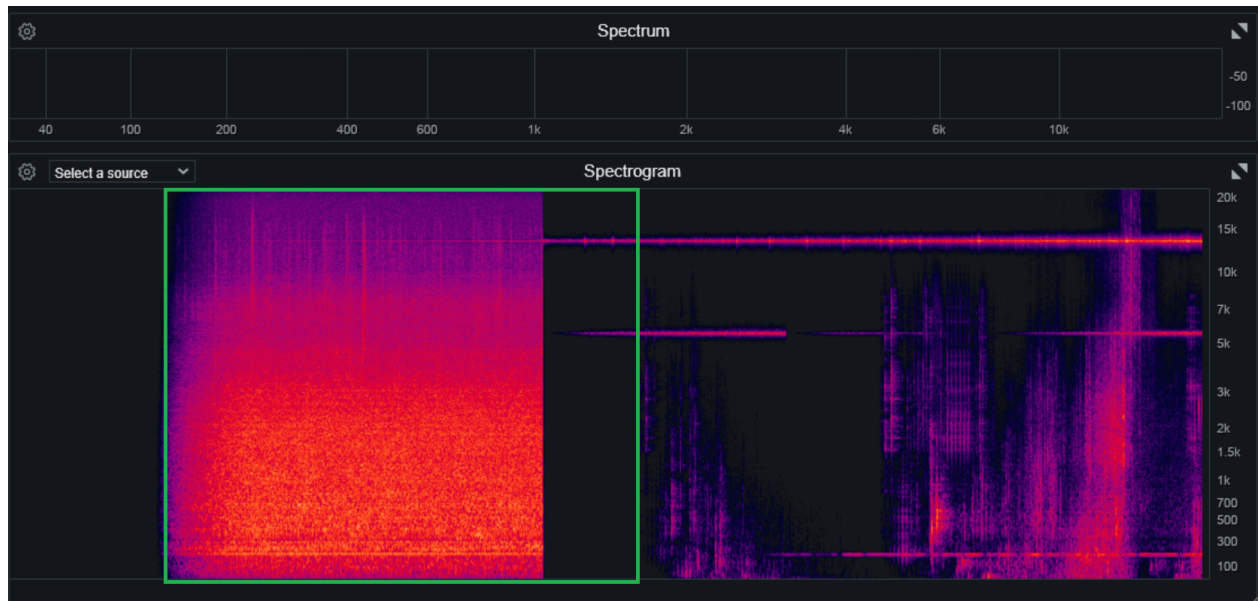


Figure 36 'Ear-opener' effect – from beginning to approximately 19 seconds (green box) followed by small, 'timid' sound gestures.

The composition continues with a synthetic soundscape narrative that introduces idiosyncratic elements produced by 'ultra-processed' found sound samples, from recordings of the sounds of snapped wood twigs, grinding or scrubbed pestle and mortar, and sprinkled rice grains in cardboard boxes. These processed sounds are arranged sparsely in the composition timeline and space, and have a texture density between thin and medium thick, where the movement of audio projection in the dark and empty space around the listener is articulated through binaural spatial cues. This material serves to stimulate the 'mind's eye' of the listener and expands on the ideas of prehistoric cave community behaviour, which may recall the listener's semantic memory in regards to the development of ancient human activity in the cave. The piece continues with the gradual introduction of geophony sounds of a water canal, whose currents run underneath the cave floor. This gradual introduction of 'pure' soundscape mimics the figurative opening of the listener's ear-drum-pupil. In pre-history, the cave area that has the nearest water source is the most preferable choice for community settlement;<sup>139</sup> and my

<sup>139</sup> Laureano, Pietro. *Water Conservation Techniques in Traditional Human Settlements*. Copal Publishing Group, 2013. 20-21.

compositional use of the sound of these ‘pure’ water currents serves as a metaphor for changes in values, personalities, and morality through historical time.

Moving along, several monotone drones derived from a cave resonance frequency were introduced to create contrast with the previous spatial sound gestures. The usage of the cave room-tone resonance recalls the concept of Alvin Lucier’s 1969 work, *I am Sitting in A Room*: Lucier highlights the ‘natural’ resonant harmonies and tones of the room itself using a repeated process of recording the loudspeaker-microphone feedback loop, from initial playback of recorded speech in the room.<sup>140</sup>

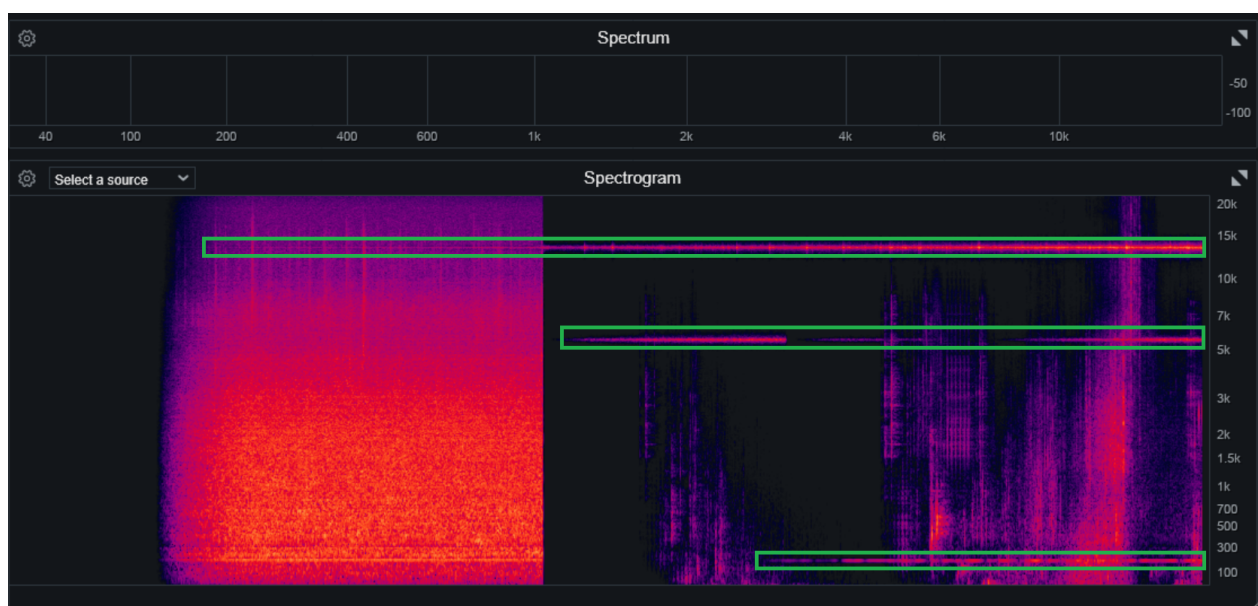


Figure 37 Monotone drone and Room-tone frequency spectrum.

The spectral shape of these monotone drones suggests to the listener a feeling of stasis, a ‘reset’, and spirituality (Figure 37). In this part of the composition, I have experimented in stimulating the physical senses, around organs close to the listener’s ear, by exciting the natural resonance frequency of the listener’s head and neck structures.<sup>141</sup> Some individual monotone drones consist of a selected overtone frequency derived from the cave room-tone resonance frequency, chosen within the natural resonance frequency range of skull bones at around 927 Hz and 1230Hz average, eyes at around 19Hz (this infrasonic frequency is made into a fundamental

<sup>140</sup> Arts at MIT. “Alvin Lucier on ‘I Am Sitting in a Room.’” YouTube, November 4, 2014. Accessed December 10, 2020. <https://www.youtube.com/watch?v=v9XJWBZBzq4>.

<sup>141</sup> Håkansson, Bo, Anders Brandt, Peder Carlsson, and Anders Tjellström. "Resonance frequencies of the human skull in vivo." *The Journal of the Acoustical Society of America* 95, no. 3 (1994): 1474-1481. Accessed January 5, 2021. <https://asa.scitation.org/doi/abs/10.1121/1.408535>

frequency for producing audible overtones through arithmetic progression) and the nasal structures at around 35Hz (Figure 38). I have adopted these averaged or ‘ideal’ frequency values as a stimulus to compositional experiment, rather than with the intention of deliberately mapping to individual physiological experience of the sounding result.

Room-tone frequencies, focused through band-pass filtering, are then elaborated with slight harmonic overtones through saturation of the audio signal processing, providing a subtle form of distortion that adds pleasant-sounding harmonics to ‘intensify’ and articulate the frequency (Figure 39). This process may undergo similar parametric audio filtering to remove the unwanted harmonic overtones, leaving the ‘energised’ fundamental frequency of the targeted band pass-filtered room-tone frequency to possibly excite the listener’s natural resonance frequency near their listening organ area.<sup>142,143</sup> The excitation of physical sensory sensations, as well as the perceptual stimulation of this drone, attempts to induce meditative feelings, divinity, mysticism and experiences beyond the real world attributed to the life story of the ancient inhabitants of this cave.

