University of Tasmania

# Harmonic Based Extended Techniques and their Compositional Applications:

## An Investigation in New String 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)

by

**Rhys Gray**

Hobart, Tasmania

January 7, 2020

## Declaration

I declare that all material in this exegesis is my own work except where there is clear acknowledgement or reference to the work of others and I have read the University statement on Academic misconduct (Plagiarism) on the University website at `www.utas.edu.au/plagiarism` or in the Student Information Handbook. I further declare that no part of this paper has been submitted for assessment in any other unit at this university or any other institution. I consent the authority of access to copying this exegesis. This authority is subject to any agreement entered into by the University concerning access to the exegesis.

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January 7, 2020

**Abstract**

This exegesis explores compositional applications of the extended string techniques half-harmonics, subharmonics, and multiphonics. A review of the literature and resources that are readily available to composers will be made to assess what techniques require further investigation and refinement. By researching these techniques and the mechanics behind them, using document analysis, and analysing recordings made, a better understanding of how these techniques can be implemented in my practice will form. As part of both the analysis of techniques and my compositional practice, I assess not only the compositional potential, but also the practicality of techniques. Reviewing the feasibility and notational aspects of the techniques will render the exegesis a practical document to reference for performance and composition. The works that I compose accompanying the exegesis will show idiomatic treatment of the techniques and serve as references as such in the exegesis. The dissemination of the material I research will contribute to the accessibility of new sound possibilities for artists.

Thank you to my supervisor, Matthew Boden, and my teachers Dr. Maria Grenfell and Dr. Scott McIntyre for their help and guidance throughout my degree. I am indebted to my music teachers for inspiring my passion in music, and my peers and friends at UTas who have supported me in my research, and kept that passion alive.

My love and thanks go to my partner Claire Farrell*, my family, and my cats Buttercup and Millie for their unconditional support.

∗. Whose cakes, biscuits, and mugs of coffee nourished me, and whose support and words of encouragement kept me sane.

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## Introduction

I propose to explore a range of extended techniques that utilise the harmonic series and to assess how they can be used in my, and other people's, creative practice in composition and performance. This exegesis considers the techniques associated with subharmonics, multiphonics, and half-harmonics on string-based instruments.† For purposes of brevity, these harmonic-based extended techniques will simply be referred to as 'techniques' throughout the paper, except for when differentiation between standard techniques is needed.

While some techniques such as harmonics are well established and understood, others, such as subharmonics, are still underdeveloped in terms of both repertoire and resources available. The timbral potentials of these techniques are uncharted territories and collectively represent an entire sound world that remains relatively inaccessible to composers.

The exegesis is intended to serve as a useful reference source for artists interested in learning about the mechanics, qualities, and potential implementations of these harmonic based extended techniques. The works that I compose accompanying the exegesis will show idiomatic treatment of the techniques and serve as references as such in the exegesis. This exegesis makes use of hyperlinks throughout to enhance its usefulness as a reference document, and ease of sharing. The dissemination of the material I research will contribute to the accessibility of new sound possibilities for artists.

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†. These video examples are part of Ellen Fallowfield's CelloMap project. I chose to use them as examples because they are performed by the same professional musician, on the same instrument, in a professional studio, which helps to establish a baseline of what can be expected of the techniques.

# Chapter 1

## Hello, world!

This first chapter is typically where one would see a literature review and methodology, at the start of the exegesis. Rather than bog the document down with irrelevant example material, this will be instructive text that can be used as a reference. Please note that it is *not* a tutorial, and is just example code that you can copy. When you're ready to write your *own* thesis, you can comment out these lines by highlighting them, and pressing ctrl (or cmd on a Mac) + / to comment it out.

## LaTex

> '[...] LaTex is like the old printing presses, except it's on screens, so it's a lot faster.'

LaTex was created in 1985, and is typesetting software designed to create beautiful documents. It is best known for its ability to handle complex mathematical equations, and do just about everything under the sun. It is *not* word processing software; it shares similar features to Word, but is notably different in that Word is a what-you-see-is-what-you-get (WYSIWYG) editor, whereas LaTex separates writing from the formatting. This means in practice that you deal with stuff that looks like *code* in LaTex, and compile it into the finished product.

### Why use LaTex?

Many articles have been written about why you should use LaTex, and a few choice have been supplied for reference. Ultimately, LaTex produces beautiful documents, but whether it is worth the stress of learning a new system is up to the reader. This document has been created as an instructional tutorial as a starting point.

### The Author's Reasons

My personal reasons were as follows:

- Stability: LaTex is a relic of the 1980s, but this works to its advantage when handling large documents, which are broken up into bite-sized chunks. This system means that you can shift sections around without any messy copy–pastes.
- Flexibility: I used LaTex for my Honours exegesis. It is able to not only insert PDFs, but even create uniform cover pages for my compositions.
- Variables: I can define a variable that might change and use that, obviating any find-and-replace-all issues.
- Integration: I am able to use Zotero to save a source to the works−cited.bib file, \autocite to automatically cite a source, and back it up to GitHub.
- Version control: A save button, combined with Time Machine- using GitHub to save my exegesis to the cloud, I can track **every** change made to the document. Version control works with plain text files (i.e. LaTex), but not proprietary formats such as .docx
- Comments: I can comment out sections, preserving it without it showing up on the finished document. This means that I can implement TODOs, make notes, and have people make changes.

This study builds on and contributes to the catalogue of resources available to composers interested in implementing harmonic based extended techniques in their practice. The topic of 'harmonic based extended techniques and their compositional applications' is broad, and I will be unable to explore the entire corpus of techniques available to all instruments as this falls outside the scope of this exegesis. This is by design, as certain instruments lack certain facets of research, while others are already well documented, the most obvious example being string harmonics, which are

common practice. This broad topic affords a certain level of flexibility to explore what is both novel and feasible given my available resources, all under the unifying theme of harmonic based extended techniques.

Many of the techniques that this study deals with are still in their comparative infancy, especially notationally.

As such, engraving the works produced in the course of this study is a more subjective matter, rather than the well-established practice that it normally is due to the lack of a myriad of scores to draw reference from. A review of the available literature makes it clear that attempts have been made to standardise contemporary music notation, but have either fallen short, or are now outdated. Kurt Stone organised an international conference on new musical notation in 1974 in Ghent, Belgium, and then produced the treatise *Music Notation in the Twentieth Century* in 1980 as a result of the conference.[1] This, along with Gardner Read's 1979 *Music Notation*, served as a strong base for the standardisation of music notation, but both are mired by their age and computer-based notation not being widespread.[2]

It is therefore unsurprising that both omit the notation of stringed multiphonics, subharmonics, and half-harmonics, the bulk of the research largely postdating publication. Elaine Gould's 2011 book *Behind Bars* immediately became the gold standard of engraving manuals, her decades of notational and editorial experience at Faber Music lending weight to her comprehensive treatise.[3] But the same new techniques are omitted from Behind Bars, with Gould stating she had been "highly selective in the choice of extended instrumental and vocal techniques included

1. **stoneMusicNotationTwentieth1980**.

