

University of Tasmania

‘Writing Wrong Right’:

An Investigation in Composing with Extended Techniques

An Exegesis Submitted to

Conservatorium of Music

in partial fulfilment of the requirements for the degree of

Bachelor of Music with Honours (or Bachelor of Music (Elite) with Honours)

Conservatorium of Music

by

Rhys Gray

Hobart, Tasmania

2020-08-31

Contents

Brief Background	1
Key Questions	2
Aims	3
Literature Review	3
Physics	8
Extended Techniques	10
Methodology	16
Outcomes Of This Project, and Why It Is Relevant .	17
Outputs	17
Bibliography	19

Brief Background

In 2019, I completed my Honours exegesis at the University of Tasmania, titled ‘Harmonic Based Extended Techniques and their Compositional Applications’, a study of three extended techniques applicable to stringed instruments; half-harmonics, subharmonics, and multiphonics. I am interested in pursuing this line of research further, as I believe that there is still more to be learnt about the techniques that I have already covered, and that many other extended techniques lack the literature that composers can use to make informed decisions about their use. The purpose of this study will therefore be to explore extended techniques further, filling literature gaps and incorporating the techniques into my own artistic language.

Cellist and new music specialist John Addison has expressed an interest in developing his technique of ‘double touch’ harmonics with me, which he describes as ‘[...] where one engages two of the harmonic nodes on the same string in the same series simultaneously, which allows upper harmonics in the series that have never been stable nor dependable to become reliable and certain.’

His technical and theoretical knowledge will be useful in testing and conducting practical research on the techniques, with eminent composer Sofia Gubaidulina stating ‘I am convinced that we are dealing with a brilliant artistic personality here. It is to be expected that John Addison’s activities as an interpreter will have a vital influence on the next generation of musicians.’¹ As a

1. Personal correspondance between John Addison and Sofia Gubaidulina.

spectralist composer, I am primarily concerned with extended techniques that make use of microtonalities, exploit the harmonic series, and spatial acoustics. The recent shift of the Conservatorium of Music to the Hedberg provides an exciting opportunity to conduct research using the variable acoustic panels, and the ways that they can be used in site-specific works. The scope of my research would therefore be surrounding the treatment of these extended techniques; a holistic review of the techniques from the view of a composer and performers will shed light on the way that the techniques can best be produced.

As a composer, exploring subharmonics, multiphonics, double touch harmonics, and other extended techniques is particularly exciting, as they are fertile ground for new and unique sounds that can be used to develop my musical identity. I plan for the resultant thesis to be a practical document that composers and artists can use as a reference manual for the production and implementation of the techniques in their own practices.

Key Questions

- How are extended techniques used in current literature, and are there ways to improve their delivery and make them more accessible to composers, performers, and audiences?
- Are there extenuating circumstances that keep these techniques from entering mainstream literature, or are they simply still in their infancy?
- How have other artists used these techniques, and what can we learn from artists that have already incorporated them into their practice?

- How can I incorporate these extended techniques into my personal practice and develop a unique style with them?
- How well understood is the physical production, and are there ways we can improve production of the sound in a performance context?
- What variables impact the production of these techniques?
- What can we learn from the way that these techniques are physically produced?

Aims

- Develop my artistic voice and personal style through the incorporation of these extended techniques into my practice.
- Broaden the field of research by studying extended techniques that have not been extensively researched.
- Develop ways of communicating the best practices of techniques to increase their accessibility to others by formalising notation.
- The best practice of how to produce the techniques will be synthesised by understanding the physical properties of the techniques and how they are produced.

Literature Review

This PhD continues upon the previous research that I conducted during my Honours, and there is significant overlap with the two topics. Therefore, the first item that is worthy of mention would be ‘Harmonic Based Extended Techniques and

their Compositional Applications’, which includes a ground-level review of the seminal literature in the field.² However, due to the limited scope of the exegesis, there were significant omissions, so for the sake of completeness its contents will be reviewed under the lens of ‘composing with extended techniques’. Additionally, there are a number of sources that were either missed or cut from the initial literature review for sake of brevity.

Unlike standard pedagogical models, wherein the student learns from the teacher, the methods used in this exegesis are a more collaborative, and less rigid practice. Composers typically will have a performer in mind when they compose a work, and collaborate with them, working to find what works for the artists and instrument. However, in subsequent performances, that direct connection to the composer is often unavailable, and the performer is left to interpret the paratext, without direct instruction from the composer. Paratextual instruction can vary in degrees of specificity, and will often be printed in the frontmatter of the work. Where there is a well established understanding of the technique (such as the Bartok pizzicato technique, which has been accepted into the canon of ‘standard’ techniques, and is no longer considered extended), this is not an issue, but can pose issues in the case of techniques where there is a great deal of variance possible, such as multiphonics and subharmonics. In some cases, the performer must rely on previous works to build a contextual language in which to interpret esoteric markings, or use previous recordings of interviews and performances to ascertain the

2. Rhys Gray, “Harmonic Based Extended Techniques and Their Compositional Applications” (Thesis, University of Tasmania, 2019).