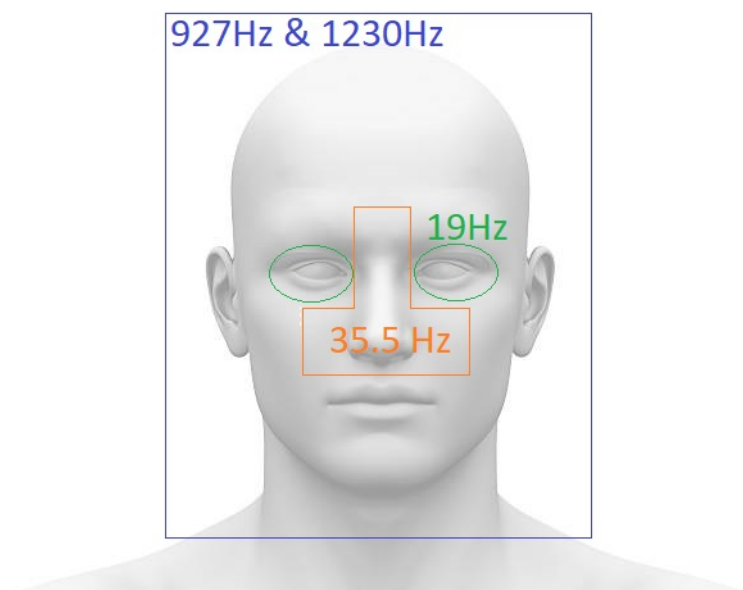


Figure 38 Natural resonance frequency of a human neck-head organ.

<sup>142</sup> Yang, Bin, Zheng Shi, Qun Wang, Feng Xiao, Tong-Tong Gu, Yong-Kai Yin, and Zhong-Liang Miao. "Frequency spectrum of the human head-neck to mechanical vibrations." *Journal of Low Frequency Noise, Vibration and Active Control* 37, no. 3 (2018): 611-618. Accessed January 6, 2021. <https://journals.sagepub.com/doi/pdf/10.1177/1461348417747179>.

<sup>143</sup> Ohlbaum, Morton King. *The mechanical resonant frequency of the human eye in vivo*. Indiana University, 1973.

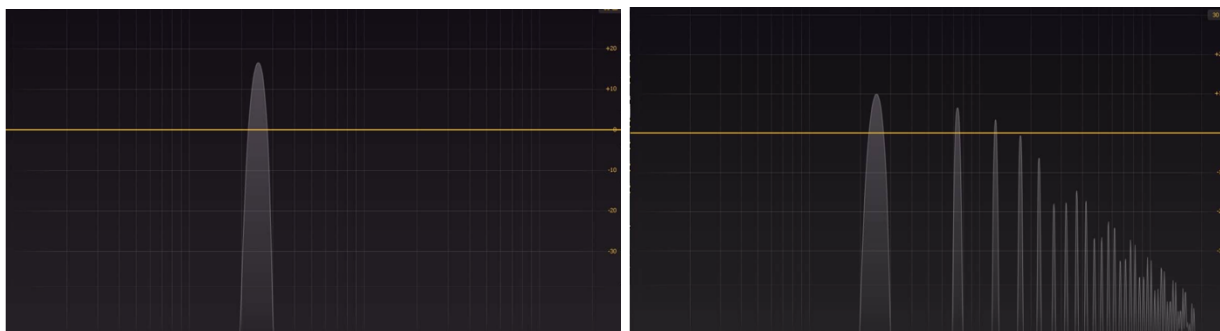


Figure 39 Example of band pass-filter (left) and saturation (right) approach applied on targeted cave room-tone frequency.

Caves are also synonymous with the natural habitat of bats, and to give a geographic clue of the soundscape location used for this composition, the echolocation sound of bat types and species found only in this region of Malaysia — the False Serotine Bat (*Hesperoptenus doriae*) — is suggested.<sup>144</sup> However, I was informed by Juliana Senawi, a bat biologist at Universiti Kebangsaan Malaysia that the echolocation sound of the bat species is still not able to be studied due to the limited numbers of the species, and the difficulty of locating them. To solve this pragmatically, echolocation sounds of bats from the Vespertilionidae family and the nearest genus, *Hesperoptenus*, retrieved from bat research data listed in the public domain,<sup>145</sup> were used in this composition. Binaural spatial cues are used to mimic the movement of bats across the listening space. This biophony sound is introduced several times in the form of ‘flash’ gestures as if to guide the listener to the real-world sounds; the geophony sound of rain, and a small water canal under the cave reappearing now with the sound of busier bat echolocation. The sound events become progressively more sparse and gradually disappear, and a tropical forest atmosphere is slowly introduced filled with the sounds of cicadas in the higher frequency spectrum and set against the low room-tone resonance frequency sounds of the cave. Finally, we return to focus fully on the cave resonance (Figure 40).

<sup>144</sup> Francis, Charles. *Field guide to the mammals of South-east Asia*. Bloomsbury Publishing, 2019.

<sup>145</sup> Warwickshire Bat Group. Accessed May 15, 2023. Accessed December 2, 2020. <https://www.warksbats.co.uk/aboutbats/species/serotine.aspx>.

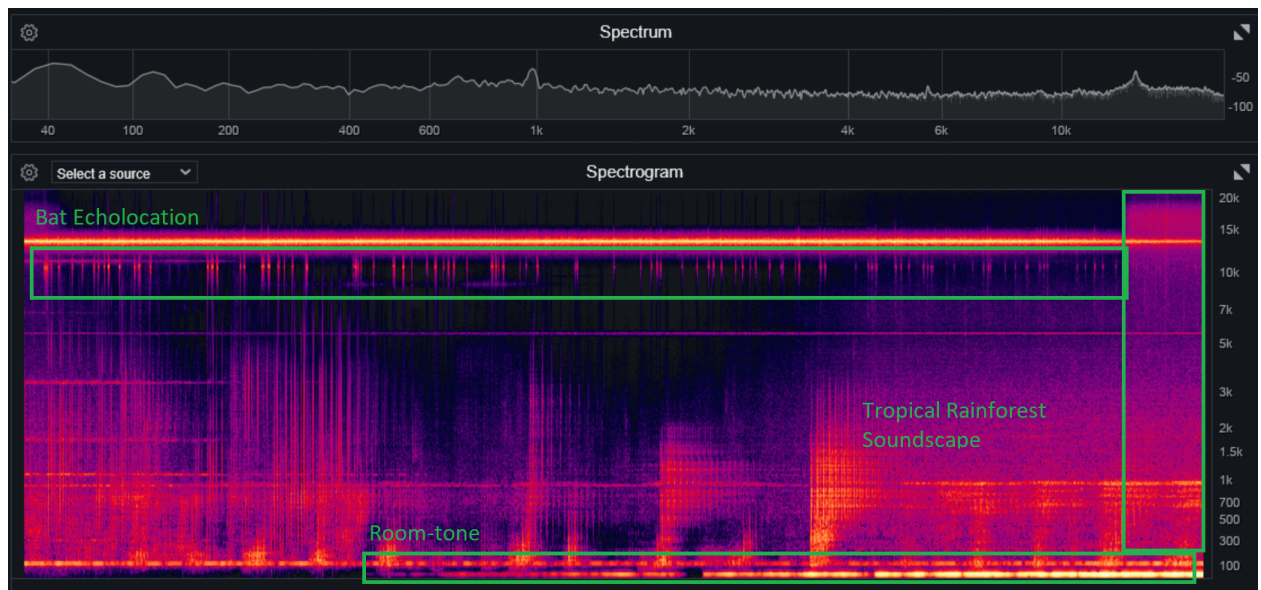


Figure 40 Middle end section of the composition with bat echolocation gestures, layered underneath with accentuated low frequency room-tone reverberation of the cave chamber and gradually exposed with tropical rainforest soundscapes.



## Seed of Life (SoL) 5: *Nada Sfera*

### A Pilot Project of Interactive Soundscape Website Installation, Analysis Tools and Binaural Soundscape Streaming Device

Video demo: screen recording of website in use. Duration: 5 minutes 00 seconds

Website installation demo: <https://dac.uitm.edu.my/>

Project Date: January 2021 - May 2022

*Seed of Life* (SoL) 5: *Nada Sfera* ('sphere of tone') is the penultimate work in the *Seed of Life* (SoL) artistic research project for my PhD studies. However, *Nada Sfera* is conceived as a long-term and ongoing project, and intended to provide 24-hour per day live audio streaming of hidden and unheard site-specific soundscapes in Malaysia, in line with the objectives of my PhD research. This long-term project involves three technical-creative outputs, namely: 1) website based interactive live-streaming soundscape installation; 2) website based live-streaming soundscape eco-acoustics observation and analysis tool; and 3) live audio streaming device for binaural capture of soundscapes at off-grid locations (see Figure 41). The websites have been published at the Data Accelerator Group website,<sup>146</sup> in demo mode to get feedback and suggestions from users for improvement over time. The Data Accelerator Group website is part of an interdisciplinary Matching Research Grant Scheme between the Institute of Biodiversity and Sustainable Development, Universiti Teknologi MARA (UiTM) Malaysia, and Cornell Lab of Ornithology, University of Cornell (Cornell), United States of America, established in 2022. The *Nada Sfera* device,<sup>147</sup> and website were proposed as part of the collaborative effort towards a real-time acoustic ecology monitoring, based on audio visualization and computational analysis with machine learning.

