CORA Cork Open Research Archive
Cartlann Taighde Oscailte Chorcaí

Title	Between consonance and dissonance
Authors	Longton, W. Hollas
Publication date	2019-12
Original Citation	Longton, W. H. 2019. Between consonance and dissonance. PhD Thesis, University College Cork.
Type of publication	Doctoral thesis
Rights	© 2019, W. Hollas Longton. - https://creativecommons.org/licenses/by-nc-nd/4.0/
Download date	2026-11-17 11:37:56
Item downloaded from	https://hdl.handle.net/10468/10130

UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Ollscoil na hÉireann, Corcaigh

National University of Ireland, Cork

Between Consonance and Dissonance

Thesis presented by

W. Hollas Longton, BMus, MMus

for the degree of

Doctor of Philosophy

University College Cork

School of Music

Head of School of Music and Theatre: Mr. John Godfrey

Research Supervisor: Mr. John Godfrey

December 2019

Table of Contents

List of Figures....4
List of Works....5
List of Works with Accompanying Max/MSP Sine-Tone Chords....6
List of Recordings....7
Epigraph....9
A Brief Definition of Experimental Art....10
Introduction....11
Artistic Statement....11
Part 1: Background and Compositional Philosophy....13
1. Philosophy: The Promise of the West....15
2. The Creation of Meaning and Hierarchical Structures....25
3. Process and Form: The Scientific/Artistic Methods....34
4. Stories About Form....39
Part 2: Examination of Techniques....47
Narratives of Technique: 1. The Invention of Timbre....50
Narratives of Technique: 2. Works Which Utilize Summation and Difference Tones....58
Narratives of Technique: 3. Grids and The Movement Towards Installations....73
Narratives of Technique: 4. 'Interval Linking' The Intimacy of the String Quartet....86
Part 3: Detailed Analyses of Four Specific Works....96
Violin Caprice: Harmonic Catalogue....96
String Trios: Some Perfect Chords/Some Imperfect Chords....102
Landscape with Train Whistle....109
Conclusion....119
The Future....120
Bibliography....122

This is to certify that the work I am submitting is my own and has not been submitted for another degree, either at University College Cork or elsewhere. All external references and sources are clearly acknowledged and identified within the contents. I have read and understood the regulations of University College Cork concerning plagiarism.

List of Figures

Figure 1: Page 28 of ‘Smudge’ (2010): 15
Figure 2: An example of a 6:1 stop from ‘For Leo’: 52
Figure 3: Cluster chord from ‘For Leo’:.....54
Figure 4: Melodic material in ‘For Leo’:.....55
Figure 5: Page 10 of ‘Mud Filigree’:.....57
Figure 6: Sketch of ‘Quartets I-VIII’:.....64
Figure 7: Harmonic rules for ’16 18 19 20’:.....66
Figure 8: Page two of ‘Immobile #1’: 70
Figure 9: Sample system of ‘Without Sky’: 73
Figure 10: Keys used in ‘The Gates of Los Angeles’:.....76
Figure 11: Deviation of keys from just intonation:.....76
Figure 12: Sample system of ‘Dissonance’ for baritone and sine-tone chord: 80
Figure 13: ‘Dissonance’ sine-tone chords tuning: 81
Figure 14: Interval linking example from ‘Walk Until Morning’: 88
Figure 17: Sizes of dyads used in ‘Harmonic Catalogue’: 99
Figure 18: Form of ‘Harmonic Catalogue’:.....99
Figure 19: Notation example from Louis Couperin’s ‘Unmeasured Preludes’: 101
Figure 20: Notation example from ‘Harmonic Catalogue’: 101
Figure 21: Harmonic series of the string trio:.....105
Figure 22: First ‘Perfect’ and ‘Imperfect’ Chords: 106
Figure 23: Form of ‘Some Perfect Chords’: 108
Figure 24: Work by Mark Lombardi:.....111
Figure 25: ‘Landscape with Train Whistle’ (piano part) with harmonic numbers:.....112
Figure 26: ‘Landscape with Train Whistle’ (ensemble part) with harmonic numbers: 113

List of Works

‘Writing for the First Time Through "An Coulin”’ (2013)	str quartet	4'15”
The Gates of Los Angeles (2013)	31-tet Huygens-Fokker org	10’ - ∞
Quartets I - VIII (2013 rev. 2015)	str quartet w or w/o sine-tone chord	8-16’
Rising for James Tenney (2013)	variable ensemble	7-30’
16 18 19 20 (2013)	str quartet	19-20’
Invisible Melody (2014)	bar, sine-tone	4’
Immobile #1 (2014)	egtr, tbn, vc	mult. of 4’
Walk Until Morning (2013-2014)	str quartet	17-68’
Dissonance for Baritone (2014)	bar, sine-tone chord	10 or 20’
For Leo (2012 rev. 2014)	pno	7’
Old Dutch Masters (2014)	as, tpt, tbn, egtr, vn, va	7’
Landscape with Train Whistle (Piano Version) (2014)	pno	10-30’
Distributions for String Quartet (2014)	str quartet	8-10’
Dissonance for Cello (2014)	vc, sine-tone chord	mult. of 5’
Mud Filigree (2014-15)	fl, bcl, tbn, pno, egtr, vn, va, vc, db	6’
Without Sky (2014-15)	vn, vc, db	12’30”
Harmonic Catalogue (2014-15)	vn	5’
Some Perfect Chords (2014-15)	vn, va, vc	21'
Notre Dame (2015)	vn, bfl, egtr, pno	10’
Dissonance for Violin (2015)	vn, sine-tone chord	mult. of 5’
Dissonance for Uilleann Pipes (2015)	uilleann pipes	mult. of 5’
Landscape with Train Whistle (Ensemble Version) (2015)	variable ens, pno	10-30’
Dissonance for Bass Flute (2015)	bfl, sine-tone chord	mult. of 5’
Dissonance (General Score) (2015)	inst(s) w or w/o sine-tone chord	mult. of 5’
Three Nocturnes (2015)	pno	12’
Some Imperfect Chords (2015)	vn, va, vc	53’

Ancillary Works

Bint (2013)	vn	5’
Just Intonation Method for Violin (2013)	vn	
Oesterle Melody (2014)	vn	5’
Markov Chain (2014)	perc solo	5-9’
Arpeggio (2015)	pno	7’-
36 Ghosts (transcription) (2015)	str quartet	2’30”

List of Works with Accompanying Max/MSP Sine-Tone Chords

Quartets I - VIII (2013 rev. 2015)

Dissonance for Baritone or Cello (2014)

Dissonance for Violin (2015)

Dissonance for Bass Flute (2015)

List of Recordings

Works Which Utilize Difference Tones

- 16 18 19 20 (2013) 19’48”
- Immobile #1 (excerpt) (2014) 2’07”

Grids and the Movement Towards Installations

- The Gates of Los Angeles (excerpt) (2013) 1’07”
- Dissonance for Cello (excerpt) (2014) 3’34”
- Notre Dame (2015) 10’12”
- Dissonance for Violin (excerpt) (2015) 5’14”
- Dissonance (General Score) (excerpts) (2015)
  - Dissonance for 2 Vc, Vn (with Violin sine-tone chord) (excerpt) 5’17”
  - Dissonance for 2 Vc, Vn (no sine-tones) (excerpt) 5’03”
  - Dissonance for 2 Vc, Vn (with Bass Flute sine-tone chord) (excerpt) 5’12”

‘Interval Linking’

- Walk Until Morning (excerpts) (2013-14)
  - Bar 1-21 4’13”
  - Bar 23-37 3’37”
  - Bar 39-55 4’17”
  - Bar 59-74 3’26”
  - Bar 74-End 6’40”
- Distributions for String Quartet (2014) 12’25”

Four Specific Works

- Harmonic Catalogue (2014-15) 4’08”
- Landscape with Train Whistle (Piano Version) (2014) 13’52”
- Landscape with Train Whistle (Ensemble Version) (2015) (premiere) 18’41”
- Landscape with Train Whistle (Ensemble Version) (Modelo 62) 18’50”
- Some Perfect Chords (2014-15) 13’20”
- Some Imperfect Chords (2015) 51’21”

Ancillary Works

- Bint (2013) 5’20”
- Oesterle Melody (2014) 4’07”
- Markov Chain (2014) 7’42”
- Death of a Salesman (excerpts) (2013)
  - Washing the Car 5’14”
  - Ben Theme 5’24”
  - Carrots 7’53”
  - A Perfect Proposition All Around 3’23”

Acknowledgements

I would like to thank my supervisor John Godfrey for his continued insight, help, and everlasting patience during the last few years. I am also grateful to my family and friends for their help and encouragement. I would also like to thank the staff at the Tuscany Village Starbucks and viewers like you.

Between Consonance and Dissonance

Epigraph

"For the body is not one member, but many. If the foot shall say, Because I am not the hand, I am not of the body; is it therefore not of the body? And if the ear shall say, Because I am not the eye, I am not of the body; is it therefore not of the body? If the whole body were an eye, where were the hearing? If the whole were hearing, where were the smelling? . . . And the eye cannot say unto the hand, I have no need of thee: nor again the head to the feet, I have no need of you. Nay, much more those members of the body, which seem to be more feeble, are necessary: And those members of the body, which we think to be less honourable, upon these we bestow more abundant honour; and our uncomely parts have more abundant comeliness..." - 1 Corinthians 12 (King James version)

A Brief Definition of Experimental Art

Falling in love is like swimming underwater. When I am underwater I don't feel separate from it, but close to and surrounded by it. The distinctions between my body and what is not my body disappear. In love, the distinctions we normally have between ourselves and others disappear and suddenly their fears, hopes, loves, desires, are our fears, hopes, loves, and desires. Whereas love is complete empathy for another person, experimental art is empathy for the world around us. Whereas love teaches us that we are not separate from another person, experimental art teaches us that we are not separate from the world around us.

Introduction

This paper will explore my interest in harmony through an examination of both the technical and philosophical aspects of my composition. The first section will provide background and place my work within the compositional/artistic canon while the second section will discuss the work in more technical detail. The second section will expand upon the conceptual and technical narratives in my body of work. This will followed by a more detailed analysis of four works which are the culmination of these narratives.

Artistic Statement

Harmony is perhaps best known for its ability to define the emotional mood of a piece of music and to create a euphonious sound. But it also has other applications, from creating colour, to changing how we perceive the passage of time. When harmony is thrust to the fore of a musical work it can become much more than a backdrop for other things - it can create what I call ‘harmonic spaces’. These harmonic spaces can be understood in a multitude of ways: 1) the formal/structural space it occupies within a work (e.g. a ‘chorale’ section), 2) the mental space it affords the performers and the audience (how it changes our perception of the work), and 3) the interactive space it affords the performers and the audience (how it changes the relationships between performers and between the performers and audience). For the purposes of this document I am mostly concerned with definitions 2) and 3).

Beginning in the 1960's La Monte Young began creating sound installations of continuously sounding static sine-tones. Within these harmonic spaces he spoke of allowing time to 'stand still[1]'. These works are a physical as well as philosophical manifestation of still time because they demarcate and define the physical/structural space of the room itself through the creation of standing waves. This idea forms the genesis of my explorations (physical, philosophical, historical) into the concept of harmonic space.

More generally, the work of La Monte Young forms a conceptual and technical framework for much of my own. I expand upon his use of just intonation and difference tones in his sine-tone installations in my own work as a means to embellish melody, produce harmony, and manufacture timbre. My work also draws upon the whimsical attitude of John Cage and visual artists (especially the work of Jackson Pollock) by introducing human error and agency into the idealism of just intonation and what Morton Feldman called the 'flat surface[2]' of the musical texture. In this way my work departs from that of Young (and the majority of composers interested in intonation) in that it celebrates human performance as a means of embellishment and subtle variation against otherwise perfect and sterile tuning environments. This unlikely marriage of the ideal and the human creates an inherent dissonance within my work. Through a broader exploration of the idea of artistic freedom I have come to the possible conclusion that the artist is only free when faced with such contradiction and restriction.

---

[1] Grimshaw, Jeremy Neal, *Draw a straight line and follow it : the music and mysticism of La Monte Young* (Oxford, Oxon, UK; New York, NY: Oxford University Press, 2011), 145.