composer's intent. Understanding the composer's intent is a crucial part in the preparation process, and the ability to accurately reproduce the composer's intent may negatively impact a work's longevity in the literature. Many academics have recognised the deficit in training in extended techniques, both in their base form and their composer-specific implementation (which may vary from composer to composer, or piece to piece). Violist Sarah Wei-Yan Kwok discusses this in her thesis 'Breaking the sound barriers : extended techniques and new timbres for the developing violist', where she commissions six etudes for viola exploring extended techniques, along with an investigation into pedagogy.³

The composer-performer collaboration dynamic has been explored at length; the most famous example being the virtuoso pianist Paul Wittgenstein, whose career came to a halt during World War 1, when he lost his right arm. Afterwards, he began commissioning leading composers to write for him, resulting in Richard Strauss' 'Parergon zur ', 'Sinfonia Domestica for Piano and Orchestra', Maurice Ravel's 'Piano Concerto for the Left Hand in D major', and further works written by Hindemith, Korngold, Britten, and Prokofiev, to name a few.⁴ Collaboration with the intended performer is crucial to a composer's ideas being realised accurately, as articulated by Jack Barnes, who stated:

3. Sarah Wei-Yan Kwok, "Breaking the Sound Barriers : Extended Techniques and New Timbres for the Developing Violist" (University of British Columbia, 2018), accessed May 30, 2019, doi:10.14288/1.0365754, <https://open.library.ubc.ca/cIRcle/collections/ubctheses/24/items/1.0365754>.

4. Georg Predota, "Paul Wittgenstein's Voice And Richard Strauss's Music: Discovering The Musical Dialogue Between Composer And Performer," *Fontes Artis Musicae* 61, no. 2 (2014): 107, JSTOR: 24330425.

My collaboration with Mathieson-Sandars allowed for subtle but important improvements to *Lines, Contexts and Freedoms*. Certain aspects such as the composer hearing his piece for the first time, experimenting with different pianistic timbres and creating more comfortable hand distributions were among the most useful outcomes of our collaboration. As the performer, it was useful for my interpretation to learn [the composer’s] intent behind the gestures; that the effect of dynamic shaping was not desirable for all of them.⁵

Discussion being needed with the composer to learn the composer’s intent suggests that there was information being provided to Barnes that was not present in the paratext. Future performers of the work that was commissioned by Barnes may not have the same level of access to the composer, hence the need for a thorough and precise documentation of the intended sound being available.

Sheet music is an abstracted conception of a musical work; the printed paper is merely a set of instructions that are interpreted by the performer, in order to express a musical idea that only the composer truly knows. Without a perfect abstraction of what the composer imagines, a ‘perfect’ reproduction is impossible. Indeed, even if there *was* a perfect reproduction, the variance in instrumental timbre and other facets of the process render it a fool’s errand. The Platonic ideal is unattainable, and perhaps why little effort has been made to make further progress towards the liminal.⁶

Attempts at combining notation with composer intent have been made, with Eftiha Victoria Arkoudis’ ‘Contemporary Music Notation for the Flute: A Unified

5. Jack Barnes, “An Examination of Composer-Performer Collaborations in a Contemporary Setting” (Thesis, University of Tasmania, 2017), 20.

6. **citation needed; obviously.**

Guide to Notational Symbols for Composers and Performers’ building on the work of Robert Dick.⁷

Instructive manuals are typically in one of two categories; performer-oriented, in which the techniques presented are articulated in a performer-focused context, and composer-oriented; orchestration manuals which dictate the end results. For brevity, these usually do not intersect, or at least are not written comprehensively with both the composer and performer in mind. The lack of literature that encompasses the entirety of the production of sound process, from the action to the resultant, is slowly being rectified, particularly with online resources such as Heather Roche’s work in clarinet multiphonics, and Fallowfield’s with CelloMap gaining popularity.⁸

Notation Manuals

Notation has long been the domain of Kurt Stone and Gardner Read being the authoritative voices, writing extensively on the subject beginning in the 1970s.⁹ Additional texts by David Cope and Erhard Karkoschka supported these with their


7. Ms. Eftihia Victoria Arkoudis, “Contemporary Music Notation for the Flute: A Unified Guide to Notational Symbols for Composers and Performers” (DMA, West Virginia University Libraries, 2019), accessed June 29, 2020, doi:10.33915/etd.3860, <https://researchrepository.wvu.edu/etd/3860>.

8. Heather Roche, “Heather Roche,” accessed August 27, 2020, <https://heatherroche.net/>; Ellen Fallowfield, “Cello Map,” accessed May 31, 2019, <http://www.cellomap.com/>.