The demo version of *Nada Sfera* Soundscape Web-Installation and *Nada Sfera* Soundscape Web eco-acoustics analysis tools uses live soundscape audio streaming resources that are available from (and credited to) the Locus Sonus Sound Map IceCast2 mountpoint website.<sup>148</sup> I have not yet used live audio streamed from the *Nada Sfera* off-grid binaural soundscape device (*Nada Sfera* device) for the reason that, ideally, the *Nada Sfera* device should be placed

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<sup>146</sup> See <https://dac.uitm.edu.my/>

<sup>147</sup> Azizol, Ainolnaim. "Live Electroacoustic Soundscape Performance Based on the Unheard Malaysia Natural Soundscape: Music Composition Approach from *Nada Sfera*". Zenodo, 2022. <https://doi.org/10.5281/zenodo.6568423>

<sup>148</sup> See <https://locusonus.org/soundmap/051/>



in a selected location in Malaysia that has a site-specific hidden and unheard natural soundscape with associated cultural narrative, in keeping with my Ph.D research objectives. The development of the *Nada Sfera* device during my PhD research period in Bristol, UK, during the Covid-19 pandemic, led to a working prototype and local demonstration. After returning to Malaysia in June 2022, I have worked to build six units of the *Nada Sfera* device, as well as to deploy and install them in the targeted areas with possible hidden and unheard natural soundscapes and suitable for the UiTM-Cornell acoustic ecology monitoring project, such as Johor National Park, Pahang National Park, and Sabah-Borneo Island Coral Reef Park. The target locations are listed at the end of this chapter. The realisation aims to be complete by the end of 2023.



*Figure 41 working prototype of Nada Sfera device with solar panel power charger and supply (right) and a mono Aquarian H2a hydrophone microphone mounted with 3-D printed hydrophone noise flow reducer can be used with the Nada Sfera device (left).*

The idea and inspiration of this *Nada Sfera* project arose from my participation in the Acoustic Commons online workshop programme,<sup>149</sup> held 25-29 January 2021, and organised by the Locus Sonus research group at ESA-Aix, France.<sup>150</sup> The workshop demonstrated the technical materials of the current and ongoing Locus Sonus projects: Sound Map, and Open Microphone. Open Microphone is an open source project that encourages people to share the live soundscape

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<sup>149</sup> See Acoustic Commons Workshop 2021 <https://www.facebook.com/locusonus/posts/next-week-acoustic-commons-online-workshop-more-informations-httpacousticcommons/2791181104485139/>

<sup>150</sup> See Locus Sonus <https://locusonus.org>

of their chosen location, through the Locus Sonus Mobile App ‘LocusCast’ and Locus Sonus Streambox live audio streaming device; and to publish the live sound in the Locus Sonus Sound Map website.<sup>151</sup> Throughout the workshop, participants were given in-depth insights,<sup>152</sup> in how to build their own live audio streaming hardware and publish to Locus Sound Map, as well as how to manipulate the audio streaming in real time with Pure Data. After the workshop, I have worked from the specifications of the Locus Sonus Streambox, and re-invented it to produce a human head-sized, self-contained device, to enable off-grid binaural soundscape live streaming, together with an additional mono audio input for either a hydrophone, geophone, or ultrasound microphone. This is the *Nada Sfera* device.

Similar to the Locus Sonus Stream Box,<sup>153</sup> the *Nada Sfera* device uses a Raspberry Pi Zero micro-computer as an audio server, with 5V 1A USB Lithium-ion battery power supply. Several choices of low-powered USB sound cards were suggested to the participants of the 2021 workshop. Here, I have used the IQAudio Codec Zero soundcard (Figure 42)<sup>154</sup> and connected it with a matched pair of Primo EM272 omni-directional electret condenser microphone.<sup>155</sup> The microphones are mounted on the left and right of the 3-D-printed head-size *Nada Sfera* waterproof shell container,<sup>156</sup> to get a binaural soundfield sound image (Audio 2).<sup>157</sup> Each of the microphone capsules is covered with a splash-proof microphone vent at IP46 waterproof rating, that comes from the microphone supplier, and an ear-muff like microphone wind-shield is applied for the binaural *Nada Sfera* device to reduce unwanted wind noise.

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<sup>151</sup> Sinclair, P. (2018, August). Locus Stream Open Microphone Project. Accessed April 12, 2021. <https://hal.science/hal-01791828/>

<sup>152</sup> After the workshop session and throughout the *Nada Sfera* development project, I continued to communicate via email with the workshop instructors, speakers and participants to further obtain relevant technical information and advice.

<sup>153</sup> “Locusonus Streambox.” Locus Sonus :: Stream Box. Accessed January 30, 2021. <http://locusonus.org/streambox/>.

<sup>154</sup> IQAudio Codrc Zero sound card has optimum technical specifications to meet the needs of the number of audio input-outputs as well as sound processing quality. See technical specs. <https://datasheets.raspberrypi.com/iqaudio/iqaudio-product-brief.pdf>

<sup>155</sup> The Primo EM272 microphone has been widely used by natural soundfield recordists as it has very low-self noise, which is helpful when recording in quiet ambient environments. See technical specs: <https://micbooster.com/microphone-capsules/199-primo-em272.html>

<sup>156</sup> I used the mean adult human head-size for the *Nada Sfera* microphone mount. See [https://www.researchgate.net/publication/264024487\\_Analysis\\_of\\_Human\\_Head\\_Shapes\\_in\\_the\\_United\\_States](https://www.researchgate.net/publication/264024487_Analysis_of_Human_Head_Shapes_in_the_United_States)

<sup>157</sup> Dan August, and Christine Hass August 30. “Microphones for Nature Recording I.: Types and Arrays.” Wild Mountain Echoes, January 5, 2021. Accessed April 5, 2021. <https://www.wildmountainechoes.com/equipment/choosing-microphones-2/>

Audio 2 *Nada Sfera* device binaural soundfield test:

[https://soundcloud.com/anllume/nadasfera\\_binauraltest?utm\\_source=clipboard&utm\\_medium=text&utm\\_campaign=social\\_sharing](https://soundcloud.com/anllume/nadasfera_binauraltest?utm_source=clipboard&utm_medium=text&utm_campaign=social_sharing)



Figure 42 Raspberry Pi Zero with IQAudio Codec Zero sound card with stereo and mono audio inputs.

The selection of the type and method of power supply for the *Nada Sfera* device is crucial, because it is designed as a self-sustained and contained device, to be placed in remote, off-grid areas and subject to unpredictable Malaysian tropical weather.<sup>158</sup> The EM272 capsules have internal FET preamps which are powered using a self-contained 4.5V Lithium-ion battery supply. This reduces electrical noise interference by comparison to deriving microphone power from a step-up regulator. Capacitors provide DC decoupling for the microphone signal (Figure 43).<sup>159</sup> The microphone system will draw less than 1mA and is powered by an external 5V rechargeable battery pack with a small solar panel charger unit. On the other hand, an approximate total of 15 amp hours (Ah) of Lithium-ion battery capacity, about 3.7V, 2.5 Ah per battery cell with DC to DC 5V step-up voltage regulator and medium sized 12-18 V solar panel battery charger with USB charger DC to DC 5V step-down regulator, has been designed

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<sup>158</sup> *Nada Sfera* enclosure is fabricated using durable 3-D printed Polyethylene Terephthalate Glycol (PETG) material for outdoor use.

<sup>159</sup> Self, Douglas. *Small signal audio design*. Taylor & Francis, 2010.

and installed as a sustainable power source for the *Nada Sfera* streamer device (Raspberry Pi Zero and Audio Codec Zero Sound Card) and this was tested during a live soundscape stream for the International Dawn Chorus Day program #Reveil2021 on 1 May 2021 (Figure 44).

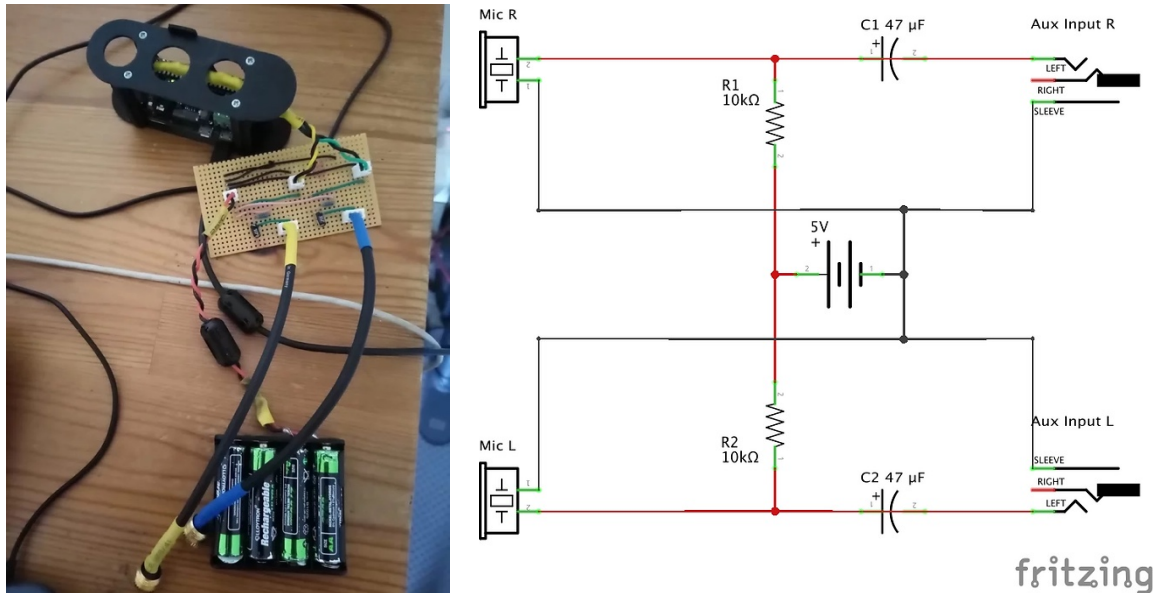


Figure 43 Matched pair Primo EM272 electret condenser microphone with battery power and DC decoupling for *Nada Sfera* device.