[2] Friedman, B. H., ed., *Give My Regards to Eighth Street: Collected Writings of Morton Feldman* (Cambridge, Ma.: Exact Change, 2000), 127.

Part 1: Background and Compositional Philosophy

Background

During my Bachelor's degree at the University of Victoria I discovered the large collection of chain gang songs on the Library of Congress website[3]. These songs provided me with several new and exciting areas of research (the technique of heterophony, the dynamic of musical performance, and the vitality and specificity of this performance practice). I had at that time very little with which to compare them. From the collection, I became almost obsessed with a single recording of the song 'Makes a Long Time Man Feel Bad'[4]. This song is a single flowing melody (essentially a lining hymn) sung in unison but spread out in time and embellished heterophonically. This heterophony differs from much of the heterophony in Western music because the relationship between the parts in time is improvisatory rather than rigid (free rather than atomized down to some arbitrary smallest note value). The singers come in and out of rhythmic and harmonic unison with one another at different times in varying degrees. This makes the structure of the song almost as florid as the song itself. At the *front* of the song (the singer who usually introduces new pitches) is the leader who dictates the general pace of the song and generally leads. However, the other singers will sometimes sing ahead of the leader, embellish the melody, or sing simple underlying

---

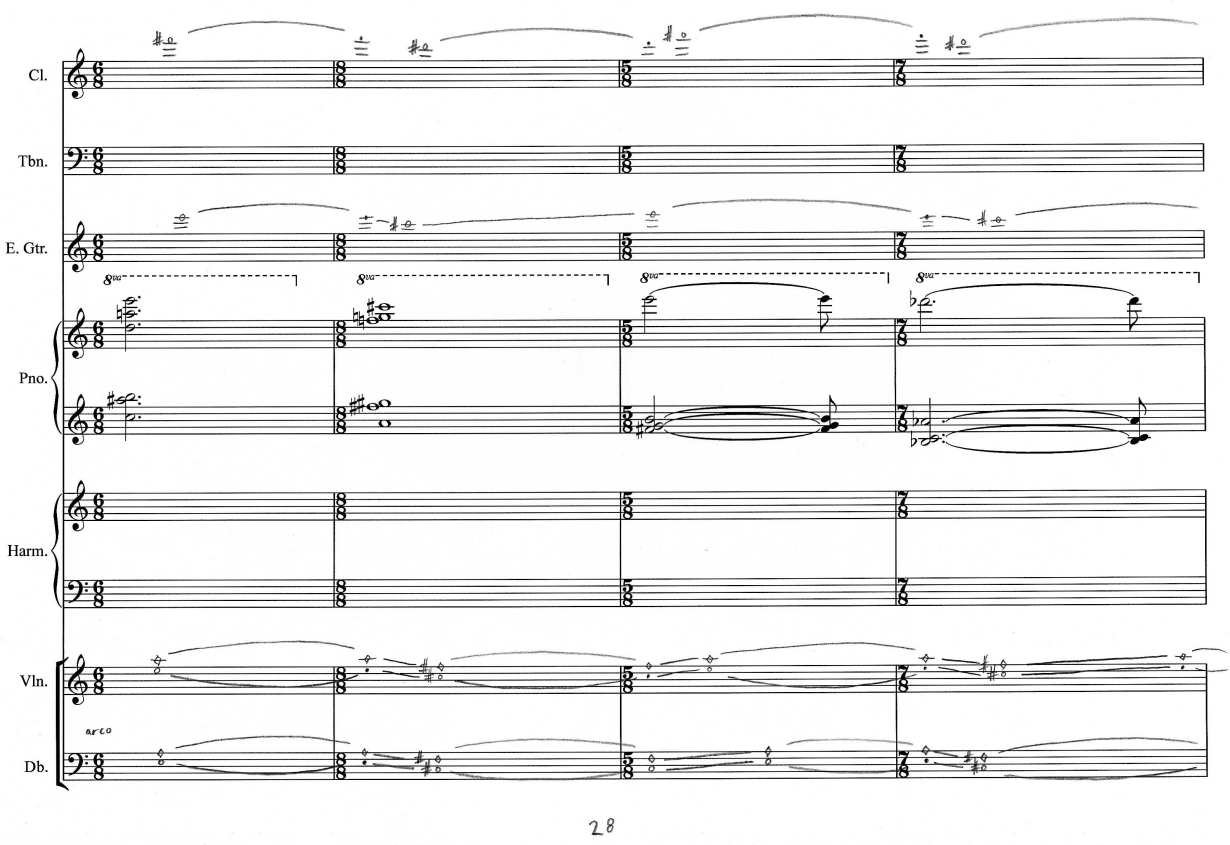
[3] John and Ruby Lomax, "1939 southern states recording trip," (AFC 1939/001), American Folklife Center, Library of Congress. https://www.loc.gov/collections/john-and-ruby-lomax/about-this-collection/

[4] Johnny Smith and Group of Convicts, *It Makes a Long Time Man Feel Bad.* Recorded May 23, 1939, Parchman Mississippi, from John and Ruby Lomax, "1939 southern states recording trip," American Folklife Center, Library of Congress. http://hdl.loc.gov/loc.afc/afcss39.2679b1

counterpoint against the mass of other singers. That a beautiful and intricate harmonic texture could be created almost entirely through a displacement in time was an idea which strongly resonated with me.

I became enamoured with this concept. Almost all of the music I composed during my Master's degree in The Hague utilized and imitated this heterophonic technique. 'Smudge', the first major work I wrote in The Hague (for the Maarten Altena Ensemble) is mostly made up of sections of florid melodies offset from one another with limited counterpoint in the same manner as the chain gang songs. However, interspersed between some of the melodic sections are near-static sections which predict my shift in focus away from melody towards harmony. These sections took the same heterophonic technique found in the chain and songs and the rest of the piece but applied it to severely restricted materials; the melody consists only of glissandi of a minor third back and forth between a B and a G#. The instrumentation of these sections (which included both a violin and a double bass playing artificial harmonics and an electric guitar played with a slide and an ebow), combined with the severely limited melody helped to bring out these acoustic effects (see 'Figure 1: Page 28 of 'Smudge' (2010)'). As with the chain gang songs, beats, changes of colour, and an awareness of the physical acoustic space suddenly came to the fore, with the melodic aspect decreasing in importance. These effects would become not only a technical focus, but also a philosophical one. My work of the last few years can be seen as a working out of the philosophical and technical implications of this particular kind of heterophony.

Figure 1: Page 28 of 'Smudge' (2010):



1. Philosophy: The Promise of the West

"History, Stephen said, is a nightmare from which I am trying to awake.[5]" - James Joyce 'Ulysses'

"It [the social contract] is to be looked on with other reverence; because it is not a partnership in things subservient only to the gross animal existence of a temporary and perishable nature. It is a partnership in all science; a partnership in all art; a partnership in every virtue, and in all perfection. As the ends of such a partnership cannot be obtained in

[5] James Joyce, *Ulysses*, (Project Gutenberg, 2008), 89, http://www.gutenberg.org/ebooks/4300

many generations, it becomes a partnership not only between those who are living, but between those who are living, those who are dead, and those who are to be born.[6]" - Edmund Burke 'Reflections on the Revolutions in France' (1790)

The Past as Physical Space

The idealized notion of the American West is one of almost infinite possibility. For Europeans coming from a world of Roman ruins and stone cathedrals into a world in which these kinds of monuments were largely absent (especially in the plains states where the people were migratory rather than stationary), the American West afforded them the luxury to view their physical space largely without a sense of responsibility or homage to the past. (At the very least, there was no European past to contend with.) While Europeans were somewhat compelled to view their landscape through the lens of the past, Europeans who arrived on the American continent allowed themselves to view this new landscape as the future. Europeans' conception of the past does not in itself however render change or innovation impossible. The ubiquity of a visible past could (and has) been seen as something to react against or build upon, as looking upon it can be at once humbling and empowering. The distinction between these two modes of thought then is simply the degree to which one is obligated to look backwards as one goes forwards, since innovation is always a dance between the past and the future.

---

6 Edmund Burke, *The Works of the Right Honourable Edmund Burke, Vol. 03 (of 12)*, (Project Gutenberg, 2005), 596, http://www.gutenberg.org/ebooks/15679

John Cage and The West

The North American idea of the west as a future space always struck me as somewhat analogous to John Cage's concept of 'nothing' or ‘silence'[7]. It is not a space without restriction, but a mental space in which the artifice of civilization can wane, and in which the built-up distinctions and demarcations of culture become unimportant or meaningless. Practically, Cage’s willingness to abandon the traditional Western European musical hierarchical structures and introduce chaos and ‘Indeterminacy’ into the musical canon as not only philosophical concepts but also as formal devices continues to be incredibly valuable in undoing many of the traditional constraints of Western culture.

A Problem with Cage

“In the course of a lecture last winter at Columbia, Suzuki said that there was a difference between Oriental thinking and European thinking, that in European thinking things are seen as causing one another and having effects, whereas in Oriental thinking this seeing of cause and effect is not emphasized but instead one makes an identification with what is here and now.[8]” - John Cage ‘Composition as Process: III. Communication’

Perhaps the greatest challenge to listeners and performers of the work of John Cage is the idea of non-consequence; that the sounds do not follow one another through a concrete

---

[7] John Cage, “Lecture on Nothing," in *Silence : lectures and writings*, 109.

[8] John Cage, “Composition as Process: III. Communication,” in *Silence : lectures and writings*, 46.

formal and semiotic system, but through happenstance. This idea, partly taken from Zen Buddhism, directly contradicts the Western ethos, in which *musical phrases are built from cells or gestures, larger sections built from phrases, and movements or whole works comprising a number of sections*. In this way the meaning of a work of Western music is seen to derive from its nested form, as notes, phrases, and sections seem to logically relate and lead to the next. Moreover, the manner in which the constituent levels of resolution of the musical form (notes, phrases, sections, and movements) interact with one another further informs this nested meaning. As the painter Gerhard Richter said in an interview with Benjamin H. D. Buchloh "When I place one colour-form next to another, then it automatically relates to that other.[9]"

Contrast this idea with Cage's quotation of Marshall McLuhan and James Tenney:

"As McLuhan says, everything happens at once. Image is no longer stream falling over rocks, getting from original to final place; it is as Tenney explained: a vibrating complex, any addition or subtraction of component(s), regardless of apparent position(s) in the total system, producing alteration, a different music.[10]" - John Cage 'Diary: How to Improve the World (You Will Only Make Matters Worse)'

---

[9] Obrist, Hans-Ulrich, ed., "Interview with Benjamin H. D. Buchloh, 1986" in *The daily practice of painting : writings and interviews, 1962-1993 / Gerhard Richter,* trans. David Britt, (Cambridge, Massachusetts: MIT Press, 2002), 155.

[10] John Cage, *Diary: How to Improve the World (You Will Only Make Matters Worse),* with John Cage, speaker, recorded June 22-24, 1991, on *Diary: How to Improve the World You Will Only Make Matters Worse*, on Wergo Germany 3795760232, 2000, compact disc.

Cage's compositional practice and attitude are thus a radical departure from the Western cultural canon. The key phrase here is *"regardless of apparent position(s)"*, as it describes a lack of hierarchical importance derived from its position in *"the total system"*. To think about it linguistically, this describes a situation in which an article is not differentiated from a verb; this dissolution of hierarchies renders the ordering of words meaningless. In somewhat the same manner, Cage sets about creating situations in which different kinds of sounds occur in a manner and texture more analogous to a forest than a symphony, as *"[a]rt is the imitation of nature in her manner of operation.[11]"* Borrowing much of his philosophy from Zen, for Cage the job of music was not to construct a narrative, but, in the words of Gita Sarabhai *"[t]o sober and quiet the mind and thus make it susceptible to divine influences.[12]"*

My issue with Cage has never been his philosophy or aesthetic principles, but rather their efficacy as manifested in my own art. It was only after a long period of reflection that I began to recognize my own typically 'Western' issues with Cage. What I ultimately realized was that as a listener I was always (unconsciously at least) constructing language and narratives about what I was experiencing, regardless of philosophy. For me, the listening experience is always a struggle between the basic human attraction towards the visceral nature of sound, and the human desire to construct meanings and order and to 'make sense' of the world around us. It is not that I personally believe that Cage's sounds have some intrinsic identifiable meaning, but that the mechanism by which westerners like myself seek to bring order to the world is always in motion.