9. Kurt Stone, *Music Notation in the Twentieth Century* (New York: W. W. Norton & Company, 1980); Gardner Read, *Compendium of Modern Instrumental Techniques*, 1st ed. (Westport, Connecticut: Greenwood Press, 1993); Gardner Read, *Contemporary Instrumental Techniques* (New York: Schirmer Books, 1976); Gardner Read, *Music Notation: A Manual of Modern Practice*, 2nd Edition (New York: Taplinger Pub. Co., 1979).

own contributions.¹⁰ Editor of Faber Music, Elaine Gould’s seminal ‘Behind Bars’ gave an authoritative voice to the methods of notating along with the building blocks for techniques which she felt had not been developed to the point of consensus.¹¹

Physics

In order to be able to accurately prescribe instructions on how to produce these techniques, there must be an understanding of the underlying physics. Helmholtz provides our basic understanding of the stick—slip motion which makes a bow produce sound on a string.¹² Knut Guettler and Håkon Thelin have provided extensive research into how the string can produce multiphonics.¹³  V. F. Schumacher, Kenneth Marskall, and Anders Askenfelt contribute additional aspects to the

10. David Cope, *New Music Notation* (Dubuque, Iowa: Kendall/Hunt Pub. Co, 1976); Erhard Karkoschka, *Notation in new music: a critical guide to interpretation and realisation* (Tonbridge: Universal Edition, 1972).

11. Elaine Gould, *Behind Bars*, 1st (London: Faber Music, 2011), iii.

12. Hermann von Helmholtz, Alexander John Ellis, and Henry Margenau, *On the Sensations of Tone as a Physiological Basis for the Theory of Music*, 2nd English ed, Dover Books Dover Books on History of Science and Classics of Science, S114, OCLC: 310478879 (New York: Dover Publications, 1954).

13. Håkon Thelin and Knut Guettler, “Analysis of Bowed-String Multiphonics,” in *Analysis of Bowed-String Multiphonics* (Sydney, Australia), https://www.acoustics.asn.au/conference_proceedings/ICA2010/cdrom-ISMA2010/papers/p15.pdf; Håkon Thelin, “Multiphonics on the Double Bass” (Norwegian Academy of Music, 2011), <http://haakonthelin.com/multiphonics/uploads/files/4%20Multiphonics/Multiphonics%20on%20the%20Double%20Bass.pdf>; Knut Guettler and Håkon Thelin, “Bowed-String Multiphonics Analyzed by Use of Impulse Response and the Poisson Summation Formula,” *The Journal of the Acoustical Society of America* 131, no. 1 (January 2012): 766–772, accessed May 28, 2019, doi:10.1121/1.3651251, <http://asa.scitation.org/doi/10.1121/1.3651251>; Knut Guettler, *A Guide to Advanced Modern Double Bass Technique* (London: Yorke Edition, 1992); Knut Guettler, “Wave Analysis of a String Bowed to Anomalous Low Frequencies,” *Catgut Acoustic Society*, II, 2, no. 6 (November 1994): 8–14, <http://knutsacoustics.com/files/alf-casj.pdf>.

literature.¹⁴ For subharmonics, the violinist that discovered the technique, Mari Kimura, has contributed practical examples on how to produce them.¹⁵ However, for research into the technique’s production, Robert Mores, Guettler, Erwin Schoonderwalt, Carleen Hutchins, and John Cantrell provide empirical data.¹⁶

14. R. T. Schumacher and J. Woodhouse, “The Transient Behaviour of Models of Bowed-string Motion,” *Chaos: An Interdisciplinary Journal of Nonlinear Science* 5, no. 3 (September 1, 1995): 509–523, accessed July 23, 2020, doi:10.1063/1.166122, <https://aip.scitation.org/doi/10.1063/1.166122>; Anders Askenfelt, “Measurement of the Bowing Parameters in Violin Playing. II: Bow–Bridge Distance, Dynamic Range, and Limits of Bow Force,” *The Journal of the Acoustical Society of America* 86, no. 2 (August 1, 1989): 503–516, accessed July 23, 2020, doi:10.1121/1.398230, <https://asa.scitation.org/doi/10.1121/1.398230>; Kenneth D. Marshall, “Modal Analysis of a Violin,” *The Journal of the Acoustical Society of America* 77, no. 2 (February 1, 1985): 695–709, accessed July 23, 2020, doi:10.1121/1.392338, <https://asa.scitation.org/doi/10.1121/1.392338>.

15. Mari Kimura, “How to Produce Subharmonics on the Violin,” *Journal of new music research* 28, no. 2 (1999): 178–184, accessed April 11, 2019, doi:10.1076/jnmr.28.2.178.3118, <https://login.ezproxy.utas.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=rih&AN=A212434&site=eds-live>.