2. **readMusicNotationManual1979**.

3. **gouldBars2011**.

in this book, but it is intended that this [book] should give the reader the facility to create notation for other techniques not in common use".[4]

Gould's book is less proscriptive than its forerunners, and focuses more on creating a consistent style language, providing the reader with the tools of standardised and codified 'common practice' notation to build new extended technique notation. As such, for all notational aspects, I will be drawing upon the Gould for the philosophy of engraving, if not exact notation, which has the benefit of almost forty years of usage and review against its peers.

Gould provides the tools which Ellen Fallowfield uses to construct a notation method for string multiphonics in her PhD 'Cello Map', the framework of which this exegesis will follow. A detailed, process-oriented review of technique informs the creation of resources which are then analysed.[5] Fallowfield's analysis produced the website cellomap.com, a manual of techniques for performers to use. She states that her text maps:

> [...] "actions that a cellist can make" onto "sounds that a cello can produce". In other words, we have tried to reduce the cello and cellist to scales of actions and sounds, and show how cellists can influence sound (loudness, overtone content, pitch...) by their actions (bow speed, contact point, stopping position...). This standpoint is a deliberate move away from providing performers and composers with catalogues of special effects and extended techniques. Instead, we would like to provide information about how the cello works that can serve the imagination of performers and composers.[6]

This approach 'future proofs' her thesis by abstracting the elements into their most base form, showing all of the sounds a cello can make using all of the actions a cellist can perform. While the website is comprehensive, Fallowfield seemingly avoids making any judgement calls on the compositional applications of the techniques that

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4. **gouldBars2011**.

5. **fallowfieldCelloMapHandbook2009**.

6. **fallowfieldCelloMap**.

she reviews, and the reader is left to draw their own conclusions on the compositional effectiveness of any given technique. Fallowfield does, however, note that a repertoire gap exists for etudes exploring multiphonics for the cello, and indeed, the entirety of the string family. As part of my practice-led research, it seems fitting to compose a piece that begins to address this repertoire gap.

Bertram Turetzky's book, *The Contemporary Contrabass* was written to exemplify the contrabass as a serious solo and melodic instrument in response to the double bass's underrepresentation in the literature.[7]

He theorised:

> [...] Concertizing Was The Key, which in the 1950's was impossible mainly due to the lack of literature. I attacked this problem in two directions:
> 1. Locating original contrabass music from the eighteenth and nineteenth centuries, and
> 2. Commissioning twentieth century music.[8]

His practice-led research centered on seeking to understand the techniques that contemporary composers could use in solo contrabass repertoire. Turetzky deliberately omitted including any guidance or judgements on notation, or categorisations of the difficulty of the techniques, stating that "the time between this printing and the second edition will suffice to suggest and select the best notational concepts from a more substantial literature than we possess now".[9] The second edition saw Turetzky call for more experimentation with multiphonics, stating: "I know of no music employing string multiphonics [...] this is entirely new ground, it remains for composers and performers to build the usable technique".[10]

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7. **turetzkyContemporaryContrabass1974**.

8. **turetzkyContemporaryContrabass1974**.

9. **turetzkyContemporaryContrabass1974**.

10. **turetzkyContemporaryContrabass1992**.

The specification of both composers and performers being needed to 'build the usable technique' is peculiar, until one re-examines the context in which Turetzky knew of these techniques. Thus, we might infer that he was attempting to address the situation through commissioning new literature.

Performers and researchers such as Fallowfield are necessary to establish the technique, but it is impossible for a 'usable technique' to be built without composers implementing their research and contributing to a pool of repertoire to show the correct usage of the technique.

Robert Dick's *The Other Flute* was released in 1989, and was notably used as the primary reference for microtonal flute fingerings by John Cage in the preface to his piece *Music For*.[11] *The Other Flute* is a thorough performance technique manual, presenting each fingering and its resultant multiphonics one after the other, using a chart of descriptions to specify the qualities.[12] It specifies the following: "exact pitch, ease of response, starting time, stability, dynamic range, timbre, and, if present, noise level, residual tone, and degree of modulation."[13] While this text focuses more on instruction, it is an efficient system, and sorts the multiphonics into four classes graded by difficulty. From the perspective of a composer, Dick's book provides ample resources on the qualities of each multiphonic, but generic descriptions of their characteristics: enough for a composer to assess whether any given multiphonic is worth investigating with a flautist. While the scope of my research focuses on stringed instruments, Dick's method of cataloguing the qualities is a logical and comprehensive model to follow.

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11. **cageMusicPartsVoice1984**.

12. **dickOtherFlute1989**.

13. **dickOtherFlute1989**.

*The Contemporary Violin* is one of the more recent books in Turetzky's *The New Instrumentation* series.[14] It provides a comprehensive review of various violin techniques, but attempts to shy away from any implication of notational authority, most notably in the section on multiphonics, which seems to contradict rules codified by Gould (though to be fair, the Gould postdates Strange).[15] Fallowfield identified issues with the presentation format of *The Contemporary Violin* in the literature review of her thesis:

> The reader will find [information about *col legno battuto*] under the first chapter heading: 'Bowing Technique', the subheading 'Col legno battuto'. Later, chapter three: 'Percussion Techniques' includes the subheading 'The Bow', in which *col legno battuto* is described again.[16]

Though the scope of my study is significantly smaller in scale, presentation of the findings is paramount to maintain accessibility as a resource. Given that my study focuses on harmonic based extended techniques, an overlap with techniques such as multiphonics is possible, and therefore needs to avoid the structural pitfalls of Strange's layout where information is repeated. Fallowfield's later concern of a need for a balance between subjectivity and level of detail when describing technique and sound is also relevant to both the Strange book and doubly so to the study. These manuals merely describe the qualities of various techniques, whereas my study will be dealing with the compositional applications of the techniques. Taking the extra-musical content such as blending, appropriateness for use in pitch sets, and other aspects of composition into account poses a threat to the usability of my study due to information overload. Marcus Weiss and Giorgio Netti discuss the reasons for limiting their study to extended techniques in the introduction to their book *The*

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14. **strangeContemporaryViolinExtended2001**.

15. **strangeContemporaryViolinExtended2001**; **gouldBars2011**.

16. **fallowfieldCelloMapHandbook2009**.