---

[11] John Cage, "On Robert Rauschenberg, Artist, And His Work" in *Silence : lectures and writings*, 100.

[12] John Cage, "45' For A Speaker" in *Silence : lectures and writings*, 158.

Wallace Stevens illustrates the human need to make order in the world in 'Anecdote of the Jar'[13]:

I placed a jar in Tennessee,

And round it was, upon a hill.

It made the slovenly wilderness

Surround that hill.

The wilderness rose up to it,

And sprawled around, no longer wild.

The jar was round upon the ground

And tall and of a port in air.

It took dominion everywhere.

The jar was gray and bare.

It did not give of bird or bush,

Like nothing else in Tennessee.

To quote Camille Paglia '[f]or Stevens the skeptic and nonbeliever, … human artifacts alone produce meaning. Without our perception and concepts, nature would remain a roiling morass.[14]' Furthermore, 'Stevens in not a realist, a holding a mirror up to nature. On the

---

[13] Wallace Stevens, "Anecdote of a Jar," from *Collected Poems,* ed. Alfred A. Knopf. (New York: Knopf Doubleday Publishing Group, a division of Random House LLC, 1990.) https://www.poetryfoundation.org/poetrymagazine/poems/14575/anecdote-of-the-jar

[14] Paglia, Camille. *Break, blow, burn* (New York, NY: Pantheon Books, 2005), 125.

contrary, like the Cubists, he believes art transforms reality, sometimes unrecognizably.[15]' The jar itself 'remains firm and still, while nature is in flux: the wilderness rises and "sprawl[s]" around the hill like a heaving sea or a woman in labor.[16]' The jar to me is evidence of artistic work, a record of attention put towards the artistic act. I would disagree slightly with Paglia's characterization that it 'transforms reality' (though it may have done for Stevens), rather I see it as evidence of the transformed reality of the artist's mind. That the jar 'took dominion everywhere' and 'did not give of bird or bush' is a demonstration of what Stevens called the 'rage to order' in his poem 'The Idea of Order at Key West'. In this poem a woman's song is the jar upon the hill, as '[s]he was the single artificer of the world[17]'. The placement of the jar upon the hill is the creation of the architecture of order within Stevens' mind. This architecture creates the frame of order for the wilderness as:

'*The wilderness rose up to it,*

And sprawled around, no longer wild.'

On the other hand, by exploding these traditional nested hierarchies, Cage makes the identification of objects, functions and meanings very difficult. Time, the default axis onto which narrative structures are mapped, is essentially robbed of its narrative '*and then'* function. Without this narrative function the musical work, like painting or sculpture, is presented essentially outside time. The musical work becomes analogous to a sculpture both

---

[15] Paglia, 125.

[16] Ibid.

[17] Wallace Stevens, "The Idea of Order at Key West," from *Collected Poems,* ed. Alfred A. Knopf. (New York: Knopf Doubleday Publishing Group, a division of Random House LLC, 1990.) https://www.poetryfoundation.org/poems/43431/the-idea-of-order-at-key-west

because the audience is invited to explore the work, rather than being passive listeners to a story, and because the audience is invited to take a more active role in the listening experience (the audience becomes the narrative function). This active role extends the breakdown of hierarchical structures outside the musical material to include the relationship between performers, performers and audience, and audience and performance space. With these distinctions broken down, the audience is invited into a new mental and philosophical space of radical empathy (as described in the 'Brief Definition of Experimental Art' at the beginning of this document).

The Connection of Cage's Environments to Idea of The West

"What I'm proposing, to myself and other people, is what I often call the tourist attitude - that you act as though you've never been there before. So that you're not supposed to know anything about it. If you really get down to brass tacks, we have never been anywhere before.[18]" - John Cage "Musicage: Cage Muses on Words, Art, Music"

As the mythologized notion of the 'West' (from the American wild west all the way back to Crete - the stomping ground of many myths) is one of fertile potent spaces, so too is Cage's idealized notion of composition the creation of fertile spaces of possible action, possible art, and possible ways of listening rather than prescribed action. This manner by which Cage was able to evade and transcend the classical didactic narrative structures and create new spaces is my main point of connection between Cage and the idealized conception of 'the West'.

---

18 John Cage, "John Cage and Joan Retallack: Cage's Loft, New York City: October 21-23, 1991" in *Musicage : Cage muses on words, art, music*, ed. Joan Retallack, (Hanover, N.H.: University Press of New England, 1996), 129.

Furthermore, these new spaces multiply both in number and in conception; a composition can open itself up along a greater number of axes, and can include notions and directions pertaining to the relationship between the audience, performers, and performance space.

Cage and the Individual

"One would think I would have gotten more involved with the ideas, since I was so deeply interested in the music they produced. It didn't work that way. The more interested I got in Cage's music the more detached I became from his ideas.[19]" - Morton Feldman 'Give My Regards To Eighth Street'

New artistic spaces breed new demands and new attitudes. Often, we are only able to understand the possibilities and limitations of a space through an exploration of possible actions within it. For these spaces to hold the broad range of interpretive possibilities for which Cage advocated, the people within them need to take this radical empathy to heart and exercise a heightened degree of agency. In many of Cage's more abstract and conceptual works (e.g. the 'Variations' series[20]), he not only gives more license to the performers to explore the works in a greater variety of ways, but also demands the performers use this license. While this view of Cage departs from the modern canonical view (which focuses on his connection to eastern philosophy, Marxism, and anarchism), it serves the purpose of unifying an underlying attachment to the structures and practices of tradition with a

---

[19] Friedman, 96.

[20] John Cage, "Variations IV : for any number of players, any sounds or combinations of sounds produced by any means, with or without other activities." (New York: C.F. Peters Corp., 1965)

fundamental need to create artistic statements which depart from them; the individual in the guise of a ‘polyglot’ musician like myself, holding the past in one hand and the future in the other.

My Compositional Spaces

Like Cage, many of my works resemble musical environments rather than explicit narratives. The sounds in my works stand for nothing (at least in any traditional specific semiotic sense), but I do not view this ‘nothing’ as Cage did through the lens of Zen. The ambiguity and sparseness of sound material in my work is more akin to a Protestant musical piety than the selflessness of Zen. Possibly stemming from the influence of my Dutch composition teachers Gilius van Bergeijk and Cornelis de Bondt, the dearth of material in some of my work is more Calvinistic: it encourages the listener to appreciate and meditate on what material there is rather than on the nature of ‘nothing’. By inviting the listener to meditate on something quite small the perception of that thing can paradoxically become quite large. When works contain very little of what we would traditionally consider musical material our sense of perspective is allowed to drastically change. In the Western mindset, we tend to compensate for a lack of material by injecting more of ourselves (expectation, importance, etc.) into what material remains. While Cage confronts us with the possibilities of infinity (that anything can happen at any time), my work confronts the listener with the infinite possibilities of one thing. This is most evident in my ever-expanding ‘Dissonance’ series, which will be discussed later.

2. The Creation of Meaning and Hierarchical Structures

Dissonance and the Birth of Restriction

"As far as I can recall, the initial shiver of inspiration was somehow prompted by a newspaper story about an ape in the Jardin des Plantes, who, after months of coaxing by a scientist, produced the first drawing ever charcoaled by an animal: this sketch shows the bars of the poor creature's cage.[21]" - Vladimir Nabokov 'On A Book Entitled 'Lolita" (1956)

While I was studying in The Hague I remarked to a friend that all I was really looking for was dissonance, but that it was getting harder and harder to come by. This was not an analytical critique, but my gut reaction, an intuitive sense of what was missing. Years later I began to fully understand the broader implications of this statement. Dissonance, in a very basic way, is a hierarchical mechanism. It defines a value system within a work, what does and does not belong and what is and is not 'normal' within the system of the piece. Consonance and dissonance together define the categories of 'normal' and 'abnormal' and creates functions and restrictions in how the piece is allowed to move forward or progress. While I maintain that these definitions are useful, I should note that the categories of consonance and dissonance are highly malleable across time and culture, and even within a single work. Individual interpretation is tempered by the broader culture the individual brings with them. The definitions of these categories are thus not self-contained, but are filtered through culture and the individual. Because of this cultural context, a sound might be

---

21 Vladimir Nabokov, "On a Book Entitled "Lolita"," in *Lolita* (New York: Vintage International, 1997), 311.

mentally categorized as ‘dissonant’ before it is ever given context in a musical work.

While we can extrapolate ‘normal’ and ‘abnormal’ (and some shades in between) from these categories, it should be noted that the use of a basic hierarchical structure like dissonance does not automatically create the highly layered and complex semiotic structures of a fully developed musical language like tonal harmony. Instead, they construct a kind of skeletal meaning; a vague outline of forms and structures which, while not necessarily resembling the past, can carry some of the same rhetorical weight. In examining these ideas and my earlier statement that I was only looking for dissonance I finally realized that the artist is not, as is the cliché, trying to be free and restricted by cultural mores and pressures, but rather looking for restriction and finding only freedom. This is a freedom which not only includes restrictions, but relies on them. As Morton Feldman described in ‘*Give My Regards to Eighth Street’*: *“Freedom is best understood by someone like Rothko who was free to do only one thing - to make a Rothko - and did so over and over again*[22]”.

Nabokov takes this idea in a slightly different direction. Rather than stating outright that we desire restriction, he puts the artist, and perhaps humanity, back into Plato’s allegorical cave[23]. What we can know about the world is only what we can see. The Romantic ideal of the artist who can see past the shallow edifice of society to reveal hidden truths is flipped on its head. The artist becomes Nabokov’s ape - the revealed hidden truths are only the bars of a previously invisible cage.

---

[22] Friedman, 99.

[23] Plato. ca. 380 BCE. The Republic. Timaeus. The Academy, Athens - in present-day Athens, Greece (in Greek).

‘Non-Cultural’ Systems

“A technique is only a means of arriving at a statement.[24]” - Jackson Pollock

One of the most unfortunate aspects of studying the writings and music of John Cage is that it soured me on traditional notions and structures of culture. However, Cage’s apathy towards these traditional structures did not eliminate my desire to find and create formal structures in my own music. Instead, Cage led me to seek out structures and techniques which were not in themselves so culturally specific (e.g. basic structures or concepts such as a tuning mode or a drone which are used in some sense across the globe). As my compositional language grew and I sought to create more defined and distinct artistic statements, my need to delineate sounds from one another and create at least semi-defined hierarchical structures gradually outgrew my previous desire to avoid the old notions of ‘culture’ at any cost. It was the desire to find and explore systems which were more general and abstract which eventually led me towards the concepts and practices of just intonation, drone, and dissonance. These investigations would form the basis for the development of harmonic and formal structures which would become a central aspect of my work.

---

[24] Hans Namuth and Paul Falkenberg (directors), “Jackson Pollock 51,” YouTube video, 3:52, posted by “facs1900b,” Dec 1, 2006, https://www.youtube.com/watch?v=CrVE-WQBcYQ

Effort and Agency

As both a violinist and composer I was previously fascinated with Cage's 'Freeman Etudes[25]', which were designed to be nearly impossible to play (and in my opinion also quite difficult to listen to). Cage's idea was that the practice of attempting to play these works would bring about interesting results, in their successes and failures, or rather that neither success nor failure is profound[26]. Because the pitches (based off of star charts) are in a sense random, there is no narrative way to understand them. Their purpose hidden, the most obvious aspect of the piece becomes the effort undertaken by the performer to play these pitches and rhythms precisely and accurately. In the absence of narrative and the normal notions of interpretation we are left with the distilled essence of virtuosity: the hero (performer) overcomes adversity (the physical limitations of their instrument and the demands of the score).

While I share with the 'Freeman Etudes' a desire to push the boundaries of virtuosity, my works have no such clear cut instruction - ostensibly to play the right notes at the right times. The attitude towards performance in my work is closer to a paragraph of Cornelius Cardew's 'The Great Learning'[27], which, in an allusion to the ancient Daoist practice of monks trying to sing over the sound of a waterfall, instructs the performers to try to sing over the sound of

---

[25] John Cage, "Freeman etudes : for violin solo, I-XVI, for Betty Freeman : New York City 1977-1980" (New York: Sole selling agents, C.F. Peters, 1981)

[26] John Cage, "Composition as Process: III. Communication," in *Silence : lectures and writings*, 46.