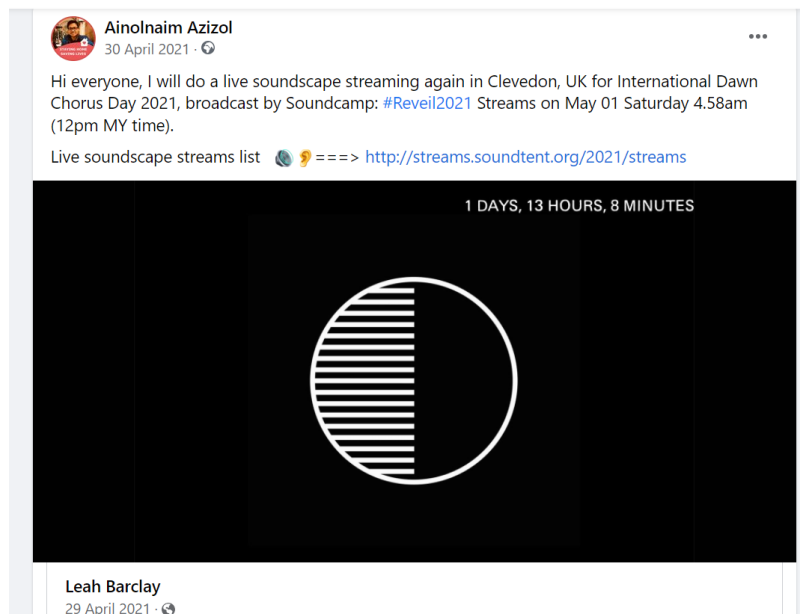


Figure 44 International Dawn Chorus Festival 2021 with *Nada Sfera* device.

The *Nada Sfera* device uses the streaming server Icecast2 mountpoint from Locus Sonus Sound Map. This provides stability and reliability, with the service maintained and regulated by the Locus Sonus team since 2006, and proven by a large network of streaming users and listeners around the globe from various institutions. The 2021 Acoustic Commons workshop included discussion of how to use Pure Data (Pd) software to implement soundscape streaming. Pd objects such as [oggamp~]<sup>160</sup> and [locusamp~] were developed for real-time live audio streaming and broadcast, and to provides sources for post-audio manipulation and sound art production in various formats such as fixed or interactive media. Between 2021 and 2022, I made a survey to find examples of website based sound installations that use live streaming soundscape, as a reference source and for inspiration. To fill an evident gap, I created the *Nada Sfera* Web-based Interactive Live Soundscape Sound Installation known as the ‘*Nada Sfera* Playground’, which was created drawing on Web Audio API HTML (MDN Web documents)<sup>161</sup> (Figure 45).

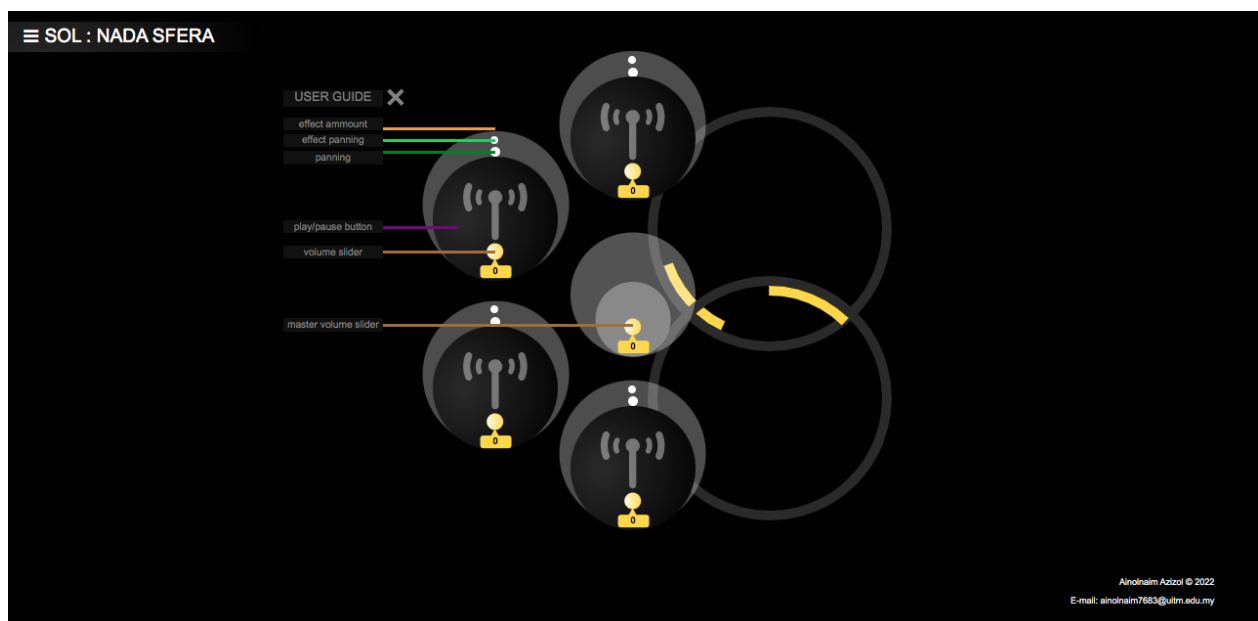


Figure 45 *Nada Sfera* Playground: Web-based interactive sound installation pilot demo as published in <https://dac.uitm.edu.my/>. From the website, there are six *Nada Sfera* sound streams in total where four *Nada Sfera* are ready to be played while two *Nada Sfera* sounds are still in loading.

To test-run the system that would host the streams from the remote *Nada Sfera* devices, *Nada Sfera* Playground was created in a pilot version where I used live soundscape audio streaming

<sup>160</sup> The [oggamp~] pure data object created by Olaf Matthes for streaming ogg format audio over the internet can be accessed via the assigned icecast audio url.

<sup>161</sup> I followed several crash courses and tutorials on websites such as Codepen, GitHub and the W3School resource to add new knowledge in writing HTML and Web Audio API.

sources from existing mountpoints on the Locus Sonus Sound Map, crediting the source in the content section from the 'About' web menu. *Nada Sfera* Playground allows users to interact with live soundscape streaming sources, with a website graphic interface that give users the opportunity to manipulate, shape and create their desired soundworld in real-time. Web Audio API nodes that are used in modular routing are quite simple and straightforward for maintenance. In this web-based sound installation, the end user can manipulate certain audio parameters, but I aim to minimise the blurring and masking of the original quality of the streamed soundscape that might result from over-manipulation. I apply a simple audio processing chain that can change the timbre, space, depth, and stereo panorama of the soundscape: but not 'too much'. The processing includes reverb effects from the Web Audio API ConvolverNode,<sup>162,163</sup> with fixed impulse response length and duration parameters; audio signal gain with variable GainNode source input and master mix; audio filters with variable BiquadFilterNode high pass and low pass filter,<sup>164</sup> and audio panning with StereoPannerNode.

Reviewing the Locus Sonus Sound Map website, I have been inspired also to develop a similar audio geolocation mapping website but with additional features for audio-visual analysis purposes that have never existed for live streaming soundscape sound maps, such as audio peak metering,<sup>165</sup> audio filtering, and real-time spectrogram analysis.<sup>166,167</sup> These ideas were inspired by the Xeno-Canto website,<sup>168</sup> while I was working on the *Seed of Life* (SoL) 1 work: *Ancestral Dance*. Here I again use Google Map Web API,<sup>169</sup> for cartographic elements and Audio API HTML which includes AnalyzerNode for visual-audio elements. This parent website is known as '*Nada Sfera Analyzer*', allowing not only sound art lovers to appreciate Malaysia's hidden and unheard natural soundscape, but to observe and analyse the audio-visual changes of the live streaming soundscape that is loaded into the website. The *Nada Sfera* device

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<sup>162</sup> Reiss, Joshua. *Working with the Web Audio API*. CRC Press, 2022.

<sup>163</sup> Smus, Boris. *Web Audio API: Advanced Sound for Games and Interactive Apps*. "O'Reilly Media, Inc.", 2013.

<sup>164</sup> Hronco, Andrej. "Making Music in the Browser - Web Audio API, Part 1." Keith McMillen Instruments, June 10, 2019. <https://www.keithmcmillen.com/blog/making-music-in-the-browser-web-audio-api-part-1/>.