*Techniques of Saxophone Playing*, stating "It might indeed be conceivable to compile a multi-dimensional 'Encyclopaedia of Saxophone Playing' [, however] the demands on presentation and readability would be so complex as to make such a text impractical".[17]

So far, all of the literature reviewed (with the exception of the Gould and other engraving manuals) has been written either with the performer in mind, or has been written by an instrumentalist. Much of the composer-focused literature is found in the form of orchestration manuals, such as Samuel Adler's *The Study of Orchestration* and Walter Piston's *Orchestration*.[18] Attempting to cover the breadth of the art of orchestration, let alone composition, necessitates the omission of extended techniques. This is the inverse of the issue Weiss and Netti encountered, where their study required an omission of ground-level theory regarding the technical aspects of saxophone playing. Read's *Compendium of Modern Instrumental Techniques* touches upon multiphonics, but delegates to Dick, Thomas Howell, and many of the other books from Turetzky's *The New Instrumentation* series for notation and structure.[19] It becomes apparent that no matter the author, instrument, or technique, the work of packaging extended technique information for composers is left to somebody else. Composers seek to cover the entirety of the craft, while performers seek to cover the entirety of the instrument. Therefore, there is a dearth of resources for composers seeking to incorporate harmonic based extended techniques into their practice. My study addresses this by covering the playability, notation, and implementation of these techniques. Through practice-based research, the exegesis produced by my study will document the process of composing using these

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17. **weissTechniquesSaxophonePlaying2010**.

18. **adlerStudyOrchestration2002**; **pistonOrchestration1969**.

19. **readCompendiumModernInstrumental1993**.

techniques, refining the methodology and notation through the creation of several new works. The resulting document will fill a hole in literature aimed at composers by acting as a practical manual for those interested in implementing harmonic based extended techniques in their own practice.

## Methodology

My research topic "Harmonic Based Extended Techniques and their Compositional Applications" is a review of techniques, and how they can be incorporated in my own practice. As such, it is highly subjective, and the research methodology — largely qualitative — reflects this. Quantitative research, such as the analysis of documents using the same techniques will be used to support subjective claims. Each technique will be reviewed individually, as they are discrete from one another. Because many of the techniques are uncommon or difficult, consultation with players is paramount to undertake a fair assessment of the techniques. Document analysis of technique manuals will augment oral history research into the qualities and attributes of techniques.

To make an educated opinion on the value of a technique, data must first be collected. Compilation of techniques both in isolated, controlled environments, and in context in musical works will allow a full and accurate use of the analytical method on recordings. Examination of techniques in musical context will allow for value judgements to be made about the musical effectiveness of the technique. The recorded data will be treated, and then interpreted and analysed, with the results being implemented in new works.[20] Through this process, my research will feed into my practice.

A holistic approach, taking both the sound possibilities and the player implications ("is this technique too difficult for the average player?", "do I need to write for specific artists if I want to use this technique?", etc.) is necessary to evaluate its overall potential for incorporation in my practice. To overcome this, oral history methodology will be used to gather first-hand experiences and opinions on techniques. In Barnett's "Aspects of Vocal Multiphonics", she conducts several

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20. **torresMultiphonicsCompositionalElement2012**.

interviews with singers to better understand the way the technique functions from a performer's perspective.[21] Interviewing musicians able to play these techniques will deepen my understanding of the mechanics and technical aspects of implementing these techniques.

Augmenting the interviews, document analysis will be used on technique manuals that detail the production and quality of techniques. By building off the framework of classification articulated in Robert Dick's seminal *The Other Flute* and adapting it to accommodate a variety of techniques, comparisons across different techniques will be able to be made.[22] Through this, an understanding of the technical and mechanical aspects of the techniques will be gained. Techniques will be assessed on their practicality, ease of use, timbral qualities, and compatibility with my practice. Notation for the techniques varies from composer to composer, and where a common notational standard has not been developed (such as subharmonics), a document analysis of current notational standards will be undertaken, making reference to Gould's seminal text on music notation, *Behind Bars*.[23] Through this, and subsequent consultation with players, development of a consistent and effective notational language can be achieved.

This process of practice-based research will feed into itself, forming a research-based practice as detailed in Hazel Smith and R. T. Dean's "Practice-led research, research-led practice in the creative arts", where the value of it is described as:

> the possibility [that] new knowledge . . .may be generated by moving from a stance more accurately seen to move from the 'unknown to the known'

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21. **barnettAspectsVocalMultiphonics1977**.

22. **dickOtherFlute1989**.

23. **gouldBars2011**.

> whereby imaginative leaps are made into what we don't know as this can lead to critical insights that can change what we do know.[24]

This iterative process will help clearly define the scope of the exegesis, and provide further insight into existing technique, as well as help 'build the new techniques'.

Through the collection of data from a multitude of sources and a range of different methods, it will become evident how harmonic based extended techniques are to be treated idiomatically. By undertaking a holistic review of the techniques including the player's point of view, the qualitative research I perform will enable not only me to incorporate these techniques into my own practice, but future composers that are interested in these techniques.

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24. **smithPracticeledResearchResearchled2009**.

## Impact and Further Research

*The author of a compendium on modern instrumental technique faces the disconcerting prospect that as soon as his tabulation is published, it is likely to be considered incomplete.*

— Guther Schuller.[25]

This exegesis will help inform other artists interested in implementing these techniques. Compositionally, the scope of this exegesis has been limited to the techniques appropriate for solos, and no research into how the techniques fit into ensemble works has been attempted. The exact mechanics of the production of subharmonics and multiphonics are still poorly understood, and would benefit from further research. Further research into the way the techniques react to artificial harmonics, the difference between the two nodal points for multiphonics, and the methods for producing different intervals of subharmonics is needed for a holistic understanding. The analysis and cataloguing of the qualities of each multiphonic and subharmonic would contribute further to the ideal of idiomatic writing for the techniques.

## Conclusion

It is apparent that the literature surrounding these techniques is still in its infancy, with few sources of authority due to the niche nature of the techniques. In this exegesis, the documentation of the existing literature and findings from the implementation of the techniques establishs a baseline for treating these techniques, which others can build upon. Through the gradual adoption of these techniques, a standardised notation will form, and further advance the acceptance of these techniques in modern literature.

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25. **readCompendiumModernInstrumental1993**.