[27] Stephen Miles, "Notes on Cornelius Cardew," NewMusicNewCollege, http://www.newmusicnewcollege.org/cardew.html

a cacophony of loud drums[28]. The task given to the performers of overpowering the 'waterfall' is (at least in the long term) impossible, but this is of secondary importance to what the performers learn in the process: the sound created through this process, and the weakening of the illusion of the self which lies at the heart of the Zen of John Cage. In my more open-ended works (the 'Dissonance' series in particular) the criteria for success is not so clear-cut as completing an objective task but rather the broad exploration of the small amount of material within the work. As a composer I am interested in the viewpoint of the performer(s) on this small world. While the performance of this work may not be obviously virtuosic, both the technique required to accurately perform the pitches and the musicianship to pull it off are of an extremely high level of difficulty.

The Drone and the Creation of Hierarchies

A drone, by serving as a fixed point in the musical texture, exists as one manner of frame to give context to otherwise abstract musical mannerisms and behaviours. The former lecturer in medieval music, Latin, and director of the Medieval Music Program at the Royal Conservatoire at The Hague, Sasha Zamler-Carhart, once described Medieval modality as "an orbital system in which notes in the mode are in orbit around the tonic[29]". This analogy is useful for its inclusivity, as it could just as easily (in a general sense) describe Indian Raga or Appalachian Lining Hymns because it describes a behavioural relationship (with varying degrees of conscious agency) rather than a particular system or practice. With this analogy in mind, it seemed to me that this orbital behaviour to and away from a drone often carries with

---

[28] Ibid.

[29] Sasha Zamler-Carhart, facebook message to author, December 18, 2017.

it a connotation of striving for or against something. The drone, as a fixed point of reference, allows us to judge more clearly the attitude and character of any juxtaposing material. The melody is essentially personified as we understand the behaviour of the material around it. The character of this personified melody is judged by a number of factors with a wide range of cultural specificity. While the particular or minute mannerisms of melodic construction around a drone are much more culturally specific, the particular cultural mores about correct or incorrect melodic construction (e.g. the ancient Greeks' rules about proper melodic construction[30]) should not eliminate any general conclusions we can make. For example, we can surmise that a melody which exhibits regular (recognizable, stable) behaviour (identifiable scale, regular rhythm or rhythmic pattern) creates a predictable listening condition. Any noticeable or sudden deviation from this regular behaviour will be heard as a change in the personality of the melody. The drone, by acting as a stable frame, acts to magnify the appearance of any change in behaviour; it allows us to better judge what might or should happen by what has already happened - to weigh expectation against past experience. With this basic framework established, more complex relationships which denote not only relative importance between component parts, but also situational and conditional levels of importance within this framework can be understood. In short, a hierarchy is established. Among these situational or conditional levels of importance is the practice of ornamentation, the subtleties of which are only possible to understand when we are able to weigh the importance of one part against another.

---

[30] Tenney, James, *A History of : 'Consonance' and 'Dissonance'*, (New York: Excelsior Music Publishing Co., 1988), 9-12.

Just-Intonation As Non-Cultural Hierarchical System

Just intonation is, briefly put, the practice of composing by tuning pitches to whole number ratios (e.g. 5:4, 3:2, 27:9). Technically speaking, any relationship between pitches which can be described as a whole number ratio is just intonation. In practice, however, a set (collection of pitches) in which the pitches can be represented as relatively small whole number ratios (e.g. 7:4, or 4:3) is what is commonly known as 'just intonation'. Because these simpler relationships are deemed 'natural' (rather than as a product of some arbitrary man-made system), there is the tendency to hold onto the naturalist fallacy that harmonies which are expressed using simple ratios *must* be beautiful because they are 'natural'. An underlying physical rationale for just intonation is that the frequencies of a just-tuned chord will be such that different harmonics of different pitches physically line up and reinforce one another in the performance space, creating what are called 'standing waves' (static places in the space where different harmonics are easily audible[31]).

A Practical Fascination with Just Intonation

In a symphony orchestra there are occasional moments of harmonic clarity, in which the whole of the orchestra will rest upon a single chord or note, sometimes even without vibrato. From the first time I heard this sound from the inside (playing in an orchestra) I was entranced by it. These short moments of pure harmony were my first window into the kaleidoscopic world of just intonation and the use of sustained tones. As I grew older, I found myself missing those visceral moments more and more. The exploration of just intonation for

---

[31] Grimshaw, 139-141.

me was not a philosophical fascination but a desire to return to those moments of harmonic clarity - to be inside the sound.

The other attraction of just intonation is that it in some ways solves a problem with form. This problem, which I will call the 'tension and release problem' is borne out of two assumptions. The first assumption is that musical material is primarily concerned with what pitches and sounds occur at what times - that musical interest and variation comes from a proper variation of pitch and rhythm. Music is put into a position in which things *must happen* (pitches and rhythms change and mutate) in order for the piece of music to hold the interest of the listener. The second assumption is that in order for formal structures to seem coherent (to allow for an easy understanding of the artwork as a whole), there is an obligation to create something akin to an 'arch form', whereby any large scale departure from the starting condition will be resolved by a return to said starting position.

While Cage sought to solve this problem and create novel new forms mainly through juxtaposition (pseudo-random procedures such as 'Indeterminacy'), others like myself have sought to solve this problem through the celebration of the vast other world of harmonics (an appreciation and recognition of harmonic spectra). If musical material is understood to be anything that can be heard, not only what pitches happen at what times but also a recognition of other acoustic properties within a sound (and amplified by the performance space), then the need for 'variation' (understood as a change in rhythm and pitch) wanes. As the listener is aware of more musical information and more willing to listen ever closer to subtle aspects of sound, one finds there is always something more to hear and there is almost no need for variation in the traditional sense. Our desire to explore and experience new things (the basic

impetus for variation) is satiated by a heightened awareness of sound. Where previously harmony held importance mostly through its narrative function (how it informed the relationship of what came before to what comes after), the recognition of the vast other world of harmonics gives harmony - and sound itself - an inner life. An awareness of the great wealth of harmonic partials in an acoustic space allows it in some sense to become non-narrative, to break free of the narrative trope of tension and release.

The recognition of the vast number and variety of harmonics present in any sound also lends more importance to the physical aspects of performance (the performance space and how the performers are arranged in that space). In this way the practice of just intonation also acts as a physical criterion for music composition; the acoustic effects created through its use are more obvious when the physical aspects of performance are taken into consideration. This is most effectively demonstrated by La Monte Young's use of standing waves in his sine-tone installations, which will be discussed later.

3. Process and Form: The Scientific/Artistic Methods

Musical Egalitarianism

"The idea that everything is equal is not different from the idea that everything is unequal, unique.[32]*" - John Cage 'Diary: How to Improve the World (You Will Only Make Matters Worse)'*

Tom Johnson

One of the central aspects in Tom Johnson's work is predictability of form, and how his use of predictable processes brings about predictable form. His most famous work, the 'Chord Catalogue'[33] is exactly as the title suggests: a catalogue comprising of all possible chords within one octave of the piano. This work is not a quirky aberration within Johnson's oeuvre, but rather a clear and concise manifestation of both his attitude towards musical form and his artistic philosophy. Tom Johnson always reminds me of the sculptor Donald Judd, whose work consists mainly of open boxes of different dimensions and materials. Judd will cite the 19th century British empiricists to precisely explain how his work is concerned with measurements and space[34]. These two artists embrace strict and often banal predictability as a means of expanding the horizons of their work. Rather than creating art *moment to moment*,

---

[32] Cage, *Diary: How to Improve the World (You Will Only Make Matters Worse).*

[33] Tom Johnson, "Chord Catalogue" (Editions 75, 1986), available http://www.editions75.com/FreeScores/TheChordCatalogue.pdf

[34] George Rickey and Donald Judd, "Two Contemporary Artists Comment," *Art Journal 41,* Issue 3 (Autumn 1981): 248-250, doi:10.1080/00043249.1981.10792483.

they embrace predictable and often banal linear processes to let other previously latent aspects of the work come forward.

The Factory and The Woods

The work of John Cage is perhaps the antithesis to the quasi-scientific methodology of Johnson. Cage's concept of ‘Indeterminacy’, which was influenced greatly by Zen, places a great emphasis on unpredictability, on not knowing, and the chaotic. Cages uses the processes of Indeterminacy to help us focus on the present moment in an attempt to free sound materials from traditional ideas of form and logical consequence.

While the methodologies of Indeterminacy and the scientific method (epitomized by Cage and Johnson) are often viewed as opposites, they are not in their attitude mutually exclusive. While the experimental tradition of Cage cultivates a radical empathy towards one's surroundings and a lack of hierarchical distinctions between things, the scientific method aims to learn about the world through a cool objectivism. Through opposite processes a similar attitude emerges, and in both world-views the task of the artist is re-imagined. The Romantic ideal of expressing one’s deepest desires is replaced by an affection for raw processes and banal materials. By letting the material speak for itself as clearly and impartially as possible, both Cage and Johnson take themselves out of the idyllic Romantic process of composition.

Logical Consequence

Both Cage and Johnson use processes which are largely arbitrary as a means to invent new form. Within these processes one thing follows another not because of the personal whims of the composer, but rather by some arbitrary rule. With Cage a great deal of choice is often left to the performers, who often have no idea (and no way of knowing) what kinds of things the other performers will or can do. This chaotic collision of individual ideas is the machinery of this pseudo-random process which creates a constant variety of sounds. The listener is metaphorically left to examine wild and strange plants. Finding these plants unrecognizable and unnameable, the traditional process of discerning form and function is ultimately futile - the listener is forced to confront the sounds as they are. Adjacent or juxtaposing sounds have no more connection to one another than the sound of traffic does with Beethoven's 'Emperor' Concerto. With Johnson one thing follows another much more systematically. In the 'Chord Catalogue' for example, note C follows note B not because Johnson liked the sound of it, but because it is the next note in a rising chromatic scale. As a process like this one becomes more obvious, it either meets an arbitrary end (as in 'Narayana's Cows'[35]) or gives us a clue as to how it logically should end (for example the accumulation of pitches in the 'Chord Catalogue'[36]). The banality of the process and the tedium of repetition makes us fully aware of each step of the process, even when we cannot identify the end result. While Johnson's predictable forms show us all of the possible combinations of sounds in an arbitrary mechanistic manner, Cage's Indeterminacy and aleatory invite us to imagine the infinity of unheard possibilities.

---

[35] Tom Johnson, "Narayana's Cows" (Editions 75, 1989).

[36] Tom Johnson, "Chord Catalogue".

The Piety of Impartiality

The problem with the application of the impartial scientific attitude in art is that while science aims to understand the world, art has no such mandate. Art has no cold impartiality, and no objective data points. As it is commonly understood, art's mandate is the creation or elucidation of beauty. Although we often hear Keats' famous line that 'beauty is truth, truth beauty' used as a kind of artistic maxim, we gain almost nothing from this statement. That is, while we may say that something is beautiful and therefore has some 'truth' to it, we cannot say the inverse. Because beauty (rather than truth) is the lens of art, we are always judging truth from beauty rather than vice versa.

Furthermore, the perspective and methodology of the artist is almost antithetical to our experience of viewing or hearing it. Even in the case of art which purports to be cold (e.g. a cube by Sol LeWitt) what we take from our experience of looking at is not only the experience of looking at a cube. Rather, the cube refers to other things we have seen individually, culturally, the room and any other artworks therein, etc. Moreover, the cube refers to other things in the absence of what it does (e.g. the Malevich 'Black Square', a kind of anti-form). It becomes in its absence of form an almost Cagean demonstration of nothing, a negative image of the artwork.

Although there are many problems with any philosophy or approach of art, as the artist is always keenly aware of their limitations, by striving for impartiality and distance from the source material the artist takes on a kind of piety. For the performer this is a devotional attitude towards the composer (try to do what they asked), while for the artist (composer) it is

a way of ensuring self-discovery through distance from the material. The lingering devotional legacy of art is the belief that it is something greater than yourself. As we believe that our art is of greater importance than our own lifespans, art becomes (as Burke stated) *"... a partnership not only between those who are living, but between those who are living, those who are dead, and those who are to be born.*[37]*"*

[37] Burke, 596.