16. Robert Mores, “Further Empirical Data for Torsion on Bowed Strings,” *PLOS ONE* 14, no. 2 (February 4, 2019): e0211217, accessed July 23, 2020, doi:10.1371/journal.pone.0211217, <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0211217>; Knut Guettler, “The Bowed String: On the Development of Helmholtz Motion and On the Creation of Anomalous Low Frequencies” (Doctorate Thesis, Royal Institute of Technology - Speech, Music and Hearing, 2002), <https://pdfs.semanticscholar.org/1d0c/968ee44366cd7d92c63f876be884c9135064.pdf>; Erwin Schoonderwaldt, “The Violinist’s Sound Palette: Spectral Centroid, Pitch Flattening and Anomalous Low Frequencies,” *Acta Acustica united with Acustica* 95, no. 5 (September 1, 2009): 901–914, accessed August 20, 2020, doi:10.3813/AAA.918221, <http://openurl.ingenta.com/content/xref?genre=article&issn=1610-1928&volume=95&issue=5&page=901>; Carleen M. Hutchins, Alvin S. Hopping, and Frederick A. Saunders, “Subharmonics and Plate Tap Tones in Violin Acoustics,” *The Journal of the Acoustical Society of America* 32, no. 11 (November 1960): 1443–1449, accessed August 20, 2020, doi:10.1121/1.1907934, <http://asa.scitation.org/doi/10.1121/1.1907934>; John H. Cantrell, Laszlo Adler, and William T. Yost, “Subharmonic Generation, Chaos, and Subharmonic Resurrection in an Acoustically Driven Fluid-Filled Cavity,” *Chaos: An Interdisciplinary Journal of Nonlinear Science* 25, no. 2 (February 1, 2015): 023115, accessed July 23, 2020, doi:10.1063/1.4913521, <https://aip.scitation.org/doi/10.1063/1.4913521>.

Extended Techniques

To understand extended techniques, we must first establish a basis of what is considered a ‘regular’ technique, or rather, what the qualifying factors are for a technique to be considered extended. To do this, we will look at what techniques are commonplace in the literature, and which are less so. Techniques that require descriptions in the frontmatter or otherwise ‘extend’ the instrument beyond the normal canon would reasonably be understood to be considered extended techniques. Read discusses this, stating:

Many so-called ‘new’ instrumental devices have developed from well established techniques; they are extensions of, or refinements of, procedures long considered part of a composer’s repertorium of expressive devices. The newness, then, is not one of kind but of degree, a further and more extensive development of basic effects found in scores from the late nineteenth century to the present day.¹⁷

Unpacking the language that we use, extended techniques are just that; an extension of the traditional techniques that are already established in the canon.



There are three aspects that are relevant to the literature review; literature surrounding the techniques themselves, literature with how the techniques are presented, and scores. Scores are necessary to understand how composers implement extended techniques in practice. By reviewing their frontmatter and the symbol notation, we gain an understanding of how composers present information to performers, and can build a system of notation that maps consistently with the rest of the established canon. Consequently, seminal scores will be included in the

17. Read, *Contemporary Instrumental Techniques*, 3.

literature review so that we may understand how they work. These scores' notation systems for extended techniques will be broken down into their elements, and through comparative analysis of how different composers implement the same techniques, we will be able to find how textual, symbolic, and graphic notation systems can be used to achieve the desired results.

Dimpker postulates the following criteria for extended technique notation;

‘(1.) As exact as possible and (2.) As simple as possible while the system may (3.) Not be contradictory to traditional notation, but should instead extend and be closely related to it.’¹⁸

This meshes well with the philosophy of Elaine Gould's 'Behind Bars', which advocates for a consistent style language, despite the two texts occasionally coming at odds with one another in the exact treatment of some cases.¹⁹ Dimpker posits that four methods of notation are acceptable in order to realise exact and precise notation; 'action notation, symbolic notation, diagrammatic notation, and schematic notation'.²⁰

Textual notation, i.e. instructions printed in the score, are the most straight forward, but limited to what can be summarised in few words. Symbolic notation assigns the technique to a symbol, typically with the instructions placed in the frontmatter. Graphical notation systems are often used when the binary of symbolic

18. Christian Dimpker, "Extended Notation: The Depiction of the Unusual" (University of Plymouth, 2012), 3, <https://pearl.plymouth.ac.uk/bitstream/handle/10026.1/3184/2013Dimpker10320048PhD.pdf?sequence=3&isAllowed=y>.

19. Dimpker, "Extended Notation: The Depiction of the Unusual"; Gould, *Behind Bars*, 120–121, 61.

20. Dimpker, "Extended Notation: The Depiction of the Unusual," 33.

notation is restrictive, and requires a greater fidelity than textual notation can provide. An example of this can be seen in Kaija Saariaho's notation of overpressure, wherein she uses a black bar to represent the amount of overpressure required, temporally relational to the position in the score.²¹

Double Touch Harmonics

The technique of 'double touch harmonics' as described by John Addison appears to be almost totally novel; it may be a matter of the technique being developed under a different name, but the only reference that seems to be relevant is a 1980 thesis, which has not been made available online.²² Addison has completed several fingering charts and made preliminary instructive documentation on the technique, which has been provided to the researched. Due to the lack of literature, collaboration with performers will be essential in order to build the technique to a stable, usable state.