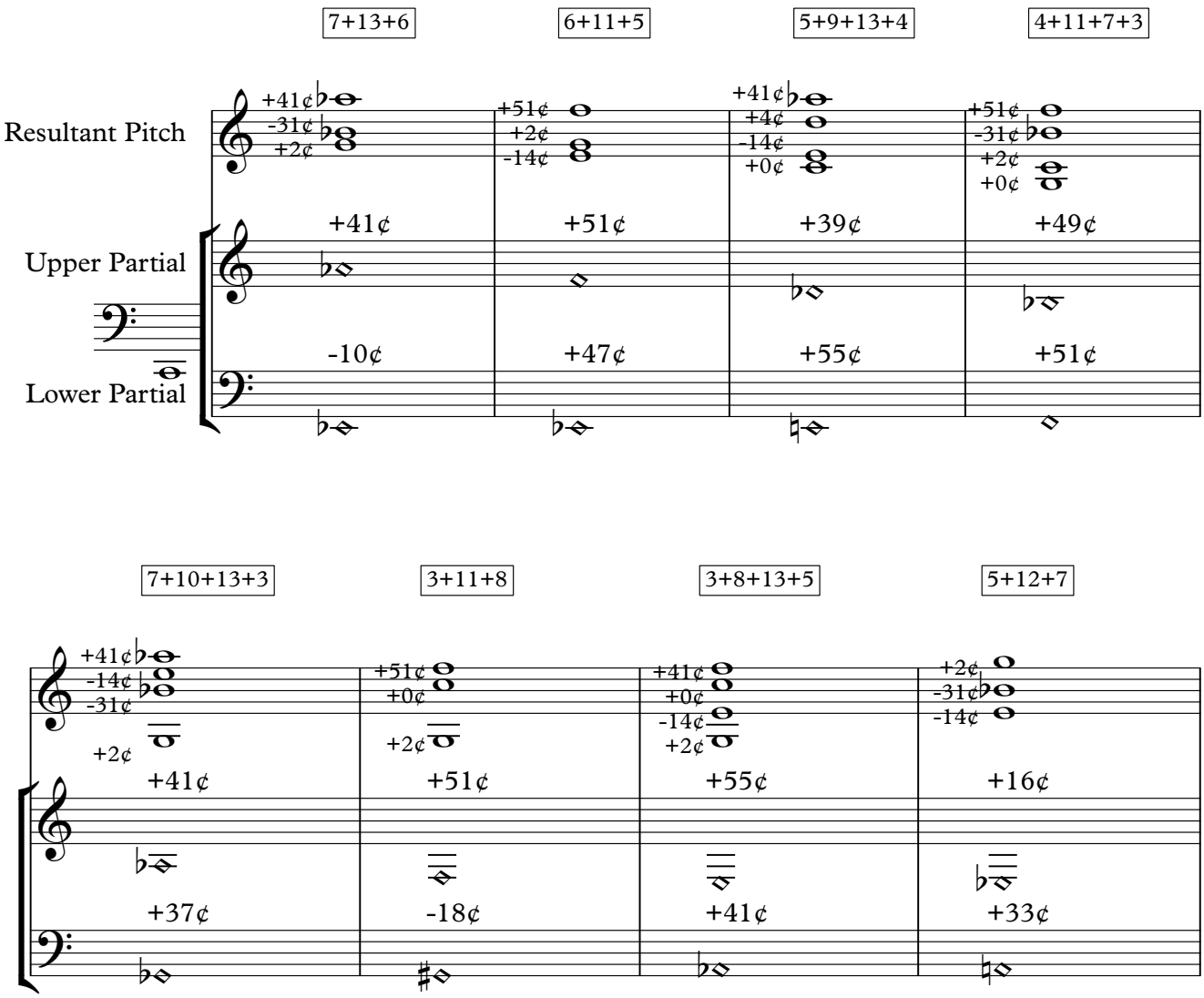
# Appendices

# Appendix A

## Multiphonic Fingering Chart

Adapted from Fallowfield's website CelloMap, which as of time of publication, is not currently online.[26] This shows the two nodes where multiphonics can be produced, and the resultant pitch for both of them. It includes the tuning in cents, and the partial ratios (i.e. 7+13+6). It should be noted that this is a fingering reference tool, and not to be used for notation (see **??** for notation of multiphonics.)

26. **fallowfieldCelloMap**.