4. Stories About Form

Scale

Standing in front of a blank canvas much larger than yourself is one of the most powerful things I have experienced as an artist. One is simultaneously in awe of, and powerless against, the vastness of the space in front of you. I never had the impetus to 'fill in' the blank space, even when I had just started painting, but rather to put something on the canvas to match this feeling of enormity and power. What I learned very quickly was that the eye effectively has an optimal resolution quite aside from what forms were placed where.

Pollock and Form

"There is no accident, just as there is no beginning and no end.[38]" - Jackson Pollock

"On the floor I am more at ease, I feel nearer more a part of the painting since this way I can walk around it, work from the four sides and literally be in the painting.[39]" - Jackson Pollock

When I was at the Metropolitan Museum of Art in New York I got to see a large Jackson Pollock for the first time ('Autumn Rhythm'). The immensity of the painting was first and foremost in my mind; the paint on it initially unimportant. Pollock's works are often immense, and they are striking almost Romantic assertions of artistic will (the 'expressionism'

---

[38] Namuth and Falkenberg, "Jackson Pollock 51."

[39] Ibid.

in 'abstract expressionism'). However, the experience of viewing a Pollock is far from a static one, as the composition is designed to endlessly entrance and excite the eye.

While we may note the similarities between Pollock and the old masters in terms of their global form, these formal similarities mask an underlying difference in their sense of scale which is the result of the nature of the works' particular forms. My perspective as a painter is that we don't desire large or small forms, but rather that we desire a particular relationship between the size of the forms on the canvas and the size of the canvas itself. With a large Rembrandt such as 'The Night Watch' we are able to stand back and understand the whole of the painting as an object and the narrative therein within one view. Although the eye jumps around from object to object, noticing and examining subtleties and gradations within the figures, this is an analysis of the mechanisms within the work rather than a general viewing of it. (An analysis of the gradations of the paint in a figurative painting tells us the mechanisms by which light, movement, and any other manner of illusion are created - how the structure and narrative of the painting is perfected, but this does not tell us what that structure or narrative is, or how we respond to it.) With 'The Night Watch', the size relationship between the forms within the work and the work as a whole remains as one would expect, as the spatial relationships between the figures within it are ordinary. The subtle gradations of colour and light within the figures effect the nature of the figures and the nature of the figures effects the nature of the relationship between figures. Although each of these levels effects the other, a single misplaced brushstroke does not destroy the cohesion within the work. The hierarchical nature of construction ensures a degree of artistic safety in this respect as the general aspect of the picture maintains a hierarchical dominance over individual figures or brushstrokes.

My sense of Pollock, however, was that this way of viewing the work was impossible. There are no objects to grab onto. Paint stands for paint; it is form, line, movement, and colour. From this standpoint the eye dances and searches infinitely for some identifiable formal clarity to hold on to. However, because Pollock lacks the kinds of objects which lend themselves to a top down hierarchical organization it is much more difficult to understand the work as the sum total of its constituent parts. Instead we are invited to go inside it, to examine its surface extremely closely - to let it surround us. The painting behaves much as a flock of starlings does: each drop or fling of paint is metaphorically an individual starling within a large flock; any subtle change of direction of any individual starling has the ability to create a cascading effect and change the direction of all of them (Cage once described a similar behaviour among clams resting upon one another[40]). To gather any real understanding of the behaviour of the paint as a whole means understanding the subtle changes of direction of the individual drips. The global 'dance' is only comprehensible from inside the work, rather than from outside it. We are put into a situation where, rather than looking at a hierarchically-arranged set of objects in a frame as with Rembrandt, we are looking at a universe from the inside out.

La Monte Young and Form

"[T]he concept of form which is not so directional in time, not so much climactic form, but rather form which allows time… to stand still.[41]" - La Monte Young

---

[40] Cage, *Diary: How to Improve the World (You Will Only Make Matters Worse)*.

[41] Grimshaw, 145.

Formally speaking, Cage and more traditional music can be said to sit at opposing ends of the traditionalist-iconoclast scale. However, sitting alongside the chaotic whimsy of Cage and Zen is the more Daoist attitude of La Monte Young[42]. While Cage presents us with musical worlds in which there is the sense that anything can happen at any time, Young's long compositions are near-static progressions along one line of thought. Young combines (in)famously long durations with restricted materials to give us space to mentally breathe inside the work and for him to slowly unfurl a kind of epic story. One would be mistaken, however, for assuming that Young's works are narratives in the traditional sense. They are closer to monologue than to Shakespeare - meditations or solitary contemplations on a static object: thoughts rather than events. Young's works are in a sense caught between the two worlds of narrative and non-narrative. With his affection for Indian music one can hear the value he places on particular gestures within a work, but these small events do not build to anything like a narrative (as they do in Indian music). Any sense of progression is offset by the immense size of the surrounding work and the sheer number of particular events inside it. Young's mammoth solo work for cello and recorded cello drone, 'Just Charles & Cello in the Romantic Chord'[43] serves as a good example of this. The piece is made up of extended quasi-improvised raga-like melodies which are occasionally broken by sections of near-static harmony. While one has a sense of progression listening to it (the melodies become generally busier and more ornamented), one cannot identify a narrative goal. It is like an epic poem in the sense that there is too much material to take in to easily see the whole picture.

---

[42] Kyle Gann, "The Outer Edge of Consonance," in *Sound and light: La Monte Young, Marian Zazeela,* eds. William Duckworth and Richard Fleming (Lewisburg, Pa.: Bucknell University Press, 1996), 153.

[43] "La Monte Young - Just Charles & Cello in The Romantic Chord," accessed February 6, 2013, http://rootstrata.com/rootblog/?p=588

While Young, the early Minimalists (Steve Reich), and other process-oriented composers (like Tom Johnson and Alvin Lucier) all heavily enlist an expanded notion of time in their work, La Monte Young and his friend Terry Riley are separated somewhat from the others by their particular use of improvisation. The addition of this human element, which likely stems from their shared immersion into jazz (and Young's immersion into Indian classical music), renders these forms not distinctly linear or 'automatic' (as with Johnson). Instead, these composers enlist the human element as agents within this process. While very little may occur within a composition, the human process of controlled improvisation renders it difficult to imagine or guess the outcome of the process once it has started. These directly human processes subject the overall form of a work to constant subtle variation. In incorporating improvisation into these extended monologues, Young creates a kind of Experimental process music which is philosophically not so far removed from the work of Morton Feldman.

Morton Feldman and Form

"As soon as you leave the 20 - 25 minute piece behind, in a one-movement work, different problems arise. Up to one hour you think about form, but after an hour and a half it's scale.[44]*" - Morton Feldman 'Universal Edition brochure (1994)'*

"What developed in String Quartet (1979) might best be described as a "novel" form, where one's sense of time is somewhat more displaced than in a musical composition, and where chronological information aids our insight in understanding the "story," rather than the

---

44 Griffiths, Paul, *Modern Music and After* (New York: Oxford University Press, 2010), 280. Available: https://labmus.emac.ufg.br/up/988/o/GRIFFITHS_-_Modern_Music_and_After.pdf

cause and effect syndrome which is so indigenous to how we listen to music.[45]" - Morton Feldman 'String Quartet' (1981)

Morton Feldman was well known to talk about his music in terms of the paintings and painters he admired (his onetime friend Philip Guston, Pollock, Mondrian and others[46]). While the sense of scale of Feldman's later works can in some ways be partly attributed to the influence of Pollock, his sense of line and subtle gradation of colour and tone which permeated the whole of his oeuvre can be attributed to Guston[47]. Early in his career he wrote "*The mood I'm trying to describe, like a fingerprint, is in all of Guston's work*[48]." Similar to Pollock, Feldman's work also loses at least some of its formal coherence through scale and overabundance of material. That is, because there is so much material we lose sight of its contextual relationships - the identifying fingerprints of the material lose their narrative value as the sections of musical material all begin to sound alike. Possibly to retain some semblance of formal coherence, there are occasionally sections within his larger works which do not appear to change much from one appearance to the next. These act as guideposts or static points along an otherwise ever-changing texture and labyrinthine form (I am reminded here of Pollock's 'Blue Poles'). I should note too that Feldman's long works often have a heightened sense of focus as if holding on to something (as in a coda) before they finish.

---

[45] Friedman, 133.

[46] Ibid., 67-79.

[47] Ibid., 39-40.

[48] Ibid., 130.

As Cage exploded the performer/audience relationship, this loss of most narrative or formal cohesion has a somewhat similar effect. Rather than watching someone perform *for you,* the audience is thrust into a sculpture gallery environment in which they are enlisted to look at things from many points of view. However, while Cage bombards our senses with an immense sense of variety, Feldman allows us to examine the material closely - we are enticed to follow the materials wherever they may go. We soon forget where we came from, which way we are facing, and how to tell the difference. We lose perspective not through a crisis of identification or purpose as with Cage, but by going down hundreds of these small narrative rabbit holes. We can only learn where these rabbit holes go by going down them.

When I think of my own work, it is often divided between those works which I see as an object (like a painting on a wall) and those that I see as the room itself. The former demands a certain logical consistency in how one thing follows another (whether this following is explicitly planned out or not), while the latter necessitates the creation of a relatively 'flat surface[49]' to facilitate losing oneself in the texture of the work. The works of mine which I feel are the most successful (e.g. 'Landscape With Train Whistle') are those which strike a balance between these two conceptions of the artwork.

Form Summation

While my attitudes about material and the use of time in music are now more similar to La Monte Young (especially his sine-tone installations and 'Just Charles and the Romantic Chord'), these attitudes were first expanded by an immersion into the works of Morton

---

[49] Friedman, 127.

Feldman. It was through through La Monte Young, James Tenney, and Alvin Lucier, that I became interested in tuning and the vast world of harmonics and the harmonic series. Longer durations formed both a technical and a philosophical solution to being in unfamiliar situations - both changing one's viewing experience from outside looking in to inside looking everywhere, and allowing the audience enough time to mentally explore their new surroundings. In much the same way as with La Monte Young's sine-tone installations or a work of Alvin Lucier, the audience is invited to explore an environment rather than an object. This is not a Zen meditation on the nature of being, but one on space, both harmonic and physical. Morton Feldman talked about creating a 'flat surface[50]', while La Monte Young spoke of allowing time to 'stand still[51]'. These two similar ideas are in ways ever-present in my work. My avoidance of obvious or abrupt change within a musical work is not explicitly illustrative of Calvinism, Zen, or Daoism, but a technique to elucidate a careful, humble kind of listening. In this way the artwork becomes an immersive model of the universe rather than an object on a wall. My hope, as always, is to create an interesting and beautiful one.

---

[50] Ibid.

[51] Grimshaw, 145.

Part 2: Examination of Techniques

From Melody to Harmony

Background: The Heterophony in Harmony

During the end of my time at The Hague, I began to turn away from heterophonic melodies towards a more grounded and static music concerned with harmony. This shift of focus was the solution to a number of problems, the first of which I term the 'tension/release problem'. In my work with melody I worried constantly that, in the way the melodies blossomed out, there was nevertheless a familiar and predictable ebb and flow to their shape. It occurred to me that this might not be 'new music' in any substantive attitudinal way, but rather old music spelled out with new words. New music, I reasoned, must not only be an exploration of new words but also new forms and new ways of hearing. (Cage's radical solution certainly formed one answer to this problem but, as explained earlier, he creates some problems of his own.) The second problem lay with the melodies themselves. The more of them I wrote, the more I wanted them to stay where they were, or, as I said to my friends "for them to sit down". As I became more preoccupied with timbre, I became less interested in how one note followed another.

An examination and contemplation of the work of La Monte Young (especially his sine-tone installations) led to a kind of synthesis of these two ideas. This synthesis resulted in the following proposals: melody could be heard as harmony; and complex harmony could contain all the traditional gradations of tension and release, albeit compressed in time. That

is, the solution to these problems was informed by Cage in the sense that the distinction between melody and harmony is broadly seen as arbitrary. My job as a composer was not to make melody into harmony, but rather to realize and exploit the frailty of these existing categories. The ideas of foreground (melody) and background (harmony) might just as easily be reversed or done away with altogether.