Multiphonics

Multiphonics have been well-documented in reed instruments, with Robert Dick's seminal 'The Other Flute', setting the gold standard in extended technique documentation, painstakingly notating the outputs, fingerings, and qualities of flute

21. **TODO: saariaho citation.**

22. Dennis Lane Woodrich, *Multi-Nodal Performance Technique for Contrabass Harmonics* (San Diego: University of California Press, 1980).

multiphonics and other extended techniques.²³ There are several Barenreiter technique manuals for other aerophones that cover multiphonics, including bassoon, saxophone, violin, and oboe, with the publisher appearing to try and compile a manual for every instrument.²⁴ The book on violin by violinist Irvine Arditty notable lacks docume

String instruments The development of literature dealing with multiphonics on stringed instruments is more recent, with a special January 2020 *Tempo* journal issue, dedicated entirely to string multiphonics. It was collated by Dr. Ellen Fallowfield, who notably contributed the landmark thesis *CelloMap* (and eponymous website) in 2009.²⁵ Her article, ‘Cello Multiphonics: Technical And Musical Parameters’ expands upon the work that she began in her thesis, ‘CelloMap’.²⁶

Plucked chordophones Rita Torres has explored multiphonics on the guitar extensively, with several papers dedicated to their research, including her thesis, ‘A New Chemistry Of Sound: The Technique Of Multiphonics As A Compositional

23. Robert Dick, *The Other Flute*, Second Edition (New York: Multiple Breath Music Company, 1989).

24. **TODO:OboeBook**; Marcus Weiss and Giorgio Netti, *The Techniques of Saxophone Playing* (Kassel: Barenreiter-Verlag Karl Votter, 2010); Pascal Gallois, *The Techniques of Bassoon Playing* (Kassel: Barenreiter-Verlag Karl Votter, 2009); Irvine Arditty and Robert HP Platz, *The Techniques of Violin Playing* (Kassel: Barenreiter-Verlag Karl Votter, 2013).

25. Ellen Fallowfield, “Cello Map: A Handbook of Cello Technique for Performers and Composers” (Thesis, University of Birmingham, 2009); Fallowfield, “Cello Map.”

26. Ellen Fallowfield, “Cello Multiphonics: Technical And Musical Parameters,” *Tempo* 74, no. 291 (January 2020): 51–69, accessed July 23, 2020, doi:10.1017/S0040298219000974, <https://www.cambridge.org/core/journals/tempo/article/cello-multiphonics-technical-and-musical-parameters/58EC8EDF732ADACA8FA322506A300964>.

Element For Guitar And Amplified Guitar’.²⁷ Paulo Ferreira-Lopez and Torres provide a robust exploration of previous systems of notation of multiphonics, suggesting notational methods similar to those that Fallowfield suggests.²⁸ Catalogues of multiphonics in the guitar literature show that there has been little interest in the technique, with the first score dating back to 1832, but only around twenty or so pieces composed since the techniques inception.²⁹ It has been suggested that the widespread adoption of the technique has been marred by the mode of playing naturally having a decay, making multiphonics more difficult to hear for an audience, as well as the guitar having a poor dynamic range.³⁰ This has been all but confirmed with the analysis of multiphonic signal decay at distances equivalent to that of an audience revealing that without amplification, the multiphonics will be inaudible.³¹ Thomas Ciszak and Seth Josel expand upon the research carried out by

27. Rita Torres and Paulo Ferreira-Lopes, “Multiphonics as a Compositional Element in Writing for Amplified Guitar (2),” *Journal of Science and Technology of the Arts* 4, no. 1 (December 27, 2012): 61–69, accessed May 9, 2019, doi:10.7559/citarj.v4i1.67, <http://artes.ucp.pt/citarj/article/view/67>.

28. Paulo Ferreira-Lopes and Rita Torres, “Guitar Multiphonics: Notations for a Formalized Approach,” *VII Simpósio Académico de Violão: Anais do evento*, accessed August 28, 2020, https://www.academia.edu/22954689/Guitar_multiphonics_Notations_for_a_formalized_approach.

29. Rita Torres and Paulo Ferreira-Lopes, “The Sound World of Guitar Multiphonics,” in *Music and Sonic Art* (Newcastle upon Tyne: Cambridge Scholars Publishing, October 1, 2018), 80–82, <https://novaresearch.unl.pt/en/publications/the-sound-world-of-guitar-multiphonics>.

30. Rita Tinoco Torres and Paulo Ferreira-Lopes, “Towards Overcoming the Guitar’s Color Research Gap,” *Revista Vortex* 2 (2014): 21–22, http://vortex.unespar.edu.br/torres_v2_n1.pdf.

31. Rita Torres and Paulo Ferreira-Lopes, *Guitar Multiphonics: Influence of Amplification* (December 1, 2014), 279.

Torres, collating a catalogue of performable multiphonics from strings 3 — 1, and examining multiphonics on the electric guitar.³²

Piano The piano, an unlikely candidate for multiphonics, has had some success in making inroads in the technique through the use of preparing the piano. With the development of more robust literature, the prospect of developing a new sound-palette for the piano is alluring. Interest begins in 2016 with Juhani Vessikala's MA thesis on the topic.³³ Sanae Yoshida acknowledges Vessikala's work in an article in the multiphonics issue of *Tempo*, where Yoshida expands upon the practical ways in which a composer can use microtonality (and multiphonics) on a piano.³⁴ Following is Caspar Walter's algorithm to calculate the frequency components of pure multiphonics.³⁵

32. Thomas Ciszak and Seth F. Josel, "Of Neon Light: Multiphonic Aggregates On The Electric Guitar," *Tempo* 74, no. 291 (January 2020): 25–49, accessed July 23, 2020, doi:10.1017/S0040298219000962, https://www.cambridge.org/core/product/identifier/S0040298219000962/type/journal_article.

