THE COMPOSER PHOTOGRAPH: A FRAMEWORK TOWARDS DESCRIBING OVERTONES IN ANIMATED NOTATION

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ABSTRACT

This paper explores a set of notational possibilities for overtones on the double bass. Engaging animated notation approaches across two compositions, *Wormwood* (2022) and *Ice Bubbles* (2023), an imaginative solution is sought to address some of the issues and confusion surrounding traditional overtone scoring for string instruments. Photographs taken by the composer are engaged as sketches to form a starting point for both works, and as a source for visual information for the representation of particular overtone pitch sets and timbre. This is intended to create a more intuitive method for the depiction of instrument preparations and effects. In *Wormwood*, insect patterns photographed in the bark of a tree were drawn and put into motion on a computer. *Ice Bubbles* begins with a map of a floating ice island that is treated as territory for a boat journey from one shore to another. These starting points provide an overarching theme for the design of further details, resulting in two works that prompt new and unfamiliar creative decisions from the performer, responding to focussed compositional parameters in real time. This paper outlines the aims and processes of what we term the 'composer photograph' for a double bass performance of these works by the composer.

1. INTRODUCTION

Sketching has been used by humans to describe the visual world since prehistoric times [1]. As different tools have evolved, they have been adapted for sketching. Photography can be similar in "approach, process, speed of execution, and apparent honesty to nature to processes such as the 'plein air' sketch used in landscape painting" [2]. It is a process that makes the most of opportunity - what happens to be found or visible at a particular location can be captured and used as a basis for further development. In context of this paper, the term 'composer photograph' is used to describe this initial capture for musical purposes. The composer photograph is a photograph taken by a musician with the intention of using it as foundational material for a performance score. These photographs are used as frameworks for describing overtones in animated notation and a starting point for compositional explorations – seen in both *Wormwood* and *Ice Bubbles*. Once captured, their finer details are enhanced in Adobe Photoshop and put into motion to create an animated score.

Animated notation is a predominately graphic music notation that engages the dynamic characteristics of screen media [3]. It is particularly useful for representing sounds that are not served well by more traditional 'Common Practice Notations (CPN)' [4]. This includes music without a pulse, with electronic sound sources, or compositions where more performer input is desired. Further, screen media offers expanded possibilities for music notation, such as colour, dynamic motion, and the addition of other elements, such as audio tracks, into the score, creating a 'super score' [5].

1.1 Motion

The motion in animated notations can be generated and leveraged via different processes in these works. Preliminary eye tracking studies have demonstrated that musicians follow the motion in animated scores in a similar way to common practice notated works [6]. Bergrun Snæbjörnsdóttur's piece *2 Viti* (2012) [7] features a score that reveals itself gradually as the piece unfolds. The motion is followed by the performers, two guitarists in this case, and invites them to make decisions in real time. Known for creating "mutable, breathing, living structures through experimental performance practices and notation" [8], Snæbjörnsdóttur often projects scores onto the floor. This invites a sense of theatrical interplay visible to the audience. A focussed vocabulary of parameters is indicated in the score key, and the result is a slowly evolving, slippery sound world which would be impossible to notate any other way.

1.2 Pace of Change, Generative Form

Animating notations allows for the "revealing of sonic parameters in real time" [9] whereby the unfolding of a score can take on different elements of pacing as determined by the composer; either "randomly or planned" [9]. In animated notation, time may be tightly controlled across a set duration and specific time markers, but also lesser so in abstract forms. An example of the latter is seen in Reich's

Pendulum Music (1968); a text composition whereby "the piece's duration is dependent on the pace of the decelerating microphone trajectories" [10, p. 65]. It would be impossible to notate this motion in a way that is accurate, or in anyway useful, for each performance, however the piece provides an example of a work in which its pace and duration depends upon the velocity and speed of the objects to generate sound.

1.3 Timeline, Timeflow

Desainte-Catherine et al. (2013) define two conceptions of time in composition and performance – 'timeline' and 'timeflow', which are engaged in *Wormwood* and *Ice Bubbles*. 'Timeline' relates to chronology of musical events in the score itself, and the ways in which specific points of time correspondence or duration take shape in the 'authoring' of the music. The 'timeflow' represents data flow, relating to dynamic events that happen during the performance and the use of software to generate sequenced data in real time [11]. The interpretation of an animated score can exist across both paradigms, and as such, the combination of both can be incorporated into a work through the use of static data and dynamic events. The notational system in *Ice Bubbles* is split into two completely separated worlds: a static part filled with time-stamped static events, and a dynamic part filled with dynamic events handled by functions [12].