<sup>165</sup> Sonderegger, E. "Esonderegger/Web-Audio-Peak-Meter: Customizable Peak Meters, Using the Web Audio API." GitHub. Accessed May 19, 2021. <https://github.com/esonderegger/web-audio-peak-meter>.

<sup>166</sup> Albaugh, Jake. "Audio Visualization on CodePen 01: Building a Spectrogram." YouTube, September 19, 2018. <https://www.youtube.com/watch?v=hYNJGPnmwls&list=LL&index=5>.

<sup>167</sup> Dirksen, Jos. "Exploring the HTML5 Web Audio: Visualizing Sound - DZone." dzone.com, October 23, 2012. Accessed 12 April 2021. <https://dzone.com/articles/exploring-html5-web-audio>.

<sup>168</sup> "Canto." xeno. Accessed January 19, 2021. <https://xeno-canto.org/>.

<sup>169</sup> Geolocation coordination of *Nada Sfera* devices can be retrieved through 4G internet cellular network communication.

is not only able to be used for sound art creation, but can also be used for natural ecological surveys and bioacoustics observations (Figure 46).

Apart from applying the device and web application for the UiTM-Cornell collaboration research project for scientific purpose, my earlier plan was to build a six set of *Nada Sfera* Devices to be deployed around Malaysian areas that have a unique natural soundscape and cultural history such as the aquascape location of Tasik Chini used in the work *Seed of Life* (SoL) 2: *The Travelers*, the soundscape of Gua Tempurung as in the work *Seed of Life* (SoL) 4: *Rest and Shelter*, and so on. I aim to complete these additional works, focused on artistic rather than ecological purposes, by the end of 2023 after the Covid-19 Pandemic has become less serious, and with the financial assistance,<sup>170</sup> of cultural or academic grants from local government bodies together with the cooperation of government agencies such as the School of Marine Science Universiti Malaysia Sabah, National Parks Malaysia and other potential funding. The six placement locations of the *Nada Sfera* devices that are unique, undisturbed with human activities but that also have local cultural stories are as follows; 1) Sabah-Borneo coral reefs; 2) Pulau Kukup Mangrove Forest Johor; 3) Tasik Chini Pahang; 4) Silver Shell Cave; 5) Rantau Abang turtle sanctuary park Terengganu; and 6) Rainforest Canopy National Park Kelantan.

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<sup>170</sup> The construction material of the *Nada Sfera* device prototype cost 150 GBP with private funds.



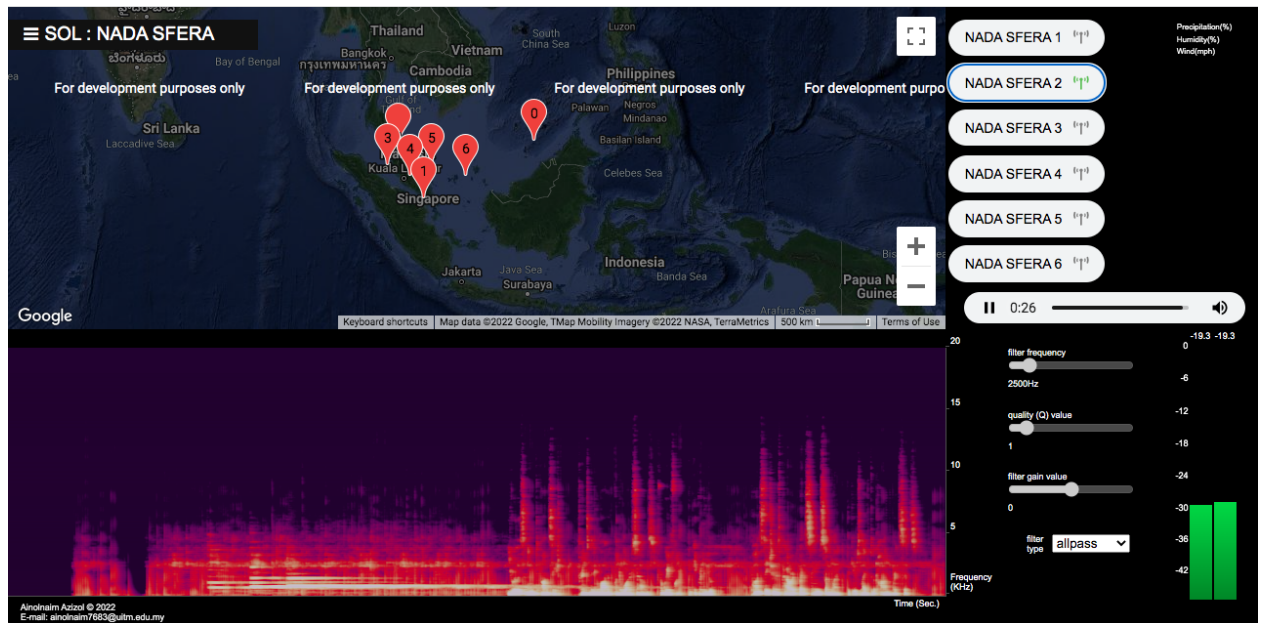


Figure 46 Nada Sfera Analyser with six Nada Sfera streams in total from the Nada Sfera Playground. The physical environmental monitoring such as humidity, windspeed, carbon dioxide level and more will be embedded, which can be used for data driven music.

## Seed of Life (SoL) 6: *The Source*

### Electroacoustic Soundscape for Amplified Cello and Live Electronics

#### 8.1.1 Surround

Composition Duration: 5 minutes 28 seconds

Composition Date: April 2022

I was invited by Taekkyu Lee, a fellow PhD composition student at the University of Bristol (UoB), to collaborate in composing an instrumental soundscape piece lasting five minutes, connected with the theme of his composition *When the Mountain and River Sings*. This collaborative composition project was presented at the Bristol New Music (BNM) festival fringe concert on 8th May 2022 at the Victoria Rooms Auditorium, UoB. We decided to divide the five minute duration of the composition into two parts where the second part would be written by me, with the theme ‘When the River Sings’ and entitled *The Source*. I was also asked by Taekkyu to assist him in organising and designing the soundscape of his part, based on his compositional draft of the timeline. However, for my doctoral portfolio I composed a full version of the piece for cello and electronics, and in this version the electronic part incorporates recordings of Taekkyu’s Tuvan throat singing.<sup>171</sup> The opening up to bar 38 corresponds to the material performed for the concert.

Since I had recorded soundscapes of waterfalls and river streams (Kroh river) and wilderness at the Forest Research Institute Malaysia (FRIM) Kepong Selangor, Kuala Lumpur, Malaysia,<sup>172</sup> as part of collecting data for my PhD art research, I agreed to compose a river-themed soundscape composition for the BNM event. The wilderness environment and ecosystem of FRIM Kepong, Malaysia, is one of the oldest natural forests in Kuala Lumpur. Kuala Lumpur is the heart of Malaysia and the centre of attention for visitors from all over the world. This can be seen in the history of the cultural development of Malay civilization, with Kuala Lumpur becoming the centre of international trade that had formerly been located in Malacca. This sense of Kuala Lumpur being a place for global convergence and exchange lies

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<sup>171</sup> Folkways. “Explore.” Smithsonian Folkways Recordings. Accessed April 20, 2021.  
<https://folkways.si.edu/throat-singing-unique-vocalization-three-cultures/world/music/article/smithsonian>.

<sup>172</sup> Overview – Forest Research Institute Malaysia (FRIM). Accessed April 20, 2021.  
<https://www.frim.gov.my/about-us/overview/>.

behind my compositional choice to combine throat singing from the Middle East, and Western instrumentation, to express the ‘melting pot’ of Malaysian culture.<sup>173</sup>

The theme of the BNM concert was ‘distance and time’ which encouraged a focus on the elements of spatiality. We had the opportunity to produce a composition for a periphonic loudspeaker setting. Due to limited resources, initially only 5.1 format surround speakers were expected to be available for the concert.<sup>174</sup> The use of 5.1 surround for large venues such as concert halls will produce low dynamic density resolution and spatial motion clarity.<sup>175</sup> However, with some reorganisation of the technical setup, we managed to use a 8.1.1 periphonic system (with mixed types of speaker model and size) instead of 5.1. We were provided with several volunteer musicians who wanted to perform our music, including cello and flute. This gave me the idea to create a natural river soundscape that morphs into a hypnotic and magical soundworld. I had imagined it would be like the streams of the creek floating around the upper and lower canopy walk of the FRIM Kepong wilderness, with glittering streams crossing and layering each other.

Due to the different speaker models and sizes used for the BNM 2022 program, I treated this limitation as an opportunity to experiment in producing an ‘open-ended’ spatialisation strategy for the soundscape, that allows response to the concert environment on the day. This approach is influenced by the type and sizes of speaker used, the speaker directions and distances, the size and acoustics of the hall, and also the number of spectators. It avoids giving preference to a single sweet-spot for listening, and seeks a more ‘democratic’ framing of the social activity that is the concert. However, it is undeniable that the sweet-spot for any surround sound format is the starting point for the development of the spatialization idea in the audio studio, and serves as the reference for overseeing and realising the production of the work.