Just Intonation

During the end of my time in The Hague I began to be more interested in just intonation and the harmonies and timbres it could almost magically produce. Unlike some composers who have become enamoured with this technique as a means of expressing a mathematical purity (not unlike a 'harmony of the spheres[52]' as Kyle Gann puts it), my work is not 'about' just intonation for its own sake - just as a bridge is not about iron or steel but rather about getting from one side to the other. Instead, my work uses just intonation as a tool for the creation and discovery of new harmonies and timbres - as a means of breaking away from my own ideas about concepts like consonance and dissonance.

Difference Tones

After returning home from a summer violin camp in my early teens, I was instructed to practice scales in intervals (especially thirds) extremely slowly until I could 'hear' that they were in tune by the presence of additional low tones, known to violinists as 'Tartini tones'. I wasn't exactly clear at the time what this meant, but after many hours of practice I found that

---

[52] Gann, 188-189.

I could indeed hear these lower tones. Sometimes these tones were too low to be clearly audible, but I learned to feel them through the vibration of my scapula. I realized then that harmony could be a physical sensation rather than merely a theoretical construct - phenomenological rather than purely cultural.

As I learned later, these ‘Tartini tones’ are in fact ‘difference tones’, and result from the difference between two tones. They can be easily expressed by the formula a - b = c, where ‘c’ is the difference tone. Summation tones are the opposite of difference tones and can be expressed in roughly the same way: a + b = c, where ‘c’ is the summation tone. Summation tones and difference tones (hereafter referred to as ‘sum and difference tones’) form an important acoustic consideration in the history of Western music and an important technique of the work of many composers interested in just intonation, such as La Monte Young and Horatiu Radulescu.

Narratives of Technique: 1. The Invention of Timbre

The Perception of Timbre

Sasha Zamler-Carhart once said that he thought the rise of singing in parallel intervals is essentially a spectral practice designed to amplify a fundamental[53]. This was done by adding an overtone to it in a specific acoustic (e.g. the addition of a fifth above the fundamental). Even though multiple pitches are present simultaneously, this was not in any way considered to be a contrapuntal or 'harmonic' practice. This observation alludes to our ability to hear the culmination of distinct harmonics not as separate entities but as one sound or timbre. Bearing this in mind, we can reverse engineer this process and invent new timbres by combining distinct sets of harmonics[54]. This quirk of human perception is one of the foundations of spectral composition and one I leverage heavily, especially in my works for piano. If the musicians of a thousand years ago heard and conceptualized organum in fifths as an amplification of a whole rather than as harmony, then perhaps newer and stranger harmonies could be created using the same technique. Through analysis of the work of other composers and the harmonic series, I endeavour to explore to an ever greater degree not only the technique of inventing timbre out of distinct pitches, but also the practice of learning to hear larger numbers of distinct pitches as a harmonic whole.

---

[53] Sasha Zamler-Carhart, facebook message to author, December 18, 2017.

[54] La Monte Young & Marian Zazeela, "3. Conversation with La Monte Young by Richard Kostelanetz" in *Selected Writings*, (ubuclassics, 2004), 55. http://www.ubu.com/historical/young/young_selected.pdf

Kurtag Bach Transcriptions

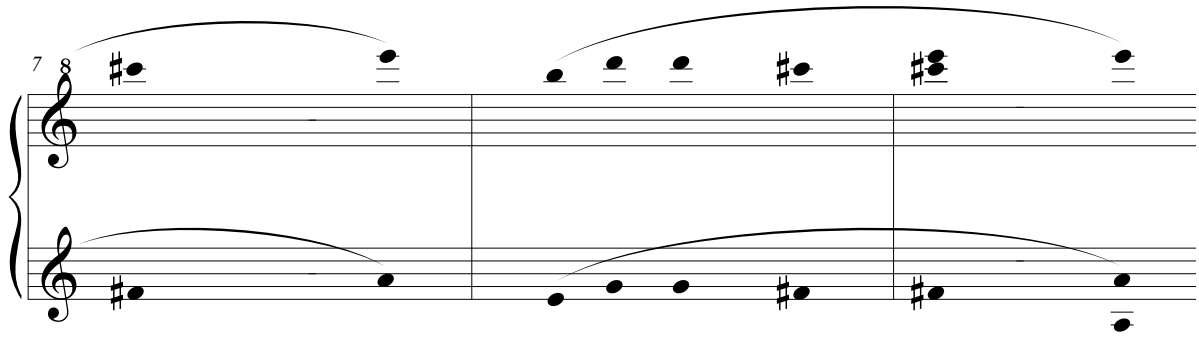
In 2008 I heard a recording of Gyorgy Kurtag and his wife Marta playing works for piano four hands[55]. The disc is split between works by Kurtag himself and transcriptions of works by J.S. Bach. The Bach transcriptions are generally very conservative, rarely venturing very far from what we know the work to be. In the transcription of the organ work ‘O Lamm Gottes, unschuldig’[56] however, there is the addition of a peculiar and beguiling timbral effect. In this transcription, an interval of an octave and a fifth is added to the top line to create a sound resembling a portative organ. In organ terminology, this technique of adding pitches above another pitch at a non-octave interval is what is referred to as a 'mixture stop’. In this example, the added interval is a perfect fifth plus one octave above the lower pitch. This makes the relationship between the two pitches 3:1 (the upper note acts as the third harmonic of the lower). Because 3:1 is the simplest non-octave harmonic relationship within the harmonic series, the upper note can blend into the sound of the lower note fairly easily - the blending of the two sounds resulting in a new timbre. The magic of this new timbre (at least to my ears) is that its sound is more than the sum of its parts, that the component parts of a timbre constructed in this manner heard separately offer no clue as to the sound of the whole.

---

[55] György Kurtág, *Játékok,* with György Kurtág and Marta Kurtág, piano, recorded July 1996, on ECM New Series: ECM 1619 (453 511-2), compact disc.

[56] Johann Sebastian Bach, arr. György Kurtág, *O Lamm Gottes unschuldig,* on *Játékok*, compact disc.

Figure 2: An example of a 6:1 stop from ‘For Leo’:



Initial Experimentation with Bach

Although this manner of timbre creation can produce interesting results, modern acoustics has revealed that the harmonic content of a sound is not the only determining factor in generating timbre. Non-harmonic overtones and noise occurring at the moment of the onset of the sound also contribute greatly in the creation and recognition of timbre. The Kurtag technique of creating mixture stops and manufacturing timbre through the addition of harmonics directly follows an older model of timbre as merely the right harmonics at the right amplitudes[57]. Because we now understand the limitations of this understanding of acoustics, I was doubtful that more complicated mixture stops would be possible on the piano. Moving from a known invented timbre (the initial Kurtag stop) towards unknown timbres was a leap which required practical experimentation. To that end, I tested this by adding more 'stops' to another Bach organ piece, albeit in MIDI. These stops were, in comparison to the Kurtag, extremely outlandish and would have required at least four pianos to perform live. The test succeeded as a proof of concept - that, given ideal conditions (proper

[57] Sethares, William A., *Tuning, Timbre, Spectrum, Scale, 2nd ed.* (London: Springer-Verlag London Limited, 2005), 20.

dynamic relationships, exact timing), it was possible to produce a greater variety of different timbres from the piano. Furthermore, the multiple simultaneous attacks of the piano in the mixture stops which contained three or four additional pitches added up to produce a timbre more like gamelan or marimba than a flute. As per the original Kurtag stop, the addition of pitches did not produce a predictable timbre in accordance with how many extra pitches were present (although the timbre became more percussive it did not become uniformly more dissonant). Instead, I was delighted to realize that timbre is too dependent upon too many variables to be manufactured in a specific manner based on any generalities of the piano sound, for my purposes the creation of these new timbres required practical experimentation.

‘For Leo'

As part of my Master's defence in 2012 at the Royal Conservatoire at The Hague my good friend Leo Svirsky played a then untitled solo piano work, now titled ’For Leo'. This work was my first foray into creating new mixture stops which were possible to perform live rather than being merely theoretical. At that time I had not yet learned about La Monte Young’s use of sum and difference tones in his sine-tone installations (in which the sum and difference tones act to reinforce other pitches already present) and I was only vaguely aware of Horatiu Radulescu’s use of sum and difference tones in his piano sonatas (from a lecture given by Bob Gilmore[58]). However, I had already intuitively used sum and difference tones to create some of the stops in ‘For Leo’. A surprising example of this is a chord which contains a very low pitch and a high cluster. The cluster manages to blend in with the low pitch not only

---

[58] Bob Gilmore, “Horatiu Radulescu: sound plasma and spectral music,” Bob Gilmore: Audio documentaries, http://homepages.inf.ed.ac.uk/stg/Bob_Gilmore/downloads.html

because the cluster is much softer than the lower pitch, but also in part due to the degree of distance between the low and the high pitches (the high pitches often being heard as inharmonic noise of the lower). A closer examination of this chord revealed a more technical explanation. If we imagine the pitches of the chord as letters a, b, c, d, and e, the cluster chord is the following formulas: c - b = a, d - c = a, and e - d = a, where e > d > c > b > a > 0 - the difference between any adjacent pair of pitches in the cluster equals the lower pitch. Because of this mathematical coherence, it is surprisingly easy to make the higher pitches blend in with the lowest, despite the several octave gap between the two groups. I would later develop harmony made up of three or more pitches utilizing the same formulae (defined by the formulas: a + b = c, where c > b > a > 0) more extensively in two string trios (‘Some Perfect Chords’, ‘Some Imperfect Chords’). These trios (which will be discussed later) utilize these formulas as a means to identify and find unexpected consonances.

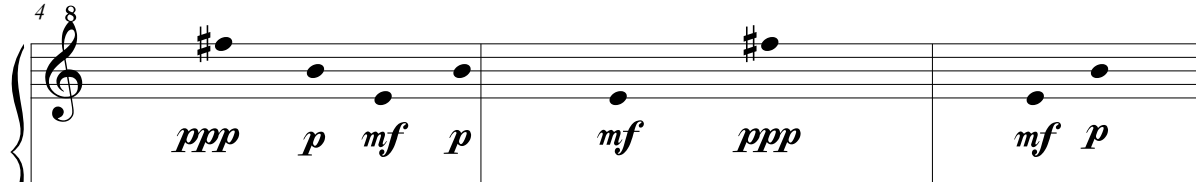
Figure 3: Cluster chord from ‘For Leo’:



‘For Leo’ occupies a certain transitional phase in my work between the melodic and the harmonic. As such it also contains fragments of melody, which are sometimes ornamented with stops and sometimes left bare. When bare, the melody is sometimes used as a kind of

arpeggiated chord used to create the impression in much the same way that the chain gang songs create the impression of harmony.