As such, there is potential for the combinatory fixed and active elements within animated notation to shift the performer's relationship with time, moving beyond numerical cues to incorporate focus on data flow. The use of both 'timeflow' and 'timeline' as corresponding paradigms can allow for a "unique musical experience with each performance, coupling the mercurial nature of improvisation with the more contemplative aspects of composition" [13]. An example is seen in Arne Eigenfeldt's *Unnatural Selection* (2014) – a work with challenging compositional parameters that generates new material across each iteration [14]. Subsequently, real-time interpretation of fixed score elements in generative animated notation such as this opens a variety of shifting possibilities across live performances.

As is discussed in the following sections, *Wormwood* and *Ice Bubbles* are works that operate within the time paradigms outlined above. In each work, generative pitch sets are interpreted in real-time. In *Ice Bubbles* the programmatic nature of the work brings multiple elements together to create an experience and reimagine a boat journey through a frozen lake.

1.4 Colour

Colour can be used in a wide range of ways in a musical score. Many composers use it to differentiate parts for the performer, or any variety of possibilities to the performer. Different shades denominate gradations in dynamics, timbre or other elements. An example of this 'musical literacy' [3] is seen in both *Wormwood* and *Ice Bubbles* whereby the use of colour not only represents pitch, but also timbre and density. This element can alter the way in which the performer responds to instruction more intuitively.

2. OVERTONE NOTATION

The prevalence of overtones in contemporary double bass repertoire exists across a limited and specialist area within composition and performance practices. The traditional and standardised notation system for overtones remains unresolved and spatially counterintuitive, leading to confusion amongst performance communities. In 'Harmonics on the Double Bass' (2010), Eric Daino argues:

> The twenty-first century presents many more options and variations for use [of overtones] by the performer and composer… In particular, there still remains a great deal of room for exploration and perfection of extended harmonics techniques on the double bass [15, p. 15].

A renewed interest in the overtone series post twentieth century has increased their prevalence in contemporary double bass repertoire across their natural and extended forms - yet this gradual evolution has somewhat furthered confusion around the use of overtones in regard to their performance and fingerboard placement, particularly across higher nodes; often the information becomes "too cluttered to adequately display what is necessary" [15, p. 4]. To counteract this ongoing issue, the two works discussed in this paper centralise the role of the performer/composer and subsequent creation of new work as a way of alternatively representing and communicating overtones in composition. They build on the work of leading performer/ composers in the field of overtone notation, including Fernando Grillo, Håkon Thelin, Stefano Scodanibbio and Mark Dresser – all of whom engage a variety of standardised overtone scoring methods in personalised combinatory ways [16]. Scodanibbio's *Sequenza XIVb* (2004) [17] uses a combination of tablature style notation, a double stave system and the 'o' symbol to denominate overtones in complex forms. Dresser's *K-Tude* (2010) uses partial numbers and the double-stave system to clarify pitch output across advanced harmonic nodes [18]. Both works highlight the variety of different ways in which complex overtone techniques can be combined to effectively communicate information to the performer. However, the limited range of extant methods commonly lack imagination in regards to the location of a harmonic node and its sounding pitch; especially as the techniques advance and become more finite and locationally specific.

Wormwood and *Ice Bubbles* seek to lessen this "discrepancy" [15, p. 2] by using graphic notation as a way to avoid the traps of standardised overtone notation, and move the focus on enabling a specific harmonic to look closer to how it sounds. Nodal numbers are derived from pitch sets across generative forms, focusing on the "physicality of music-making" [10, p. 66] as opposed to a set pitch output. Both compositions explore a visualisation of overtone relationships into an animated graphic format from an initial 'composer photograph', with the aim of creating a form of action notation that hones in on fingerboard placement and

physicality, opening new creative pathways in improvisation, composition and performance.

2.1 Fingerboard Anatomy

As the use of overtone techniques in contemporary double bass repertoire continues to evolve, a thorough physical understanding of the fingerboard anatomy and problem-solving is commonly required prior to performance - particularly whereby the sounding pitch does not correlate with the fundamental. As discussed, traditional notation techniques have been innovated and combined in idiosyncratic ways in the work of leading performer/composers such as Thelin, Scodanibbio and Dresser; however the limitation of standardised overtone notation systems continues to pose issues in regards to the physicality of soundmaking across this technical area.