The use of natural river sounds, for literal or metaphorical roles in soundscape composition, has been explored by previous composers and sound artists. In the construction of *The Source*,

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<sup>173</sup> Wolters, Oliver William. "The fall of Srivijaya in Malay history." (1970). Accessed January 15, 2021. [https://myrepositori.pnm.gov.my/xmlui/bitstream/handle/1/217/JB0058\\_FSMH.pdf?sequence=1](https://myrepositori.pnm.gov.my/xmlui/bitstream/handle/1/217/JB0058_FSMH.pdf?sequence=1).

<sup>174</sup> Otondo, Felipe. "Some considerations for spatial design and concert projection with surround 5.1." In *Digital Music Research Network Summer Conference*, vol. 21. 2005. Accessed January 12, 2021. [http://www.otondo.net/texts/article\\_surround130705.pdf](http://www.otondo.net/texts/article_surround130705.pdf).

<sup>175</sup> Deruty, Emmanuel. Loudspeaker Orchestras, January, 2012. Accessed January 15, 2021. <https://www.soundonsound.com/techniques/loudspeaker-orchestras>.

I was interested in the soundworld aesthetics and techniques used by composer Barry Truax in his work *Riverrun* (1986). In this composition, Truax has explored the world of granular synthesis sounds originally pioneered by Xenaxis. In *Riverrun*, he created an aesthetic river-flow soundscape drawing on concepts of stasis and flux, realised through a combination of granular synthesis sound groups and octophonic spatial diffusion.<sup>176</sup> In *The Source*, I borrow these ideas but with the use of both original and manipulated sound sources. This is achieved with tools in the Ableton Live Digital Audio Workstation (DAW), through granular synthesis using ‘Granular Delay’, and additive synthesis ‘EQ-eight’. In this work, the river soundscape will be the main component for the composed texture, accompanied by cello and throat singing as a catalyst to the imaged soundworld as mentioned before. The open-source spatialisation software Envelope for Live (E4L) is applied, and spatialisation control is done by random surround parameter envelope techniques in Pure Data and by programmed DAW parameter automation.

The cello and vocal throat (Tuvan) singing works as an accompaniment component by adding various textural effects to the soundscape recordings. The composition is through-composed. It starts with textural homophony and then changes to heterophony. The textural heterophony which is more focused on the soundscape recordings is diffused by periophonic techniques. The textural layer of forest environmental sound, that includes the geophonic elements of blowing leaves, swaying and snapping branches, the biomechanical sound production of small insects and the vocalization of birds, functions as background. The foreground is the river sound, which changes its form from something that is familiar and natural to a somewhat abstract, artificial and spatially interwoven sound.

Selected composition devices for creating tension are applied by introducing a gradual dissonance between the cello and pre-recorded throat singing pitches. The wilderness soundscape, which contains the main background tone (C#) of cicadas, is the basis for the movement of the tone and timbre of the pitched and un-pitched aspects of the instrumentation. The cello produces a ‘white noise’ sound through friction bowing on the upper bout, lower bout and cello waist.<sup>177</sup> The ‘white noise’ is amplified and mixed for the opening of the work and

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<sup>176</sup> Truax, Barry. “Riverrun (1986).” RIVERRUN. Accessed January 12, 2021.

<https://www.sfu.ca/~truax/river.html>.

<sup>177</sup> Rodrigues, G. “Cello Extended Techniques – Breath sounds.” YouTube, February 13, 2021.

<https://www.youtube.com/watch?v=aOqmEivYY6M>.

gradually introduces a set of drones with harmonic tones between the C and D pitch ranges, including their microtones to generate tension. At the transition towards the abstract river sound, more attention is given to the low-end undulating throat singing, to emulate a shamanistic and magical spirit which is similar to the chanting soundworld of Tibetan monks.

*The Source* ends in a classic fade-out, emphasised and articulated more deeply through an isolated spatial gesture that moves from behind the listener to the front. The sound becomes dimmer in the front sound image as if the listener's ear is enveloped by a closing curtain. A long sustained tone, from bowing the cello end-pin,<sup>178</sup> becomes the final marker of this work.

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<sup>178</sup> Rodrigues, G. "Cello Extended Techniques - Bowing the Endpin." YouTube, February 5, 2021. <https://www.youtube.com/watch?v=9HITp3RvHAY>.

## Hidden Bristol

### Soundscape for interactive soundwalk-map in binaural mix

#### Composition Duration:

- Rail Tracks 1:17
- Historic Medieval Harbourside 5:24
- Pump, Push, Pull and Roll 5:27

#### Composition Date: May 2021

*Hidden Sounds of Spike Island* is the product of a research project by the Building Instruments group funded by the Brigstow Institute 2021 seedcorn funding program. Brigstow Institute, one of the University of Bristol's five University Research Institutes, has as its central 'vision ... to transform the way we research all aspects of what it means to be human in the 21st century.'<sup>179</sup> The full title of the funded project is 'Building Instruments: Community Soundscapes for Urban Exploration and Sonic Architecture',<sup>180</sup> and I was affiliated to the group as an academic, field researcher and sound artist supported by a studentship funded by Bristow. *Hidden Sounds of Spike Island* was produced for an audio walking tour in conjunction with the 2021 Bristol Open Doors Festival on 10th to 12th September 2021. The soundwalk was designed in a collaboration between the research team (me, Peter Bennett, Joshua Taylor, Jameson Musyoki and Szabina Orosz) and local sound artists Kathy Hinde, Dave Meekin, and Dan Pollard. The three tracks above were my contribution, forming a part of the hour-long duration of the collaborative output. The soundwalk production was supervised by Tom Bonnett, producer of the Bristol Open Doors audio walking tour program (Bristol Open Doors, 2021). Soundwalk is a soundscape composition technique that tends to use a narrative framework, sometimes supported by spoken-word voiceover, as a guide for listeners to follow developments in the composed sound story. The technique was pioneered by sound artist Hildegard Westerkamp in works such as *Kits Beach Soundwalk* (1989)<sup>181</sup> and *Harbour Symphony* (1986)<sup>182</sup>. Visitors to the Bristol Open Doors festival could enjoy the soundwalks

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<sup>179</sup> University of Bristol. "Brigstow Institute." Brigstow Institute | Brigstow Institute | University of Bristol, January 12, 2021. <http://bristol.ac.uk/brigstow/>.

<sup>180</sup> "Building Instruments: Community Soundscapes for Urban Exploration and Sonic Architecture." Brigstow Institute. Accessed January 12, 2021. <https://brigstowinstitute.blogs.bristol.ac.uk/project/building-instruments/>.

<sup>181</sup> "Kits Beach Soundwalk." Hildegard Westerkamp. Accessed January 20, 2021. <https://www.hildegardwesterkamp.ca/sound/comp/3/kitsbeach/>.

<sup>182</sup> "Harbour Symphonies." Hildegard Westerkamp. Accessed January 20, 2021. <https://www.hildegardwesterkamp.ca/sound/comp/3/harboursymphonies/>.



through the Echoes mobile apps so that,<sup>183</sup> in this hour long audio walking tour (a literal soundwalk), listeners will be guided to listen deeply and reflect on the present, past and future soundscapes along the harbourside along Spike Island trail from point location M Shed to point location The Underfall Yard (Figure 47). The spoken word narration was written and delivered by Joshua Taylor.

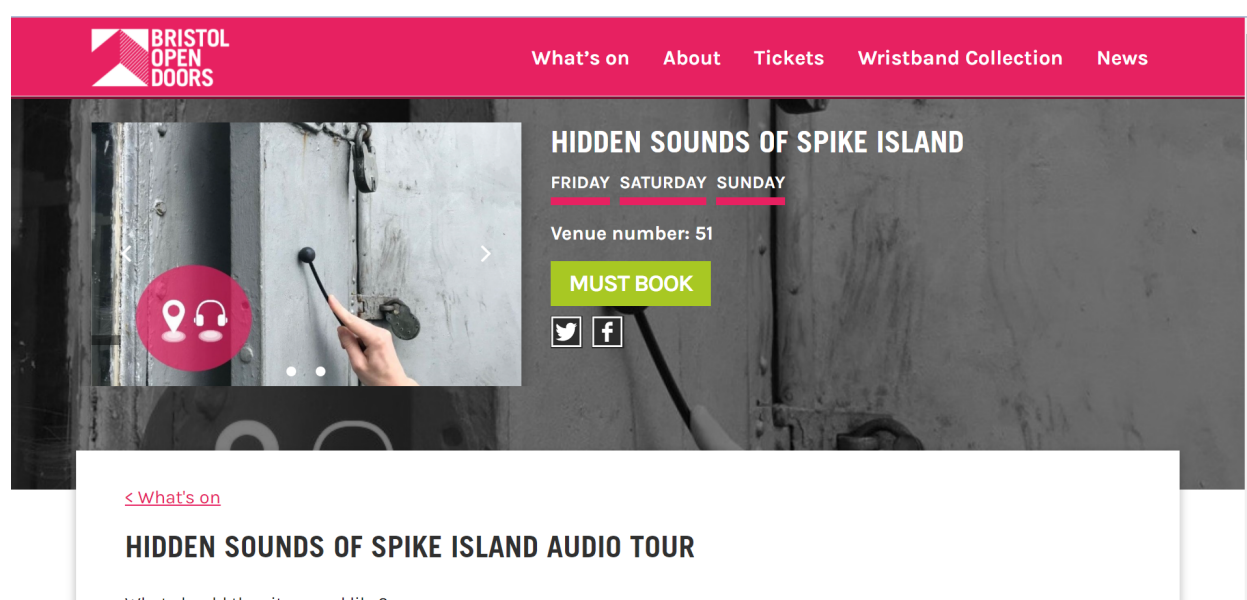


Figure 47 Website of the Hidden Sounds of Spike Island soundwalk program in conjunction with the Bristol Open Doors Festival on 10 to 12 September 2021.<sup>184</sup>

In developing this product, the Building Instruments group came up with two research questions, to set objectives for the soundwalks based on the theme of present, past and future soundscapes along the harbourside:

1. What should the city sound like?
2. How has the sonic environment changed over time? And, importantly, how can we shape the future soundscapes of our cities?