7+13+6
6+11+5
5+9+13+4
4+11+7+3
Resultant Pitch
Upper Partial
Lower Partial
+41¢
-31¢
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+2¢
-14¢
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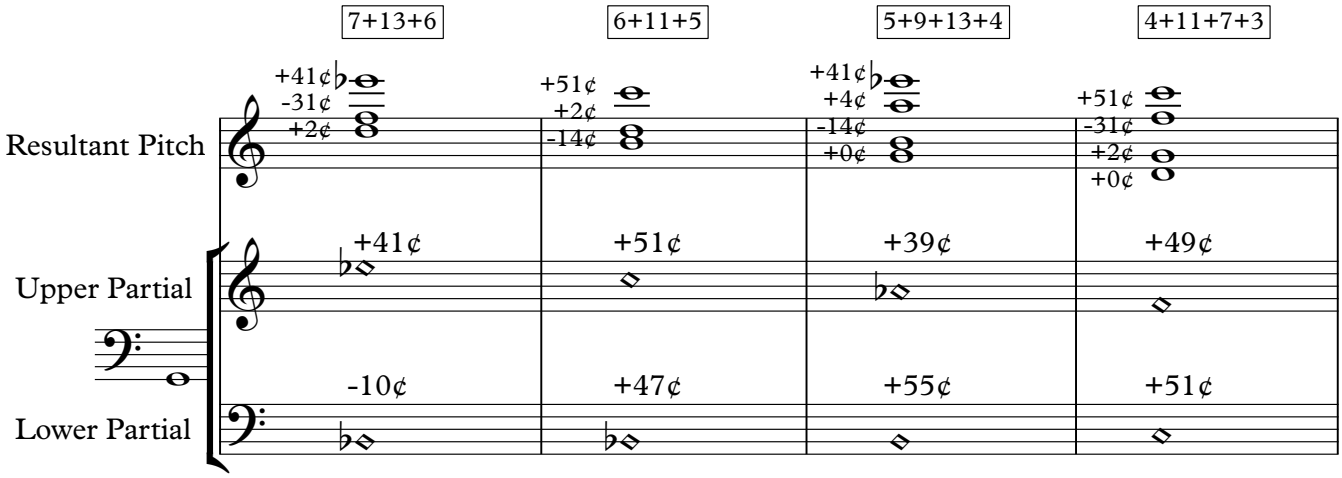
7+13+6
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Resultant Pitch
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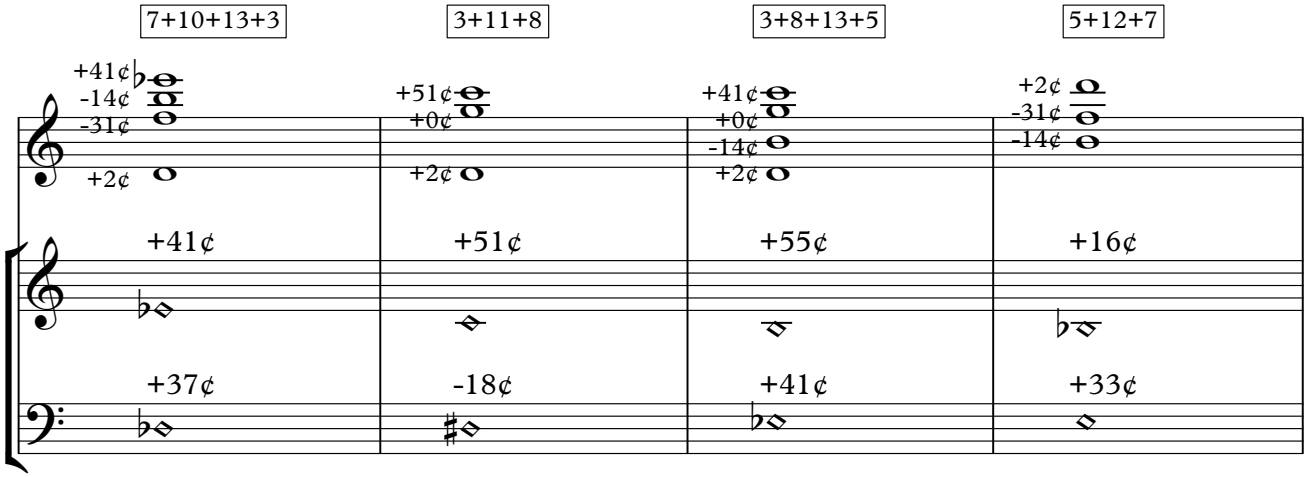