2.2 Action Notation

Action-based notation can 'mediate' the relationship between body and instrument; akin to a 'choreography' of soundmaking [19]. In composition, these systems can be personalised in the way that they illustrate gestures upon an instrument where the focus is on spatial and body awareness, or "what to perform and how to perform it" [10, pp. 65–66] – strengthening a performer's relationship with their instrument and the operational aspect of realising sound. Australian composer Vincent Giles identifies a growing idiosyncrasy across modern notation systems post twentieth century, with an increased level of specificity across compositions and their individualistic ways of communicating information to the performer [19]. Aaron Cassidy's *Second String Quartet* (2013) is one such example where the score represents

> a physical mapping of the instruments in question in a type of tablature notation that shows the physical movement necessary in the piece – the performative gesture – rather than the resultant sonic output, which is variable [19, p. 1].

The indeterminate nature of the resultant sound is largely dependent on a list of variables including hand size and bow quality, with a greater focus on the notation movement itself as a part of the piece in its realisation. In a similar vein, Helmut Lachenmann's *Guero* (1988) [20] for solo piano incorporates a proportional topographic view of the instrument. Separated into three pitch registers, note heads of various shapes and fillings indicate the nature, direction and duration of the physical gestures. The resultant sounds are determined by the movement mapping embedded into the score (Figure 1):

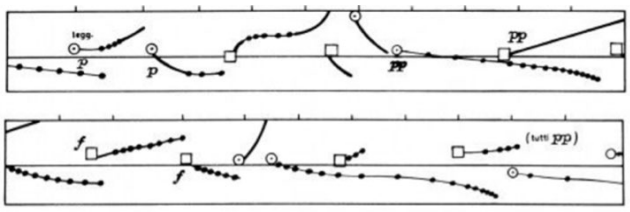

Figure 1. *Guero*. (1988). Physical gestures embedded in the score indicate sounds, techniques, and directions.

Similarly, *Wormwood* and *Ice Bubbles* explore the use of pitch maps and tablature style action-notation systems to enable a focus on what Kojs calls the 'physicality' of overtone production [10, pp. 65–66], prioritising eye-hand coordination and gesture at the centre of the sound. Instead of a focus on the desired pitch output, the performer is presented with information regarding the spatial position of a harmonic node; as such, the relationship with the fingerboard enters a visual, intuitive space in interpreting score materials. This creates what Kojs identifies as:

> music (that) is treated as a physical process, engaging our bodies and objects in actions. Experiencing music enactively - that is creating, notating, and performing it through such lens and ear - enriches our musical imagination and connects it to our everyday world [10, p. 71].

3. THE COMPOSER PHOTOGRAPH

The 'composer photograph' is used as a compositional framework in both *Wormwood* and *Ice Bubbles*. Upon the initial capture, the selection of visual material is a process that makes the most of opportunity; what happens to be found or visible at a particular location can be captured and used as a basis for further development within a score. If this capture is made/considered/found/identified by a musician, with the intention to sound the imagery, then this can be thought of as a composer photograph. Photographic details (i.e. colours, textures, shapes, lines) are accentuated and used as compositional foundations to intuitively represent overtones. These elements are used in combination with generative pitch sets which initiate a sense of overall pacing and flow to the performer.

Figure 2 outlines three phases of compositional development using the composer photograph as a method:

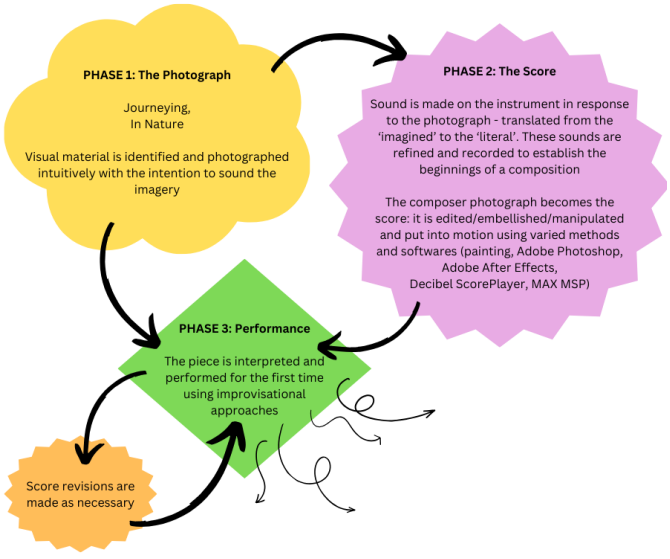

Figure 2. *The Composer Photograph*. (2024). Three phases of compositional development.