33. Juhani Topias Vesikkala, "Multiphonics of the Grand Piano - Timbral Composition and Performance with Flageolets" (Thesis, Sibelius Academy, 2016), accessed August 20, 2020, <http://urn.fi/URN:NBN:fi-fe2018050923865>.


34. Sanae Yoshida, "The Microtonal Piano And The Tuned-In Interpreter," *Tempo* 74, no. 291 (January 2020): 77–84, accessed July 23, 2020, doi:10.1017/S0040298219000998, https://www.cambridge.org/core/product/identifier/S0040298219000998/type/journal_article.

35. Caspar Johannes Walter, "Variants of Continued Fraction Algorithms and Their Relationship to the Fraction Windowing Algorithm for Modeling the Sounding Pitches of Multiphonics on Piano Strings," August 2019, accessed August 21, 2020, https://casparjohanneswalter.de/texts/fraction_windowing.

Methodology

Through interviews with players at varying stages of proficiency and familiarity with the techniques, I will be able to uncover the barriers to producing these techniques. Document analysis of existing resources and compositions will help direct and support the line of enquiry. Autoethnography of my creative process will document the research process and clarify my intent.

The aim of this research project is not to make the techniques popular enough to make clarification of technique unnecessary, or for it to enter the canon of techniques so that it is no longer considered to be ‘extended’ (as the Bartok pizzicato has). Rather, this is intended to act as a resource for composers and artists to be drawn upon as a reference for when they wish to use the technique. A considered and informed judgement call over a technique can only be made when the technique is understood well. The composer will communicate the information necessary to realise the technique to the player, typically through the frontmatter. In order to better understand what information composers deem useful to communicate to players, a review of scores with similar techniques will take place. By breaking the score’s frontmatter content up into its actions, we can understand how composers communicate their desired techniques to players.

By using the polling option of online forums such as the Facebook group ‘Music Engraving Tips’, we will be able to rapidly crowdsource data. 

Outcomes Of This Project, and Why It Is Relevant

This project will provide me with a better understanding of the mechanics and musical capabilities of the extended techniques. As these techniques currently have a deficit of literature, both instructive and artistic; there are few resources for people to learn from, and even fewer practical examples of how to implement the techniques in a musical context. My research will address this, filling the research gaps where identified. The outcome of my research into the technique of ‘double touch harmonics’, as developed by John Addison, is particularly relevant as it presents an exciting possibility for a new method of producing familiar harmonics. This will increase the number of available fingering positions of harmonics within existing compositions, as well as providing more colour options for performers to choose from.

Outputs

My research into underexplored techniques will broaden the performative and compositional palette available to artists. Through the documentation of my process in researching this technique, it will be catalogued and brought into the literature, facilitating further development.

Through a comprehensive review of how composers construct their frontmatter, guidelines to how new and experimental techniques can be communicated to performers will be developed. This will lower the friction of learning new works, and promote the uptake of contemporary works. This will be

further aided by the development of a \LaTeX style which can quickly scaffold the relevant extended techniques for consistent and universal verbiage.

The resultant thesis, ‘Writing Wrong Right: Composing With Extended Techniques’, will consequently be a practical document, suitable as a reference for artists interested in implementing extended techniques into their practice.

Bibliography

- Arditty, Irvine, and Robert HP Platz. *The Techniques of Violin Playing*. Kassel: Barenreiter-Verlag Karl Votter, 2013.
- Arkoudis, Ms. Eftihia Victoria. "Contemporary Music Notation for the Flute: A Unified Guide to Notational Symbols for Composers and Performers." DMA, West Virginia University Libraries, 2019. Accessed June 29, 2020. doi:10.33915/etd.3860. <https://researchrepository.wvu.edu/etd/3860>.
- Askenfelt, Anders. "Measurement of the Bowing Parameters in Violin Playing. II: Bow–Bridge Distance, Dynamic Range, and Limits of Bow Force." *The Journal of the Acoustical Society of America* 86, no. 2 (August 1, 1989): 503–516. Accessed July 23, 2020. doi:10.1121/1.398230. <https://asa.scitation.org/doi/10.1121/1.398230>.
- Cantrell, John H., Laszlo Adler, and William T. Yost. "Subharmonic Generation, Chaos, and Subharmonic Resurrection in an Acoustically Driven Fluid-Filled Cavity." *Chaos: An Interdisciplinary Journal of Nonlinear Science* 25, no. 2 (February 1, 2015): 023115. Accessed July 23, 2020. doi:10.1063/1.4913521. <https://aip.scitation.org/doi/10.1063/1.4913521>.
- Caspar Johannes Walter. "Variants of Continued Fraction Algorithms and Their Relationship to the Fraction Windowing Algorithm for Modeling the Sounding Pitches of Multiphonics on Piano Strings." August 2019. Accessed August 21, 2020. https://casparjohanneswalter.de/texts/fraction_windowing.
- Ciszak, Thomas, and Seth F. Josel. "Of Neon Light: Multiphonic Aggregates On The Electric Guitar." *Tempo* 74, no. 291 (January 2020): 25–49. Accessed July 23, 2020. doi:10.1017/S0040298219000962. https://www.cambridge.org/core/product/identifier/S0040298219000962/type/journal_article.
- Cope, David. *New Music Notation*. Dubuque, Iowa: Kendall/Hunt Pub. Co, 1976.
- Dick, Robert. *The Other Flute*. Second Edition. New York: Multiple Breath Music Company, 1989.
- Dimpker, Christian. "Extended Notation: The Depiction of the Unusual," University of Plymouth, 2012.