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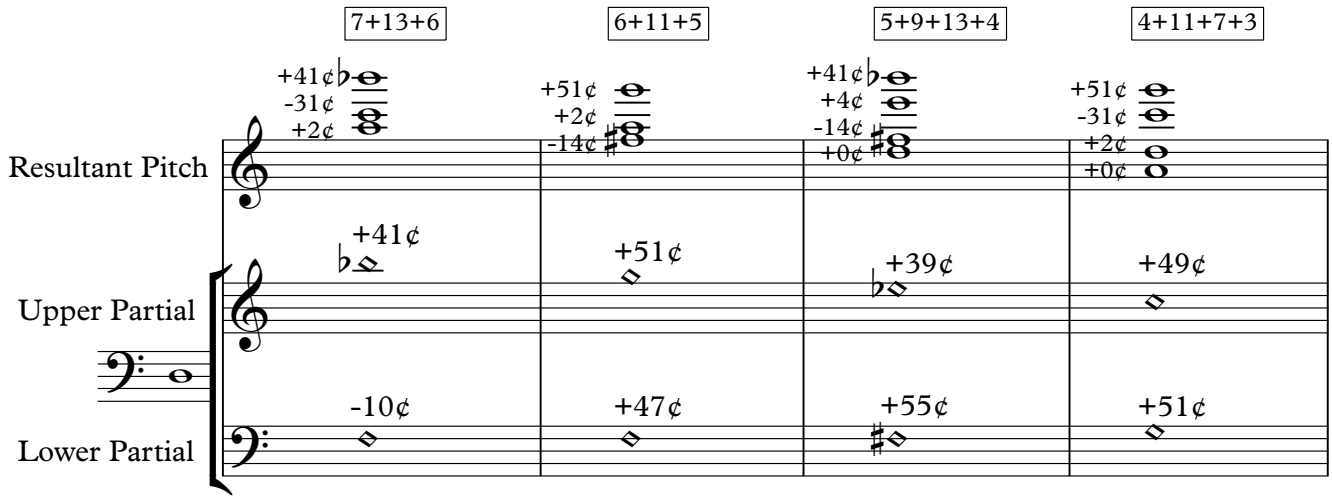
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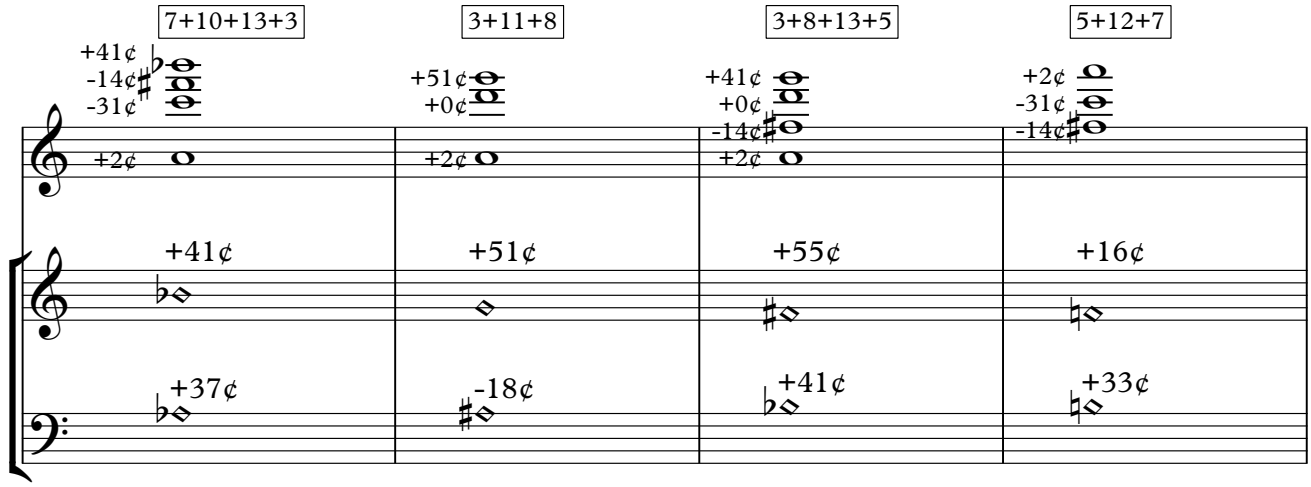
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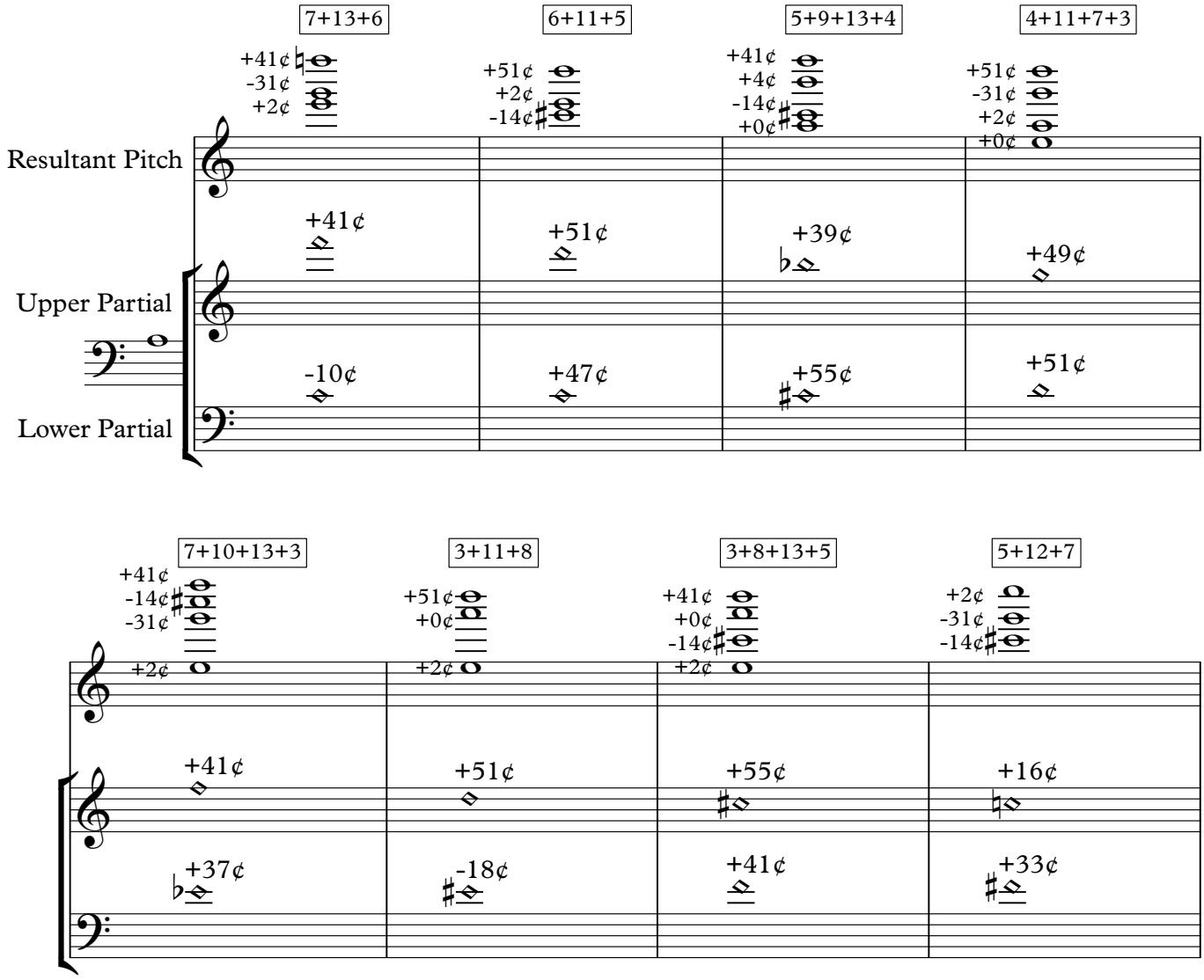
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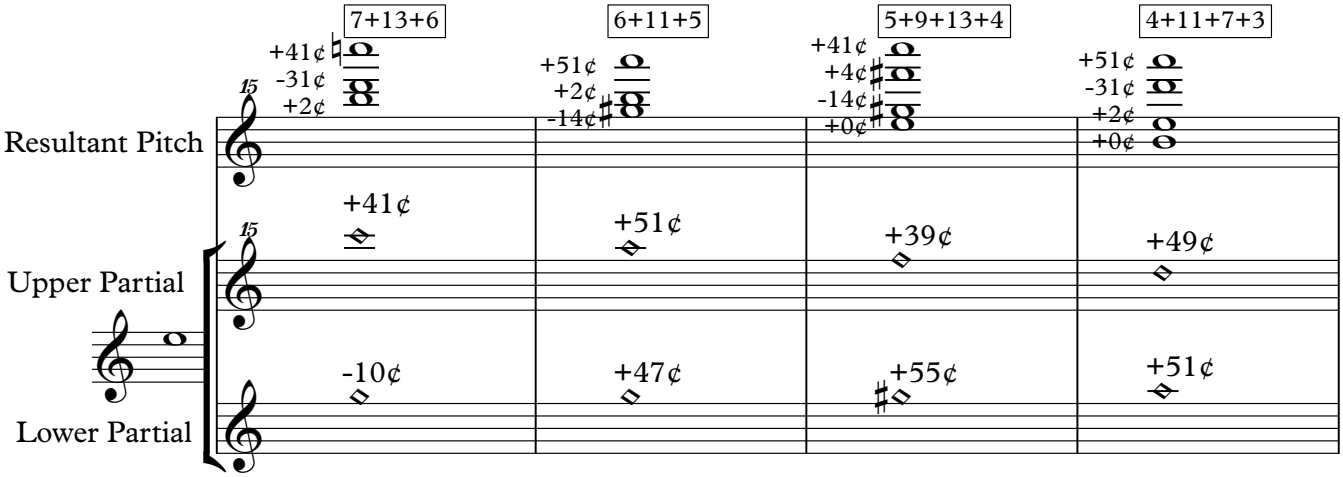
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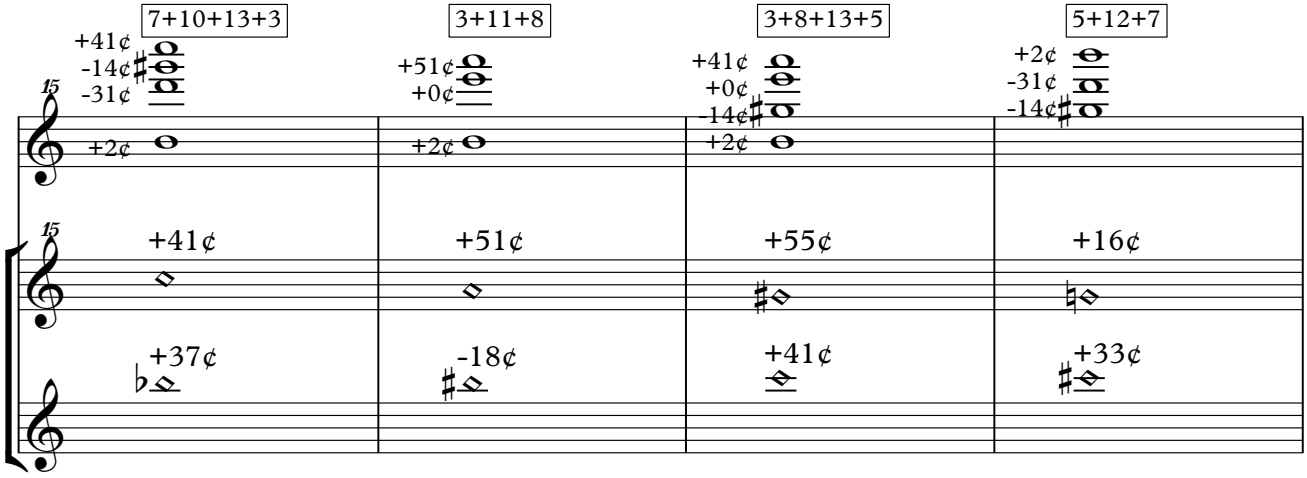
+55¢
+51¢