As shown in Figure 2, Phase 1 for these works takes place when journeying in nature. 'Journeying' here refers to time spent in new natural environments, where senses

are heightened. This leads the composer to photograph visual material of interest with the intention of engaging with it as a score. Phase 2 involves the making of the score. Details are accentuated in Adobe Photoshop and put into motion (i.e. linear patterns, textures, colours) using software such as MAX [21] in the case of *Wormwood,* and the Decibel ScorePlayer [22] in *Ice Bubbles.* The performer ascribes sonic ideas that have formed in response to the visual stimulus by editing the image to be a score. In Phase 3, the work is interpreted for performance, responding to a combination of compositional approaches. The cycle begins again with refinements discovered as part of the performance process. As seen in Figure 2, the three phases create an iterative process, where the composers photograph provides a site for further score and performance development. This is described in more detail below.

4. WORMWOOD

Wormwood [23] is the first of a series of solo double bass works which tests the implementation of composer photographs of organic structures. Pitch sets are ascribed to a series of worm tracings in the bark of a tree, photographed in the Tasmanian forest in September 2022. The 'Glowing Edges' effect in Adobe Photoshop was applied to the images to enhance the linear patterns, zooming in on areas of interest (Figure 3):

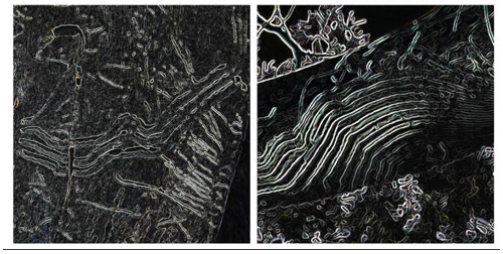

Figure 3. *Wormwood*. (2022). Worm patterns in tree bark, effected in Adobe Photoshop.

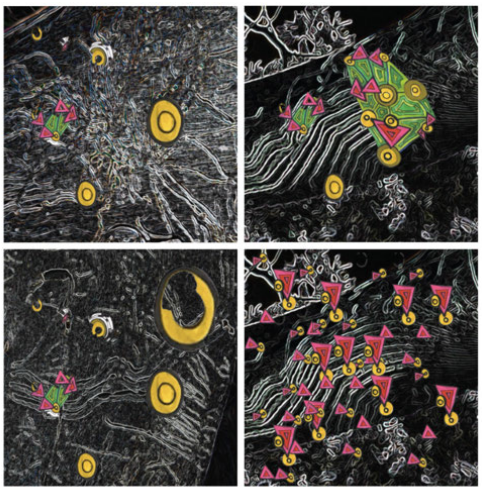

Figure 4. *Wormwood*. (2022). Preliminary experiments of overtone shape categories, drawn and overlaid over composer photographs of worm tracings in photoshop.

Multiple shape categories within the tree bark arose. These were drawn and overlaid upon the original image, then assigned different colour categories to indicate specific overtone relationships (Figure 4).

These images were then put into motion on a computer via a MAX patch. This generated changes and transitions in the shapes, creating an animated score. Variance in speed, motion, line and colour across each of the shapes indicates different arco techniques (ricochet, smooth, pulsating) and natural/artificial harmonics. Arco techniques are described through a left-to-right wobble of the shapes (ranging from slow to fast) and their smooth or jagged edges to represent articulation. Natural/artificial harmonics are represented in the multiplicity of the shapes; the first shape describes the fundamental, and each additional shape doubles the frequency and resulting pitch (Figure 5):

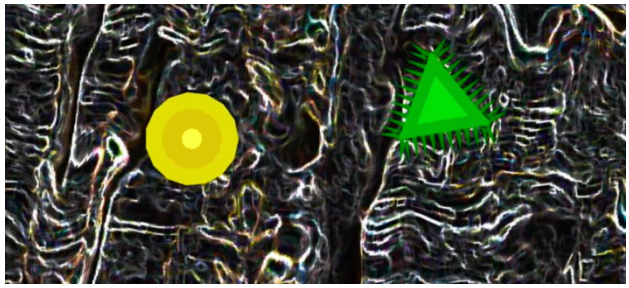

Figure 5. *Wormwood*. (2022). Screenshot of overtone shape categories in the animated score. The yellow shape indicates pulsating arco across a multiplicity of three (i.e. overtones 1, 2, 4). The green triangle indicates arco ricochet across multiplicity of two (i.e. overtones 3, 6).