<https://pearl.plymouth.ac.uk/bitstream/handle/10026.1/3184/2013Dimpker10320048PhD.pdf?sequence=3&isAllowed=y>.

Fallowfield, Ellen. “Cello Map.” Accessed May 31, 2019.
<http://www.cellomap.com/>.

———. “Cello Map: A Handbook of Cello Technique for Performers and Composers.” Thesis, University of Birmingham, 2009.

———. “Cello Multiphonics: Technical And Musical Parameters.” *Tempo* 74, no. 291 (January 2020): 51–69. Accessed July 23, 2020.
doi:10.1017/S0040298219000974.
<https://www.cambridge.org/core/journals/tempo/article/cello-multiphonics-technical-and-musical-parameters/58EC8EDF732ADACA8FA322506A300964>.

Ferreira-Lopes, Paulo, and Rita Torres. “Guitar Multiphonics: Notations for a Formalized Approach.” *VII Simpósio Académico de Violão: Anais do evento*. Accessed August 28, 2020. https://www.academia.edu/22954689/Guitar_multiphonics_Notations_for_a_formalized_approach.

Gallois, Pascal. *The Techniques of Bassoon Playing*. Kassel: Barenreiter-Verlag Karl Votter, 2009.

Gould, Elaine. *Behind Bars*. 1st. London: Faber Music, 2011.

Gray, Rhys. “Harmonic Based Extended Techniques and Their Compositional Applications.” Thesis, University of Tasmania, 2019.

Guettler, Knut. *A Guide to Advanced Modern Double Bass Technique*. London: Yorke Edition, 1992.

———. “The Bowed String: On the Development of Helmholtz Motion and On the Creation of Anomalous Low Frequencies.” Doctorate Thesis, Royal Institute of Technology - Speech, Music and Hearing, 2002.
<https://pdfs.semanticscholar.org/1d0c/968ee44366cd7d92c63f876be884c9135064.pdf>.

———. “Wave Analysis of a String Bowed to Anomalous Low Frequencies.” *Catgut Acoustic Society*, II, 2, no. 6 (November 1994): 8–14.
<http://knutsacoustics.com/files/alf-casj.pdf>.

Guettler, Knut, and Håkon Thelin. “Bowed-String Multiphonics Analyzed by Use of Impulse Response and the Poisson Summation Formula.” *The Journal of the Acoustical Society of America* 131, no. 1 (January 2012): 766–772. Accessed

May 28, 2019. doi:10.1121/1.3651251.
<http://asa.scitation.org/doi/10.1121/1.3651251>.

Helmholtz, Hermann von, Alexander John Ellis, and Henry Margenau. *On the Sensations of Tone as a Physiological Basis for the Theory of Music*. 2nd English ed. Dover Books Dover Books on History of Science and Classics of Science, S114. OCLC: 310478879. New York: Dover Publications, 1954.

Hutchins, Carleen M., Alvin S. Hopping, and Frederick A. Saunders.
 “Subharmonics and Plate Tap Tones in Violin Acoustics.” *The Journal of the Acoustical Society of America* 32, no. 11 (November 1960): 1443–1449.
 Accessed August 20, 2020. doi:10.1121/1.1907934.
<http://asa.scitation.org/doi/10.1121/1.1907934>.

Jack Barnes. “An Examination of Composer-Performer Collaborations in a Contemporary Setting.” Thesis, University of Tasmania, 2017.

Karkoschka, Erhard. *Notation in new music: a critical guide to interpretation and realisation*. Tonbridge: Universal Edition, 1972.

Kimura, Mari. “How to Produce Subharmonics on the Violin.” *Journal of new music research* 28, no. 2 (1999): 178–184. Accessed April 11, 2019.
 doi:10.1076/jnmr.28.2.178.3118. <https://login.ezproxy.utas.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=rih&AN=A212434&site=eds-live>.