Several sets of questionnaires were formulated based on these research questions, to gain input from members of the public around the harbourside location. This served to get an idea of the listeners' view about the surrounding soundscape at the interview location. Soundscape field recordings were made at the interview locations, as a data collection method for archival

<sup>183</sup> Echoes Apps, a geolocated audio tours and experiences for mobile device. See <https://echoes.xyz>

<sup>184</sup> (Image) "Hidden Sounds of Spike Island." Bristol Open Doors, September 9, 2021. Accessed May 11, 2021. <https://bristolopendoors.org.uk/events/hidden-sounds-of-spike-island/>.

purposes and also to be used as artistic material for soundwalk sound design and composition. We identified a number of specific 'listening point' locations along Spike Island Harbourside, that had potential in the uniqueness and diversity of their soundscape quality, and that suggested narratives of present, future and past that could be developed in the compositions based on the interviews and feedback from the public. From here, we decided to collaborate with local sound artists and share our findings to create the soundscape representations of those locations.

I was assigned by Joshua Taylor, the project Principle Investigator (PI), to create three soundscapes for the soundwalk audio tour. The first location is along the old harbourside rail tracks at the end of the M Shed after the steam crane, with a soundscape titled *Rail Tracks*; the second location is the pedestrian path between M Shed and Brunel's SS Great Britain, with a soundscape titled *Historic Medieval Harbourside*; and the third is at The Underfall Yard with a soundscape titled *Pump, Push, Pull and Roll*. These locations are shown in Figure 48. The soundwalk project has a 'hidden sound' theme: past, present and future. This suggested to me a strong link with my PhD research topic, which is exploring the unheard and hidden Malaysian soundscape and articulating my self-culture and identity through sound arts practice. At the time of the *Hidden Sounds of Spike Island* project, I was still not allowed to travel back to Malaysia due to Covid-19 restrictions, and so I could not carry out fieldwork directly for the Malaysian theme. However, my temporary home was in Bristol (and the neighbouring town of Clevedon), in effect becoming part of my identity. I took the opportunity to collaborate and to put the conceptual framework of my artistic inquiry into the *Hidden Sounds of Spike Island* soundwalk project, and get to know the unique history and narrative of the local culture of Spike Island Harbourside, Bristol.

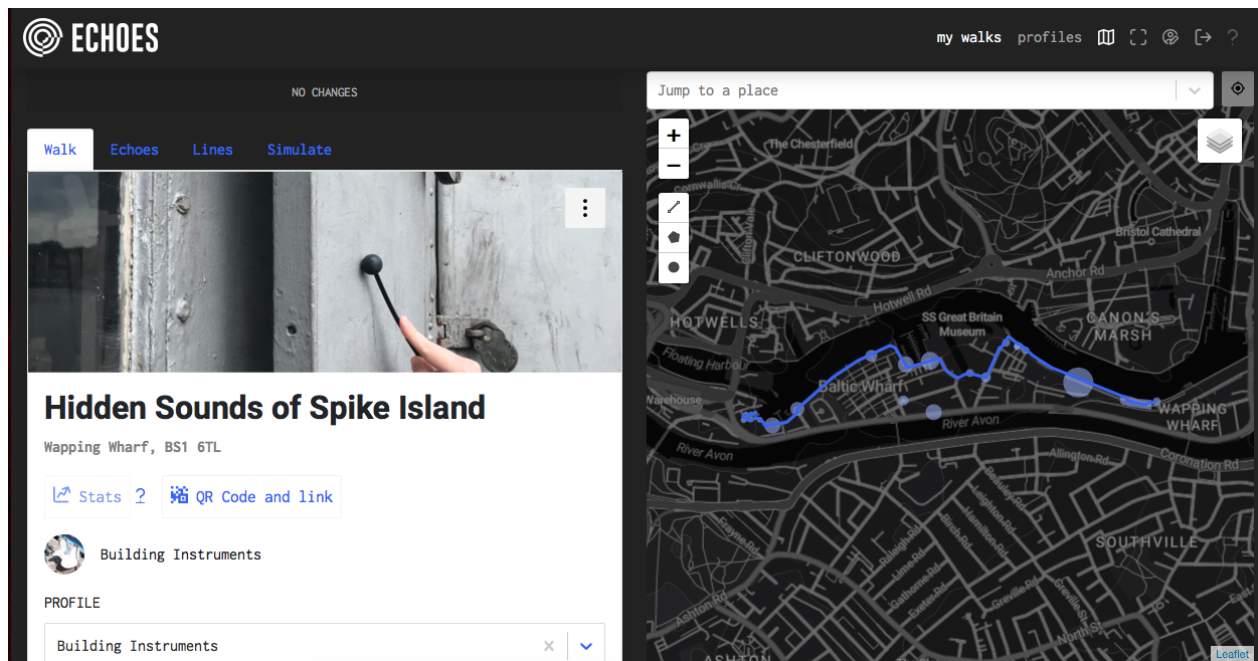


Figure 48 Geolocated audio tour app, Echoes is used in mapping the soundwalk route and installing soundscape sounds along the mapped soundwalk route.

## Rail Tracks

The Bristol Museums website outlines the recent history of the Harbour Railway:

In the 1940s and 50s, the Spike Island docks prospered, handling goods such as coal, esparto grass, wood, meat, as well as alcoholic beverages such as sherry and Guinness. During the 1960s the lines and harbour went into decline and some of the branches closed. In 1964, the Harbour Railway was closed, and the track lifted. The docks closed to commercial shipping in 1975 and the area became derelict although the return of Brunel's SS Great Britain in 1970 sparked interest in preserving what was left of the docks.<sup>185</sup>

The Bristol Harbour Railway is now run as a heritage railway, with steam trains providing rides for tourists on holiday weekends, but this operation was suspended during the Covid-19 pandemic, I referred instead to an archival video of the Harbourside rail tracks operation (Video 10.1: <http://surl.li/cjpps>). Responding to this, I was inspired to reuse railway footage which I had previously recorded in Malaysia, from the steam train that transports tin metal from the

<sup>185</sup> "The History of the Bristol Harbour Railway," Bristol Museums Collections, June 6, 2020, Accessed January 2, 2021. <https://collections.bristolmuseums.org.uk/stories/m-sheds-working-exhibits/the-history-of-the-bristol-harbour-railway/>.

world's deepest tin mine, at Sungai Lembing, once known as the El-Dorado of Asia.<sup>186</sup> I used a contact microphone AKG411L,<sup>187</sup> which is attached to the metal structure on the side of the cargo train body. This recording captures the sound activity of the railroad, and invites listeners to explore the timeline of railroad history and its great contribution to the global industrial revolution. My short piece *Rail Tracks* maintains the original sound qualities with minimal sound editing, except for subtle use of low pass and high pass EQ, including a minimal compression and limiting, to maintain the original identity or 'sonic image' of the sound.

### Historic Medieval Harbourside

This second soundscape, for the next location of the soundwalk, lies along the harbourside roadway that connects the end of the rail tracks near M Shed to the SS Great Britain Museum. Seeing the impressive 19th-century SS Great Britain, and the Matthew of Bristol (a 20th century replica of John Cabot's 15th-century vessel, usually moored along the same stretch of the harbour), reminded me of Bristol's long history as a maritime port, and prompted me to explore how the location might have sounded in Medieval times. To get an idea of the soundscape during the Medieval (as well as Baroque) period along the harbourside, I have studied visual materials such as paintings and medieval maps of locations around Bristol harbourside (Figure 49 & Figure 50). The landscape, objects and materials sketched in the those images gave me ideas for the sound materials that I could use to create this synthetic soundscape.

Environmental soundscape materials were identified for three main components, namely biophony, geophony and anthrophony. Anthrophony materials such as humans riding horse carriages, public noise around the harbourside, activities such as the handling of ship goods and others are taken from audio archive collections from websites such as freesounds.org with Creative Commons copyrights. Biophonic sounds such as the calls of seagulls, and geophonic sounds of wind blowing and swaying tree branches, were captured by me in field recordings around the location of the soundwalk. These sound collections are arranged to suggest an imagined sound environment of the Medieval period.

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<sup>186</sup> Por, Dr Oh Seong. "Sungai Lembing Used to Be Called El Dorado of the East." The Star, November 12, 2017. Accessed 11 January 2021. <https://www.thestar.com.my/lifestyle/travel/2017/11/12/sungai-lembing-used-to-be-called-el-dorado-of-the-east>.