Randomisation is implemented to break habitual improvisatory patterns with an increased sense of intention across the pitch sets. The use of animated notation subsequently alters the decision-making process into a more focussed state, opening a transitory space to discover alternate creative pathways in performance. The fluidity of the image evokes a sense of non-urgency, inviting more consideration across the parameters within the score key; colour represents pitch selection, and shape outlines and their corresponding movements represent articulation. The generative component of the score and these materials propels sound that is enlivened from the moving image - the sonic results of which rely on motion for its realisation [26].

5. ICE BUBBLES

Ice Bubbles [24] explores plucked overtones across an animated graphic score projected over the double bass, which is laying on its back. The piece illustrates a ten-minute boat journey from Suomenlinna island to Helsinki in the Finnish winter. The work is a sonic representation of the experience of daily ferry transit, during which the vessel would break through the frozen ice from shore to shore. Generative pitch sets and instrument preparations are subject to a variety of electronic effects that are described in the score. A composer photograph of an ice sheet forms the basis of the sketch and score materials.

The floating ice sheet is projected upon the double bass – or 'boat'. Four coloured gradients within the animated image represent shifting density, incorporating use of the

Chase Bliss MOOD MKII pedal [25] on the double bass to multiply sounds as the ice densifies using the delay and slip effects [26]. An identical gradient map appears in Decibel ScorePlayer software's canvas mode, in combination with a series of generative overtone pitch sets, to which the player responds. Instrument preparations incorporate aluminium foil, finger picks, scordatura and contact microphones to accentuate the tactility of crackling ice. Focussed contact microphone placement on the bridge further highlights the sonic evocation of crackling, capturing each individual overtone in both their raw forms and with use of effects to multiply these sounds and transform pitch as the ice thickens and cracks.

The score for *Ice Bubbles* comprises two parts, incorporating components of timeline and timeflow [11]:

1. Overhead Gradient Map/Floating Ice Sheet (projected onto the double bass) – *timeline*
2. Pitch Set Generator (read in the Decibel ScorePlayer software) – *timeflow*

5.1 Overhead Gradient Map / Floating Ice Sheet (timeline)

An overhead projection sees an animated image of frozen water projected onto the double bass, which is laid horizontally on its back – i.e. 'the boat' (Figure 6):

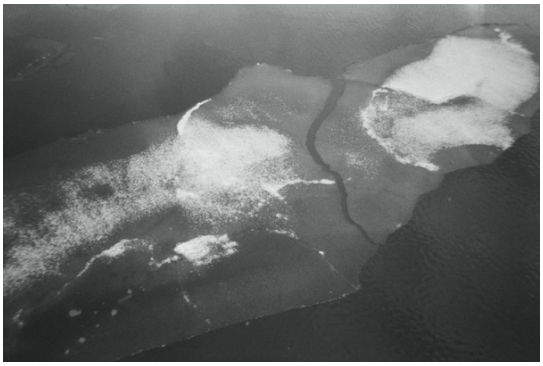

Figure 6. *Ice Bubbles*. (2023). Composer photograph.

Figure 7. *Ice Bubbles*. (2023). Pink gradient with aluminium foil. Indicates maximum density and use of FX.

Ice sheets within the photograph are highlighted with different coloured gradients (Figures 7, 8), to which the performer responds. Each of the coloured gradients indicates a varying degree of density and rate of change, resulting in a symmetrical compositional arc inspired by the nature of the frozen lake; closest to the shore, the ice is prone to melting due to more movement in the water, whilst the middle of the lake is thick and increasingly immovable.

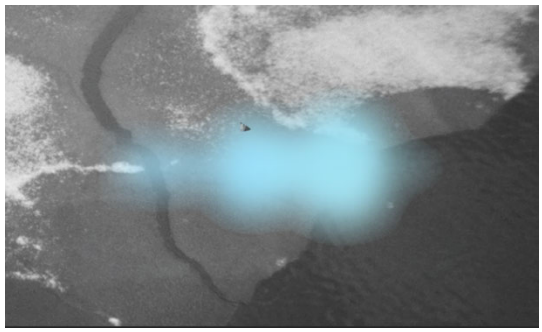

Figure 8. *Ice Bubbles*. (2023). Blue gradient with outline of the double bass (i.e. the boat). Indicates sparse density, without FX.