Figure 4: Melodic material in ‘For Leo’:

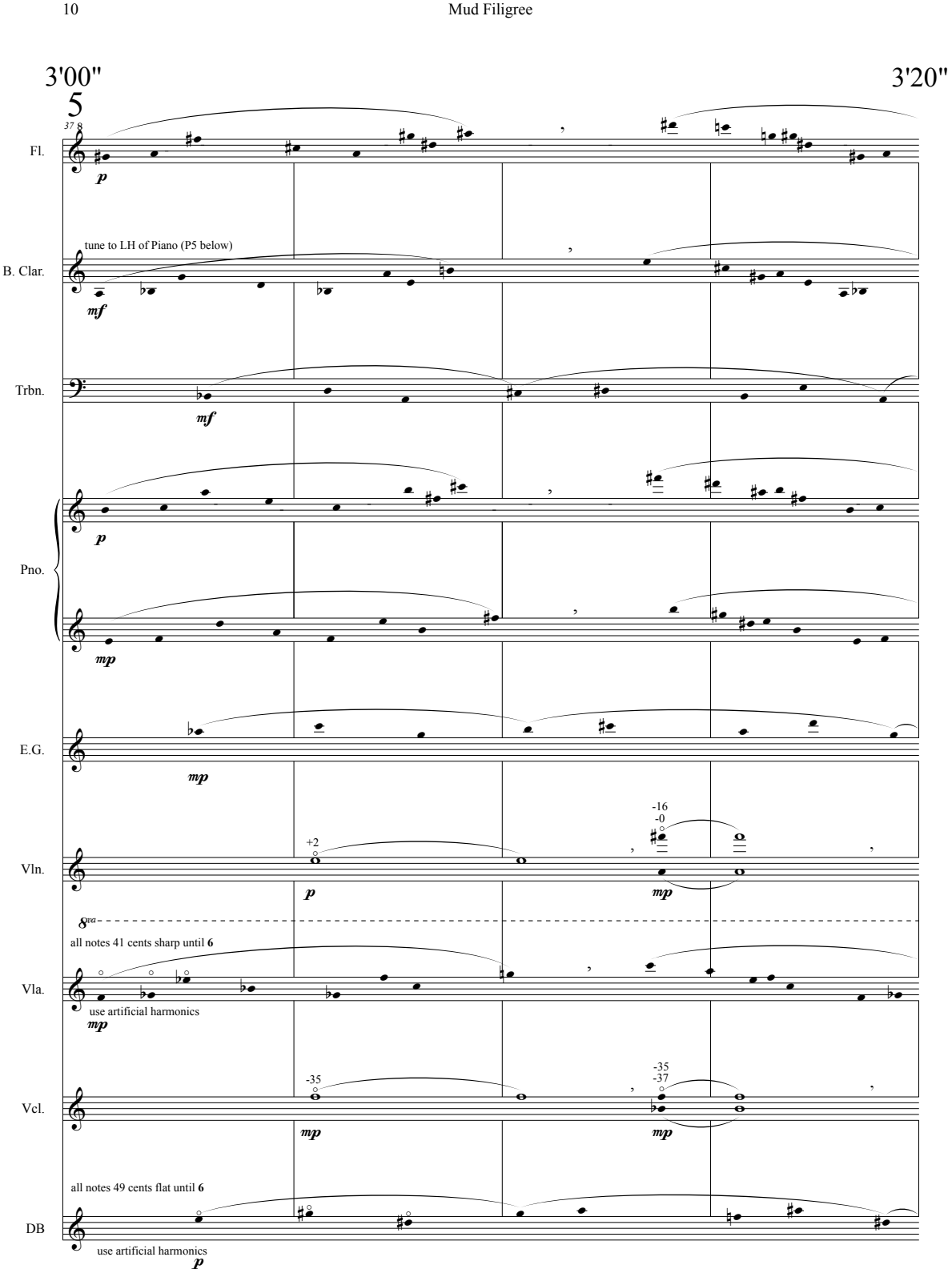


‘Mud Filigree'

I wrote 'Mud Filigree' in 2013 (revised in 2014) for the Crash Ensemble for their “Free State” call for scores. The piece is a radical recomposition of my earlier work 'Lining Hymn and Prayer' (2011) for harmonium orchestra (24 harmoniums). Originally an exploration of heterophony based on African American lining hymns from the deep south, this piece took on a dual purpose in its simultaneous explorations of melody and timbre. The melodic material of the original piece (about a dozen melodies occurring mostly in harmonic unison but rhythmically out of alignment with one another) was then embellished with elaborate mixture stops as I had similarly done with Bach. However, whereas the Bach test was only a timbral elaboration, this manner of adornment contained both the vertical addition of pitches as before (the various intervals of the stops to the melody) and the added (heterophonic) horizontal deviation (the mixture stops coming in and out of sync with the melody they adorn). The combination of these two techniques had no precursors in my work. Practically, the situation is one in which timbres come in and out seemingly at random depending on the coincidental simultaneous attacks of different groupings of stops. In composing this piece I

focused almost entirely on the vertical dimension rather than the horizontal, preferring to let the mixture stops form these random groups. Although the instruments interact in very complex ways, there is no intended counterpoint to speak of. While each melodic section has a very particular stop, timbres are not specifically manufactured within these melodic sections. Moreover, the rhythmic leeway given by the spatial notation is vague enough to illicit dramatic yet subtle differences from one performance another. The idea is that within the subtle errors and deviations from performance to performance both the audience and performers would be in a constant state of discovery. My hope was that the resulting effect of these pseudo-random on/off combinations of stops would be a kind of spectral kaleidoscope.

Figure 5: Page 10 of ‘Mud Filigree’:



Narratives of Technique: 2. Works Which Utilize Summation and Difference Tones

This section traces the progression of my works which utilize summation and difference tones. Beginning with a brief technical and aesthetic examination of La Monte Young's sine-tone installation 'The Romantic Symmetry' I further examine how Young's conception and use of harmony affected my own.

Background

In attempting to manufacture timbre I noticed that certain manufactured timbres were in effect easier to 'pass off' as a single sound than others - the 'trompe de l'orielle' (trickery of the ear) was in some cases more effective than in others. For example, the 'cluster chord' in 'For Leo', was easier to play in a manner which masked its construction and created the impression of timbre than other stops which contained fewer pitches and lower harmonic numbers. In analyzing their structure (aided by Kyle Gann's analyses and insights into the works of La Monte Young[59]) it became clear that those harmonies which used sum and difference tones in their construction were more readily able to 'pass' as timbre.

---

[59] Gann, 173.

‘The Romantic Symmetry’

When I was in New York, I went to the La Monte Young installation in the Dia Arts Foundation building in Chelsea[60]. I listened to this installation for several hours and noticed how people generally experienced the work. Although Young has spoken of allowing 'time to stand still[61]' in his installations, the experience of listening to them is not a static one. This is because the listening experience itself has a fairly precise and even active form. While it is tempting to say that these installations, by containing only a single chord have no form to speak of, the form has effectively been transplanted to the audience.

Upon entering the gallery one is initially shocked at the volume of sound. A large barrier wall stands between the entrance and the main gallery area. As you round the wall and enter the main gallery space behind it, the sound suddenly gets even louder. The listener then proceeds to walk slowly around the space, aimlessly at first (usually towards the middle of the space), then more systematically against the walls. At this point the listener slows down somewhat and begins to notice that movements of their head also result in a change in the sound. The listener will then usually find a place to sit down. Once seated they continue to tilt their head slowly in different directions, gauging carefully the different sounds that result. After a while the listener might lie down. As they do so they will notice that the sound is not static, but changes slightly even with their own breathing. The slow cycle of inhaling and exhaling

---

[60] Dia Art Foundation, "Dia Art Foundation Acquires Dream House by La Monte Young, Marian Zazeela, and Jung Hee Choi," accessed October 23, 2017, https://www.diaart.org/about/press/dia-art-foundation-acquires-dream-house-by-la-monte-young-marian-zazeela-and-jung-hee-choi/type/text

[61] Grimshaw, 145.

produces a subtle change in the sound of the chord - one sound for exhale and a slightly different one for inhale. Your own breathing creates a harmonic rhythm which slowly rocks back and forth. This installation (and others created by Young over the last several decades) resembles sculpture, not simply because the audience is moving around to find their ideal 'view' of the work, but also because no ideal view exists. It is the complexity and contradictions within the work which invite us to explore it. The traditional narrative structure of a musical composition has been replaced by a process of exploration. Conflict and resolution have been compressed into a simultaneity, the exploration of which is one of personal choice and of contemplation.

Technical Aspects of La Monte Young's Sine-Tone Installations

Kyle Gann's survey of La Monte Young's work, 'The Outer Edge of Consonance[62]' describes how Young uses difference tones in his sine-tone installations as another parameter with which to limit pitch selection. Young's avoidance of any ratio or difference tone which is a multiple of five (Young hates the 'major' sounding fifth harmonic), and his use of harmonics and their octaves which lie only within the 7 - 9 range combine to produce a compositional practice as rigid, rigorous, and restrictive as any. Gann's analysis shows these static works to have pitch structures similar in their construction to Webern's rows - some semblance of the mirror symmetry of Webern's 'Symphonie' is mirrored by Young's near-octave construction[63].

---

[62] Gann, 173.

[63] Ibid., 179-186.

Young's use of harmonics of a single series up to the thousands (mostly near-octave multiples of this 7 - 9 range) makes audible some extremely obscure relationships within this harmonic space. Because many of these harmonics are completely unknown to us, this kind of harmony - containing a multitude of strange harmonic relationships - contains both relationships we would term both consonant and those we would term dissonant. The harmony itself is thus conflicted and eschews traditional and simplistic categorizations of consonant and dissonant. It is this kind of complicated harmony which truly interests me because these infinite gradations of consonant and dissonant are used to create (as Young himself stated) different 'feelings[64]' in the sound without the need for narrative context. Because there are at times upwards of fifty harmonics in Young's installations - and because each unfamiliar harmonic has its own relationship to all the others - this harmony is nearly impossible to categorize. We are left with a complex simultaneity of these subtle gradations of consonant and dissonant.

Primes, Mersenne Primes, and Young Primes

Young's interest in Mersenne Primes (defined as 2p - 1, where 'p' is any prime number) led towards his interest in near-octave relationships (harmonic relationships defined as one more or less than double (2x +/- 1))[65]. Because Young uses a frequency of 7.5 Hz as the virtual fundamental for all of his later sine-tone installations, this frequency is often heard (as a beating frequency) as the smallest possible result of the subtraction between any two tones in the chord. This is also the result of the arrangement of near-octave relationships. Young chose the frequency of 7.5 Hz in part because in the early days of making sine-tone installations in

---

[64] Gann, 175.

[65] Ibid.

the 1960's he could not get rid of the mains hum from the speakers, which (in North America) is at a frequency of 60 Hz. The 7.5 Hz frequency is therefore three octaves below the mains hum; Young effectively tuned his compositions to the noise he could not eliminate.

Application of Young's Techniques

A greater awareness of the work of La Monte Young led me to the realization that complex (and sometimes contradictory) harmony could be generated with simple ratios. Furthermore, I realized that an entirely vertical composition could contain all of the components of a traditional musical work (sans time) and that this offered a way out of the endless cycle of tension and release that characterizes almost all of Western performance art. This idea of breaking that cycle of tension and release comprised the more conceptual side of my compositional explorations over the past few years ('The Gates of Los Angeles', 'Dissonance').

The use of difference tones offers a softer solution to the tension and release problem, serving as a vague stand-in for tonal harmony, both in how they dictate chordal construction and as a starting point for determining how one chord should follow another. The further implication of this kind of arithmetic chordal construction is that it proposes new definitions for consonance and dissonance which do not take as their starting point the traditional narrative uses of those terms. My twin string trios 'Some Perfect Chords' and 'Some Imperfect Chords' (which will be discussed later) are the final culmination of this exploration.

Works Which Use Sum and Difference Tones

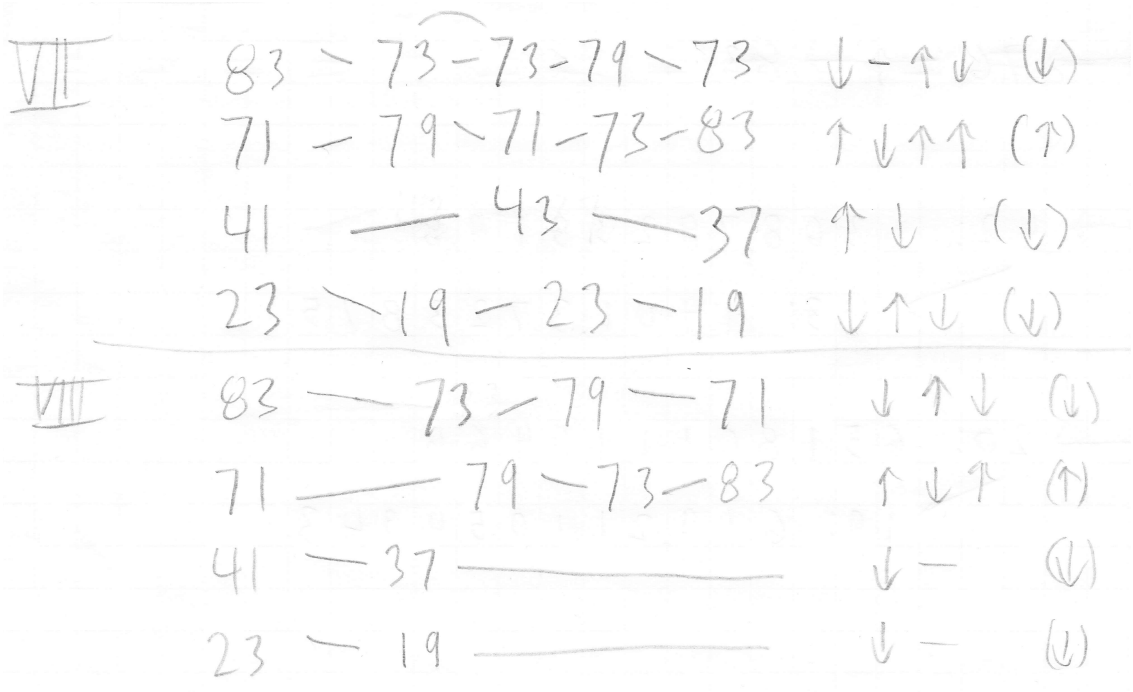
‘Quartets I-VIII’

‘Quartets I-VIII’ for string quartet was composed as a kind of concert realization of the experience of listening to a sine-tone installation of La Monte Young. As such ‘Quartets I-VIII’ is designed as a virtual walkthrough of a simple chord, showing you different patterns of difference tones and audible beats that one can found within it. If one thinks of Young’s installations as sculpture, then ‘Quartets I-VIII’ is a series of paintings of one such sculpture from different angles.