Kwok, Sarah Wei-Yan. “Breaking the Sound Barriers : Extended Techniques and New Timbres for the Developing Violist,” University of British Columbia, 2018. Accessed May 30, 2019. doi:10.14288/1.0365754. <https://open.library.ubc.ca/cIRcle/collections/ubctheses/24/items/1.0365754>.

Marshall, Kenneth D. “Modal Analysis of a Violin.” *The Journal of the Acoustical Society of America* 77, no. 2 (February 1, 1985): 695–709. Accessed July 23, 2020. doi:10.1121/1.392338.
<https://asa.scitation.org/doi/10.1121/1.392338>.

Mores, Robert. “Further Empirical Data for Torsion on Bowed Strings.” *PLOS ONE* 14, no. 2 (February 4, 2019): e0211217. Accessed July 23, 2020.
 doi:10.1371/journal.pone.0211217. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0211217>.

Predota, Georg. “Paul Wittgenstein’S Voice And Richard Strauss’s Music: Discovering The Musical Dialogue Between Composer And Performer.” *Fontes Artis Musicae* 61, no. 2 (2014): 107–137. JSTOR: 24330425.

Read, Gardner. *Compendium of Modern Instrumental Techniques*. 1st ed. Westport, Connecticut: Greenwood Press, 1993.

———. *Contemporary Instrumental Techniques*. New York: Schirmer Books, 1976.

———. *Music Notation: A Manual of Modern Practice*. 2nd Edition. New York: Taplinger Pub. Co., 1979.

Roche, Heather. “Heather Roche.” Accessed August 27, 2020.
<https://heatherroche.net/>.

Schoonderwaldt, Erwin. “The Violinist’s Sound Palette: Spectral Centroid, Pitch Flattening and Anomalous Low Frequencies.” *Acta Acustica united with Acustica* 95, no. 5 (September 1, 2009): 901–914. Accessed August 20, 2020. doi:10.3813/AAA.918221. <http://openurl.ingenta.com/content/xref?genre=article&issn=1610-1928&volume=95&issue=5&spage=901>.

Schumacher, R. T., and J. Woodhouse. “The Transient Behaviour of Models of Bowed-string Motion.” *Chaos: An Interdisciplinary Journal of Nonlinear Science* 5, no. 3 (September 1, 1995): 509–523. Accessed July 23, 2020. doi:10.1063/1.166122.
<https://aip.scitation.org/doi/10.1063/1.166122>.

Stone, Kurt. *Music Notation in the Twentieth Century*. New York: W. W. Norton & Company, 1980.

Thelin, Håkon. “Multiphonics on the Double Bass,” Norwegian Academy of Music, 2011. <http://haakonthelin.com/multiphonics/uploads/files/4%20Multiphonics/Multiphonics%20on%20the%20Double%20Bass.pdf>.

Thelin, Håkon, and Knut Guettler. “Analysis of Bowed-String Multiphonics.” In *Analysis of Bowed-String Multiphonics*. Sydney, Australia.
https://www.acoustics.asn.au/conference_proceedings/ICA2010/cdrom-ISMA2010/papers/p15.pdf.

Torres, Rita Tinoco, and Paulo Ferreira-Lopes. “Towards Overcoming the Guitar’s Color Research Gap.” *Revista Vortex* 2 (2014).
http://vortex.unespar.edu.br/torres_v2_n1.pdf.

Torres, Rita, and Paulo Ferreira-Lopes. *Guitar Multiphonics: Influence of Amplification*. December 1, 2014.

———. “Multiphonics as a Compositional Element in Writing for Amplified Guitar (2).” *Journal of Science and Technology of the Arts* 4, no. 1 (December 27,

2012): 61–69. Accessed May 9, 2019. doi:10.7559/citarj.v4i1.67.
<http://artes.ucp.pt/citarj/article/view/67>.

Torres, Rita, and Paulo Ferreira-Lopes. “The Sound World of Guitar Multiphonics.” In *Music and Sonic Art*, 78–94. Newcastle upon Tyne: Cambridge Scholars Publishing, October 1, 2018. <https://novaresearch.unl.pt/en/publications/the-sound-world-of-guitar-multiphonics>.

Vesikkala, Juhani Topias. “Multiphonics of the Grand Piano - Timbral Composition and Performance with Flageolets.” Thesis, Sibelius Academy, 2016. Accessed August 20, 2020. <http://urn.fi/URN:NBN:fi-fe2018050923865>.

Weiss, Marcus, and Giorgio Netti. *The Techniques of Saxophone Playing*. Kassel: Barenreiter-Verlag Karl Votter, 2010.

Woodrich, Dennis Lane. *Multi-Nodal Performance Technique for Contrabass Harmonics*. San Diego: University of California Press, 1980.

Yoshida, Sanae. “The Microtonal Piano And The Tuned-In Interpreter.” *Tempo* 74, no. 291 (January 2020): 77–84. Accessed July 23, 2020. doi:10.1017/S0040298219000998. https://www.cambridge.org/core/product/identifier/S0040298219000998/type/journal_article.