<sup>187</sup> "C411 L." High-performance miniature condenser vibration pickup with mini XLR connector. Accessed January 11, 2021. <https://www.ake.com/Microphones/Condenser%20Microphones/C411L.html>.



Figure 49 Broad Quay ~ Late 18th century oil canvas painting attributed to Philip Vandyke.<sup>188</sup>

<sup>188</sup> (Image: brisray@yahoo.co.uk, Ray Thomas). "Bristol Docks." A History of Bristol Docks and Harbourside. Accessed January 11, 2021. <http://brisray.com/bristol/docks.htm>.





Figure 50 Medieval maps of Bristol - John Speed's map in 1611.<sup>189</sup>

### Pump, Push, Pull and Roll

The final soundwalk location was at the Underfall Yard, Spike Island. The location is a dry dock for the repair and maintenance of docked ships (Figure 51). There is also a pump house that is used to pump shipyard water, as well as powering a hydraulic mechanical system to control the shipyard's canal gate. Here, I had the opportunity to explore the ambient sounds of the industrial age of Bristol harbourside and to use those environmental sounds, especially mechanical sounds, in a synthetic soundscape that brings the listener's imagination to the industrial age of Bristol harbourside, busy with its shipping and trading activities.

Together with a group of researchers and fellow sound artists from the project team, I visited the Underfall Yard and the Pump House for an environmental sound recording session, with the guidance of the exhibition technician on duty. I was informed by the exhibition technician that the Underfall Yard and the Pump House were once the heart of Bristol Harbourside in its

<sup>189</sup> (Image: Robin Murray). "Seven Things This Medieval Map of Bristol Tells Us." BristolLive, November 30, 2019. Accessed January 11, 2021. <https://www.bristolpost.co.uk/news/bristol-news/seven-things-medieval-map-bristol-3592556>.



heyday.<sup>190</sup> I have recorded the environment of the Pump House location when the machines were silent, as well as the mechanical sounds while the Pump House was operating. Hydraulic mechanical sounds, that are normally hidden to the ears because they are contained inside the machinery and pipework, were successfully captured using a contact microphone. The collections of these sound materials are arranged according to the path of the soundwalk, leading to the Pump House with increasingly busy, energetic and very mechanical sounds, whereby the mix changes in real-time according to the user's location which the Echoes app measures via a Global Positioning System (GPS) feed. The soundfile supplied in this portfolio is a render of a representative sequence.



*Figure 51 The shipyard area and slipway at Underfall Yard.<sup>191</sup>*

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<sup>190</sup> "Our Story - Underfall Yard." Underfall Yard - The Heart of Bristol City Harbour, March 26, 2021. <https://underfallyard.co.uk/about/our-story/>.

<sup>191</sup> (Image) "Slipway Restoration Project 2022 - Underfall Yard." Underfall Yard - The Heart of Bristol City Harbour, July 26, 2020. Accessed March 9, 2021. <https://underfallyard.co.uk/2022/01/19/slipway-restoration-project-2022/>.

## Reflections and Conclusions

Over the past three years of researching and developing this portfolio, I had the sense that I was creating an eclectic body of work that would demonstrate varied branches of musical ideas and techniques, but whose application was nonetheless coherently reflecting my research theme, questions and objectives as posited in the introduction of this commentary. Although specific thoughts and ideas are apparent in particular pieces, an overall sense of commonality in musical concept, function and technique across the portfolio has also emerged. I believe I succeeded also in minimising the usage of clichéd materials in my works that might articulate my research topic but without original style, such as invoking a Malay soundworld (through traditional musical scales, tunings, timbre and gestures) that might be perceived by the audience too overtly.

Creating this portfolio, under the constrained recording and performance opportunities during the Covid-19 period, was mentally and practically arduous. As a music composer, live performance of a piece is important, as one gets to hear what works (and what does not) within real time and space and with people involved, just like driving a real car on the road instead of simulation. To address this, I had to re-strategise my portfolio proposal for the instrumental works, and adapt to the available opportunities. Eventually, I managed to produce two sets of works with multiple movements that are in line with the research theme, with contrasting musical elements in terms of instrumentations, timbre, energy of articulation and dynamics, electronic manipulation techniques, and the selection of recorded natural soundscape, that retain strong association with their cultural narrative origins. I was also able to find a ‘silver lining’ in the travel constraints of Covid-19, by applying my research concepts and techniques outside Malaysia in the ‘Hidden Bristol’ project.

The portfolio begins with the first movement of the *Miroirs of Malay Rebab* (MiMaR) cycle, *Berlabuh*, which serves as an introduction to the deeper exploration of the research theme, *Nada Bumi*. *Berlabuh* is a solo piano piece with fragments of various quasi-minimal, melodic and harmonic gestures that ebb and flow in aleatoric sequence, accompanied by a drone-like ambient soundscape on stereo fixed media that acts like an aquarium or a tank for the piano ‘lifeforms’. This introductory piece gently immerses the listener just beneath the metaphorical surface, preparing them for a deeper sonic journey into the heart of the research theme. The

piece concerns timbre, articulation and time-span that I believe listeners may be comfortable with, and is a good way to introduce this ‘musical’ portfolio. *Miroirs of Malay Rebab* (MiMaR) comprises mostly instrumental electroacoustic music, and the four movements presented in this portfolio exemplify the diversity and complexity of the research theme. These movements, namely *Miroirs of Malay Rebab* (MiMaR) I, III, V and VI offer varying levels of tension and energy, allowing the listener to resurface and engage with different facets of the abstract soundworld.

As the title of this commentary suggests, I started composing music for this portfolio with an emphasis on sound as raw material, particularly natural sounds rather than notes, echoing Gérard Grisey’s comments on *Les Espaces Acoustiques*: ‘To not compose any more with notes, but sounds’.<sup>192</sup> A broad sense of musical atmosphere based on organic, Nature-informed gestures, was emphasised in the development of the portfolio compositions. I made a ‘deep dive’ into selected unheard and hidden sounds of Malaysia’s natural heritage, and into the unique stories and tales that associate with the origin of the sounds and their environments. As a result, a set of five movements, *Seed of Life* (SoL 1-4, and 6) were composed, which concern textural and timbral development that flows sometimes in similar directions, shapes and form with recorded natural sounds from Malaysia, and sometimes varies and contrasts with them. This form of musical tension reflects the stories and tales of the sounds’ origins and environments that I had absorbed, imagined and drawn inspiration from, that may reflect my cultural identity and play it out in a time-based narrative.

As the world grappled with the initial stages of the Covid-19, I had sketched a version of *Miroirs of Malay Rebab* (MiMaR) I as an acousmatic work for octophonic playback, and *Miroirs of Malay Rebab* (MiMaR) II for amplified Viola Da Gamba and octophonic setup. However, I lost my routes to developing those pieces when Covid-19 became pandemic. As we emerged from Covid-19, I decided to compose another set of movements and revisit *Mirror of the Malay Rebab* (MiMAR) by adopting a structure of multiple movements, similar to the idea of *Seed of Life*, but here exploring the integration between recorded natural sounds with acoustic musical instruments, using live electronic manipulation as mediator and catalyst. For this portfolio, only four movements (I, III, V, VI) are presented, which were performed live

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<sup>192</sup> “From Our Repertoire: Grisey’s *Les Espaces Acoustiques*.” Universal Music Publishing Classical, November 20, 2014. Accessed January 11, 2021. <https://www.umpgclassical.com/en-GB/News/2014/11/Grisey-Les-Espaces-Acoustiques.aspx>.

during the post-Covid-19 period. Here, I drew on my advancing technical and conceptual skills in computer and electronic music, and particularly surround sound in live performance installations. In parallel, I had the opportunity to explore into other related fields, and collaborate with several interdisciplinary projects such as Web-audio technology development and sound-based geolocation.

Finally, I wanted to create a research output that can offer both art awareness and science experience in the longer term, to the public at any time and any place, and which would have ‘the power of people’ element. Drawing on the notion of the Internet of Things (IoT), I have created a pilot demo project that became part of the *Seeds of Life* (SoL) cycle, the *Nada Sfera* (SoL 5) project, which is available in the public domain for anyone to experiment with live natural soundscape as a means of music-making, to actively perceive and observe the voices of nature and place (*Nada Bumi*), and hopefully be drawn to learn more stories and tales about the sounds’ origin and their environment. This pilot project has a lot of room for further development, for example embedding machine learning for wildlife and environmental monitoring and music making in *Nada Sfera* Web. This will be the focus of my ongoing collaborative post-PhD learning and development in the future.

As I reflect on this transformative journey, I am reminded of the concept of *Nada Bumi* that underpinned my research theme from the very beginning. This concept, drawn from the opening of this thesis, has been a guiding light throughout my work, and it is fitting to reintroduce it here in the conclusion. *Nada Bumi* has served as a framework to express the spirit of place and cultural identity through sound arts practice. In revisiting this concept, I can affirm that my creative journey has been deeply rooted in the exploration and accentuation of Malaysia's biophonic and geophonic materials. Through my compositions, I have strived to engage with the narratives hidden within the sounds of the land, forging a unique and profound connection between self, culture, and the environment. While the path has been arduous, it has been a journey of discovery, innovation, and resilience.

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