7+10+13+3
3+11+8
3+8+13+5
5+12+7
+41¢
-14¢
-31¢
+2¢
+51¢
+0¢
+41¢
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-31¢
-14¢
+41¢
+51¢
+55¢
+16¢
+37¢
-18¢
+41¢
+33¢

**Appendix B**

FOR SOLO VIOLIN

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# *what are you doing with the humans*

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October, 2019

Rhys Gray

## Program Notes

*what are you doing with the humans* is a solo work for violin that explores half-harmonics. It is a non-programmatic work, and the title was inspired by a question that my supervisor posed to me while I sought ethics approval for my exegesis; a simple phrase laden with possible contexts, spurring the imagination to try and complete the meaning.

It is, in a way, an etude, treating the half-harmonics in a way similar to those found in Sciarrino's *6 Caprricio for violin*. Half-harmonics are produced by applying left hand finger pressure halfway between that required to create a harmonic, and a *normale* sound. The sound that is produced should be a mixture of the stopped string pitch, the harmonic pitch, and a resistant, slightly noisy quality.

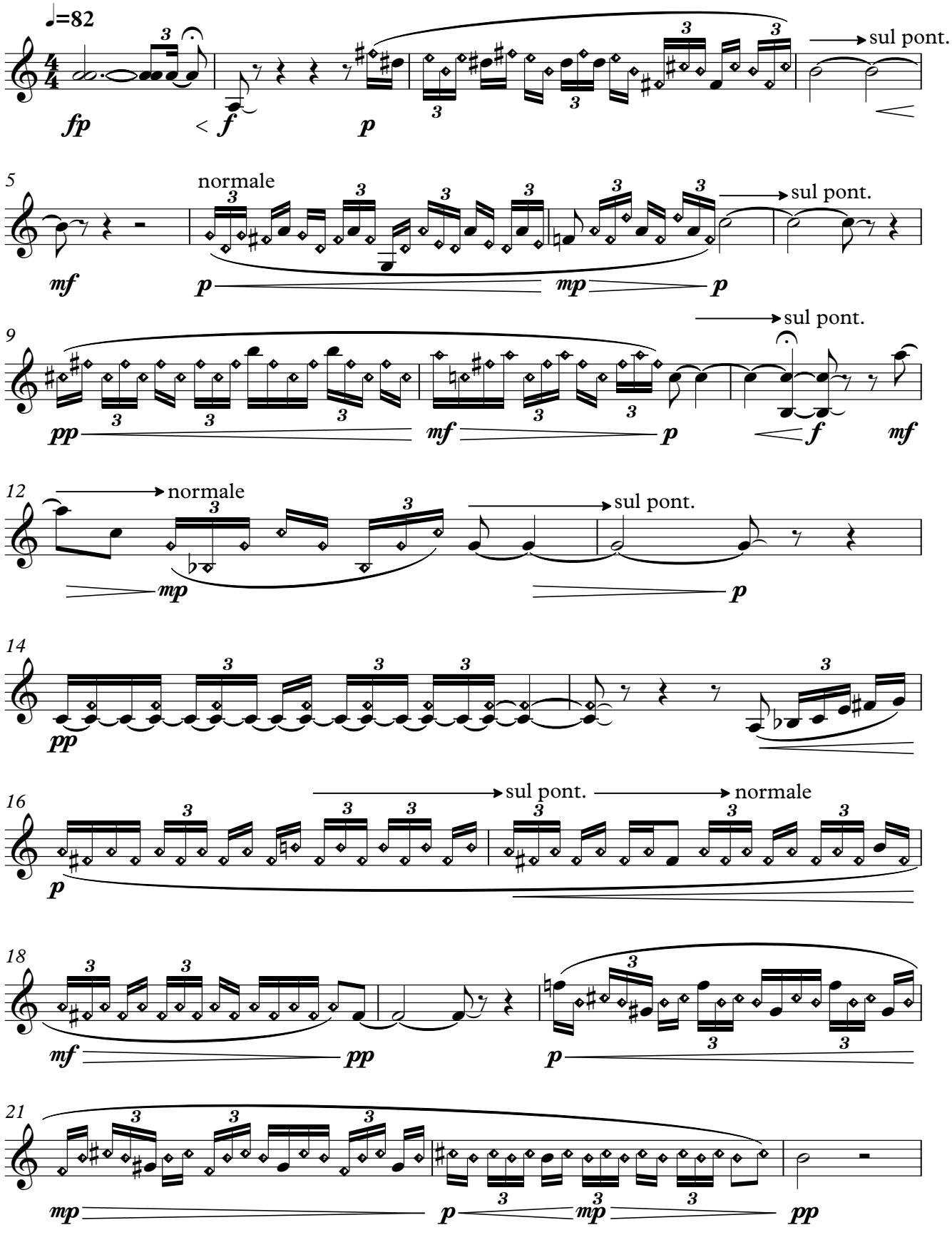
## Notation

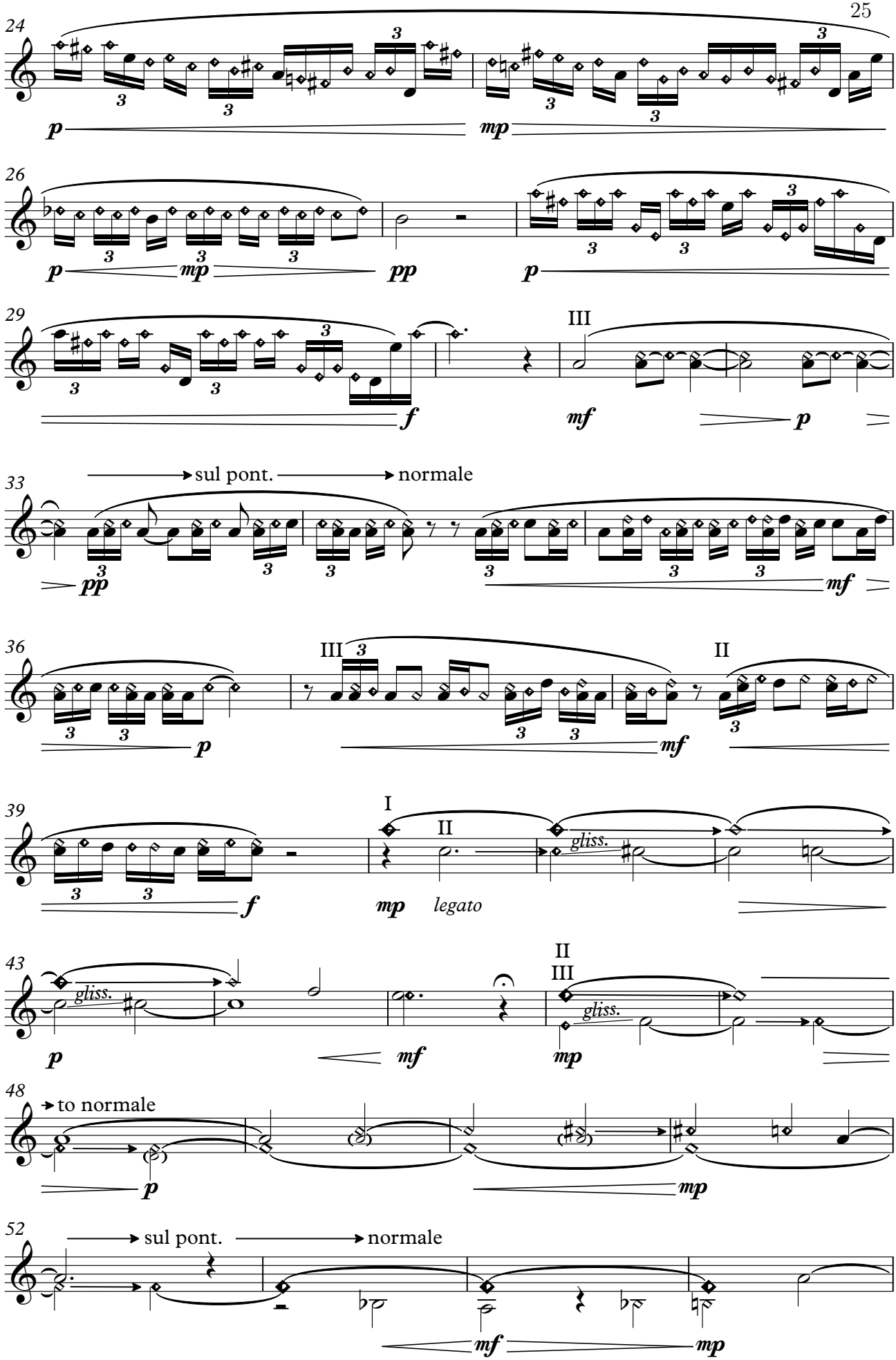
- Half-harmonics are notated in the score as a half-filled diamond notehead.
- Arrows denote gradual transitions to the technique that the arrow is pointing to.
    - Arrows between notes denote transitions between the types of notes (i.e. *normale* to harmonic finger pressure.)

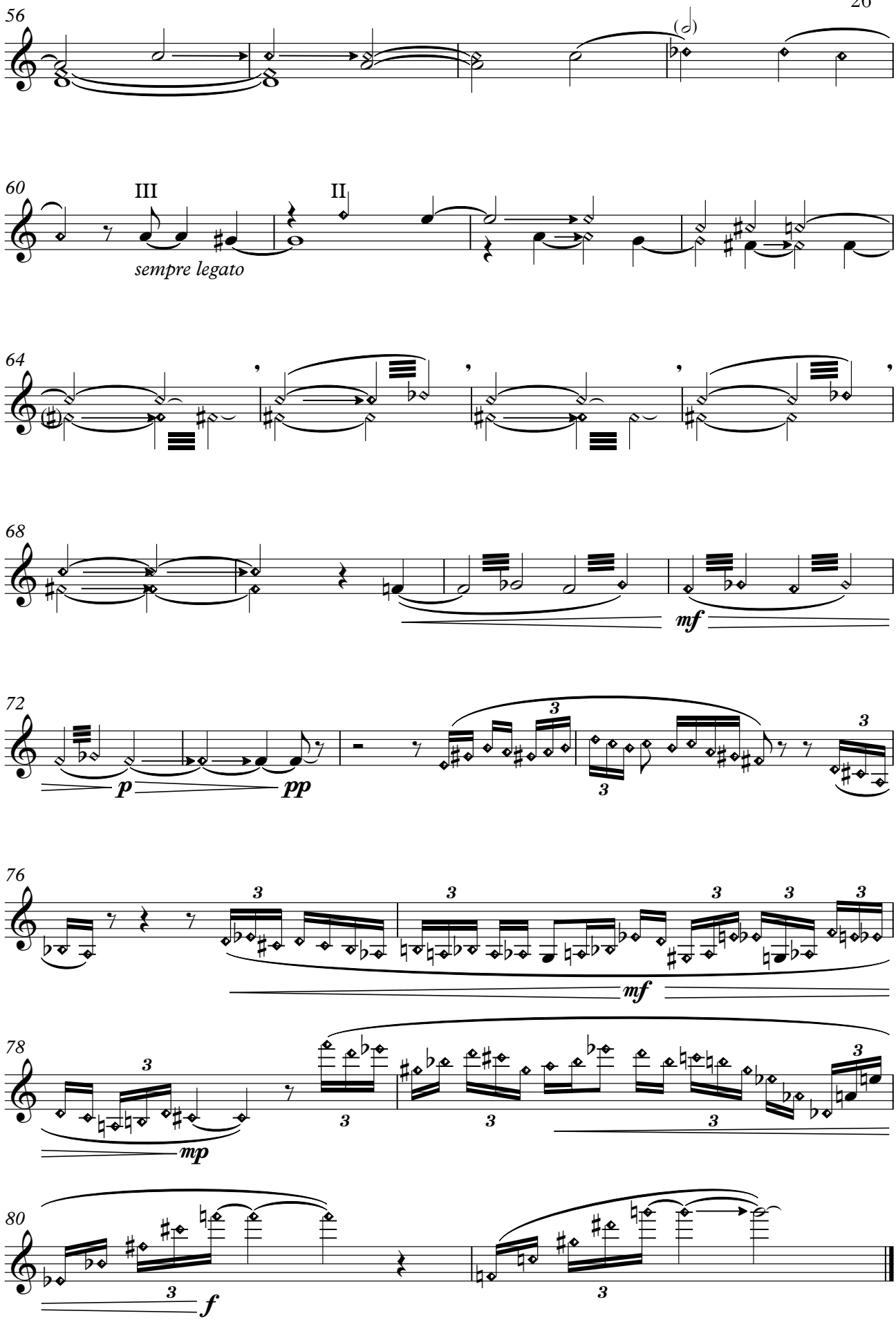
# what are you doing with the humans?

for solo violin

Rhys Gray




24
p
mp
26
p
mp
pp
p
29
f
III
mf
p
33
sul pont.
normale
pp
mf
36
p
III
mf
II
39
f
I
II
mp
legato
gliss.
43
gliss.
p
mf
II
III
gliss.
mp
48
to normale
p
mp
52
sul pont.
normale
mf
mp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III
II
sempre legato
64
68
mf
72
p
pp
3
76
mf
78
mp
80
f