The gradient arc is explored across the following compositional parameters (see Table 1):

Gradient	Density
light blue → blue	Sparse → less sparse
Blue → purple	Becoming moderately dense
purple → pink	Moderately dense → Dense *** incorporates slip FX on MOOD MKII for multiplication + gradual addition of alfoil
deep pink → *alfoil*	Dense → Maximum density *** incorporates delay FX on MOOD MKII for multiplication + alfoil

Table 1. *Ice Bubbles.* (2023). Gradient parameters, representative of density, effects and preparations.

The amount of highlighted ice sheets increases towards the middle of the work as the ice densifies, then tapers off as the ferry moves back towards the shore. This element of the score is fixed, akin to the concept of a static timeline, but without a visible numerical duration. The pacing of the piece aims to evoke a sense of blurred time when travelling by sea.

5.2 Pitch Set Generator (timeflow)

Twelve pitch sets are generated in real-time within the Decibel ScorePlayer, using the canvas mode. The pitch sets appear across a series of randomised slides, to which the performer responds in combination with gradient information from the overhead projections. As the gradient begins to indicate more density, the pitch sets incorporate use of slip and delay effects on the MOOD MKII in combination with aluminium foil wrapped around the top two strings.

Pitch sets represent the four strings of the double bass, placed vertically in the score image frame (lowest to the left, highest to the right). Overtone numbers are placed within the coloured shapes to communicate desired pitch output and placement. Directional orange arrows indicate the ordering of the pitches (Figure 9):

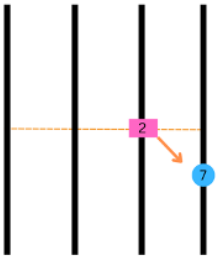

Figure 9. *Ice Bubbles*. (2023). Pitch Set #5 – the 2nd overtone on the 2nd string (in scordatura) is to be plucked with a fingerpick on the right hand index finger, followed by the 7th overtone on the G string with the left hand.

The generative form in this component of the piece incorporates the essence of timeflow to allow for dynamic real-time interaction with fixed materials [11]. The fixed gradient arc from shore to shore propels an abstract sense of time, conceptualising the journey without numerical cues. The use of effects allows for pitch transformations and multiplications across purple to pink gradients as the density grows, augmenting the metallic crackles from vibrating aluminium foil wrapped around the strings [33].

6. CONCLUSIONS

The use of the 'composer photograph' in both *Wormwood* and *Ice Bubbles* provides a framework for the creation of a new graphic notation system for overtones on the double bass. The visual information inherent within both initial sketches allows for a sense of zooming in; deriving information from the raw image to represent different parameters of sound, and ways in which to perform overtones. The incorporation of animation within both of these works creates a sense of dynamic and fixed data flow allowing for real-time interpretation of sequenced parameters. In *Ice Bubbles*, the overhead projection of the floating ice sheet remains fixed with the gradient arc, whilst the generative pitch sets are randomised to allow for interactivity and variance across performances. The notion of these two corresponding time paradigms within the programmatic nature of *Ice Bubbles* brings multiple elements together to create an experience and signify a boat journey through a frozen lake, resulting in an abstracted re-imagining of a distant memory. In *Wormwood*, the generative pitch sets appear on the screen, prompting creative decisions from the performer. The slowly morphing insect-like patterns on screen invite a sense of gradual motion and increased intentionality across each performance as it varies and evolves. The design principles across both works have informed alternative ways in which to communicate overtone techniques to the performer, inviting more intuitive ways to practice and guide the performance of overtones.

Acknowledgments

The Decibel ScorePlayer component of *Ice Bubbles* has been developed in collaboration with Aaron Wyatt. The video projection for *Ice Bubbles* has been developed in collaboration with Ciaran Frame. The MAX patch for *Wormwood* was developed by Ciaran Frame. *Wormwood* was premiered in Hamburg in 2022 as part of The Digital Score Project (DigiScore), which was supported by the Hamburg Institute of Advanced Study, the Hochschule für Musik und Theater Hamburg, and the Sir Zelman Cowen School of Music at Monash University.

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