The eight movements of ‘Quartets’ are each two minutes long and all begin on the same chord which, in the spirit of Young, is composed of prime-numbered harmonics of a low C (a reference to the cello’s lowest string). The chord is initially held (the length of which varies from movement to movement) and then from two to four of the four members of the string quartet glissando away from their starting pitches, briefly resting on a new pitch, before repeating this process to rest on another - the average movement is three resting pitches per instrument with two glissandi connecting them. The resting pitches, like the starting pitches, are also whole numbered harmonics derived from a low C, but unlike the starting pitches they are not limited to primes. This is because the part of the harmonic series in which this piece lies lacks a great number of primes, so the choice of harmonics would simply be too limited. The manner of formal experimentation in this piece is very much in the vein of Tom Johnson in the sense that it is vaguely systematic and interested in exploring permutations of a single small idea or bit of material. While the basic form of each movement is unchanging, the

specific components within each movement (number and direction of glissandi, degree of parallel/contrary motion, number of static pitches) change drastically from one movement to another. As with Johnson, variation (in the sense of a change in material) is enlisted not for narrative or aesthetic purposes, but rather to show more of the musical object - to investigate it closer. The following sketch of movements VII and VIII of 'Quartets I-VIII' shows harmonic numbers, the direction of the movement of pitches (arrows and dashes), and the global direction of movement of pitches (arrows in parentheses).

Figure 6: Sketch of 'Quartets I-VIII':



Occasionally, pitches will cross one another creating a difference tone which glissandos down, disappears, and then reappears. Without the aide of technology, many of the difference tones would be hard or impossible to hear, either being too low, too quiet, or interfered with by the other instruments. For example, in the upper range of the violin, the pitches often

become too noisy for difference tones to be clearly audible. Upon hearing the Vanbrugh Quartet read some of these movements, I decided to partially rearrange them utilizing distortion pedals to help emphasize these difference tones (much in the same manner as Michael Gordon's 'Industry'[66]). Alternatively, these quartets can be performed with sine-tones of the initial chord. This changes the emphasis of the piece from difference tones to beats due to the narrow range of movement away from the initial chord - the difference (in Hz) between the pitches of the quartet and the initial chord is rarely large enough (~30 Hz) to produce difference tones.

'16 18 19 20'

The string quartet '16 18 19 20' was written a couple months after 'Quartets I-VIII' and in many ways is its antithesis. While 'Quartets I-VIII' was a virtual walkthrough of a simple sine-tone installation *a la* La Monte Young, '16 18 19 20' is a near-static exploration of difference tones as a technique for generating harmony. The score is a written-out improvisation on rules modelled after those of the melodic version of La Monte Young's 'Four Dreams of China' (otherwise known as 'The Second Dream of the High-Tension Line Step-down Transformer'), which were reprinted by Kyle Gann in his 'The Outer Edge of Consonance[67]'. Whereas Young's rules *"...have to do with avoidance of the 5th harmonic, which results as a difference tone from the sounding of the 12th and 17th harmonics.[68]"*, I am

---

[66] Gordon, Michael. "Michael Gordon - Industry", from 'Bang On A Can All-Stars'. Original recording, 1992. YouTube video, 15:29. Posted by "beefwelshington," February 13, 2012, https://www.youtube.com/watch?v=gujb-wyTy5s

[67] Gann, 165.

[68] Ibid.

not interested in discounting any particular harmonic as a difference tone, but rather in matching difference tones to one another. The rules for ’16 18 19 20’ are shown below, where ’16’ is an Ab just below middle C.

Figure 7: Harmonic rules for ’16 18 19 20’:

Allowed:

20	20	20	20	20				20				
19		19			19	19			19			
18	18		18		18		18			18		
	16			16		16	16				16	

Not Allowed:

20	20	
19	19	19
18		18
16	16	16

Summation Tones of Adjacent Pitches of Allowed Chords:

39	38	39	38	36	37	35	34
38	36						
37	34						

Difference Tones of Adjacent Pitches of Allowed Chords:

1	2	1	2	4	1	3	2
1	2						
2	4						

This scheme dictates that the difference tone between adjacent pitches must be a unison or an octave of the fundamental. For example, the chord 18/19/20 creates difference tones as follows: 20 - 19 = 1 and 19 - 18 = 1. Since both of these difference tones are 1, this is a legal chord. However, with the chord 16/19/20, we have 20 - 19 = 1 and 19 - 16 = 3, and because

the third harmonic is an octave plus a fifth rather than an octave, this is an illegal chord. Despite the mathematical purity of this difference tone scheme, the difference tones created by these pitches are heard as beating frequencies rather than pitch. This is due to the low range of the initial pitches. The reasoning for this low pitch range is twofold: to allow all the instruments of the quartet (which have different body sizes contributing different sonic qualities) easy access to all of the pitches in the set, and to showcase the summation tones (rather than difference tones) created through this harmonic scheme. The audibility of the summation tones is assisted by the playing instruction *'molto sul ponticello'* (play very close to the bridge) which shifts the priority of the sound from the fundamental to its harmonics. Where desired the players are also given the option of fingering the given pitch half-pressed along with an Ab on the same string to produce very high artificial harmonics of the Ab. When multiple players share the same pitch the harmonics seem to jump out of the texture wildly. Because it is difficult to judge what harmonics will become audible when, and because at any given time no one knows who is going to play what pitch (the players may play any of the pitches within the bar at any time), the sound produced is at once focused and chaotic. An odd quirk of this piece is that it is essentially composed upside down. Difference tones - the mathematical rationale for determining legal and illegal chords - are the opposite acoustic artefacts from those which are most evident in performance (summation tones). This simple mathematical process is then not used to define harmonic cohesion or formal clarity, but a controlled chaos which has only a second-hand relation to the process which created it. It is in this regard that my work holds a similar attitude to John Cage and his use of arbitrary processes (e.g. star maps) to bring about a pseudo-random result. This arbitrary process paired with the pseudo-random fluctuations of the harmonics of string instruments effectively

distances a rather strict harmonic structure from the idealized notions of its performance. Working within this contradiction has proven an especially fertile area of my recent work.

Immobile #1

"Immobile #1", written for a subset of the Quiet Music Ensemble (electric guitar, cello, trombone), explores the use of difference tones in a slightly different manner. It comprises a sliding tone (electric guitar played with a slide and an ebow) and the two other instruments playing fixed tones which are realizations of hypothetical difference tones. These difference tones are hypothetical because they are not the differences between sounding pitches in the piece. Instead, the multiple staves of these fixed tones are octave transpositions of the differences between different combinations of the multiple staves of the electric guitar. That is, were there four electric guitars playing the four staves at the same time, the difference tones which make up the cello and the trombone parts would become audible (although they would occasionally sound as beating frequencies).

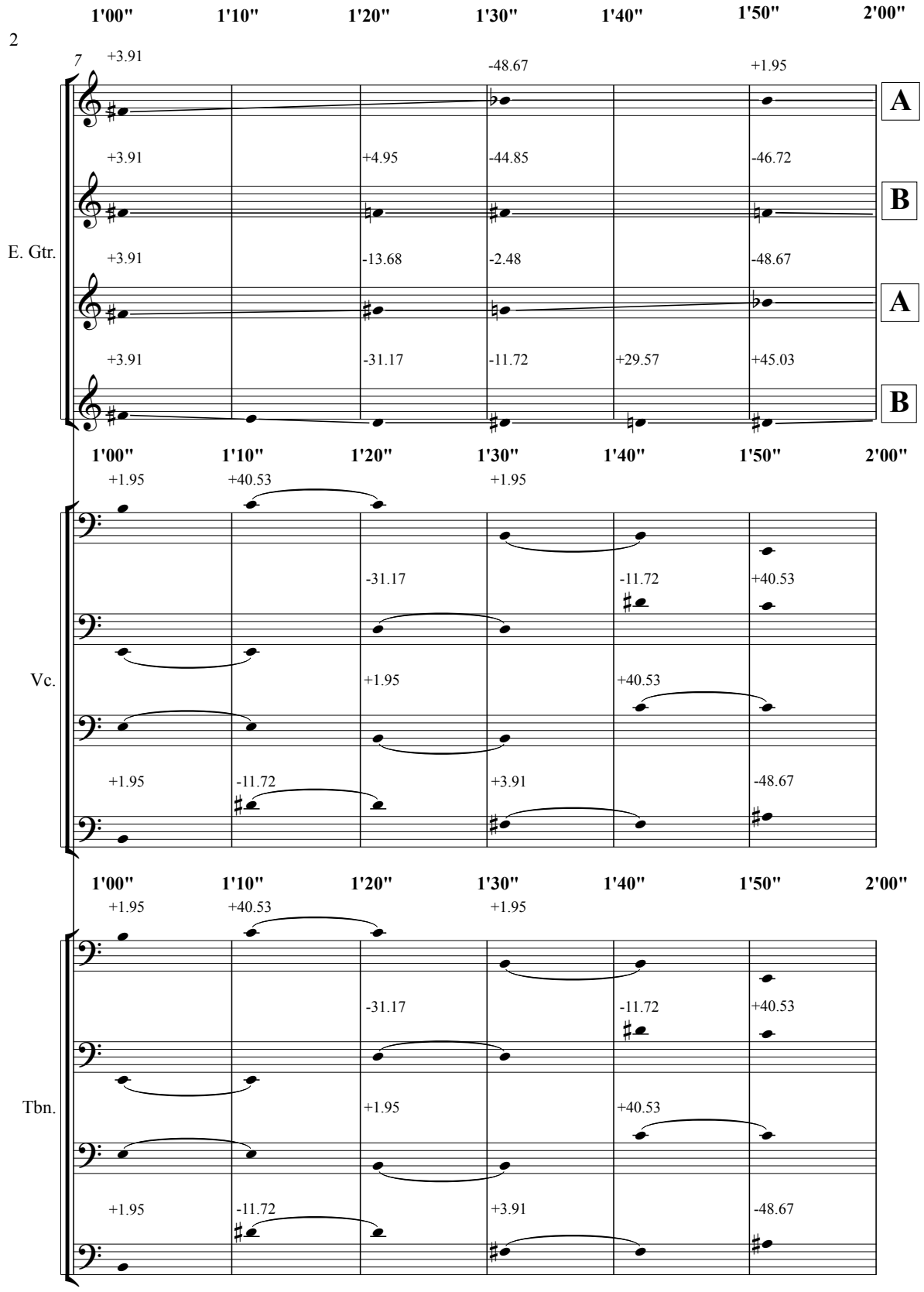
This piece was my first real attempt at discovering consonances through a mathematical formula. These explorations would later become more fruitful in the construction of what I would later term ‘perfect chords’. These 'perfect chords' are constructed so that the frequency of the lower two notes is equal to the upper note, and the difference between the upper two notes equals the bottom note. This can be expressed in the formula: $a + b = c$, where a, b, and c are harmonic numbers (or Hz) and where $c > b > a > 0$.

The use of a sliding tone in the context of just intonation was inspired partly by Michael Pisaro's 'Closed Categories in Cartesian Worlds'[69] for bowed crotales and sine-tones. What I thought I had heard in Pisaro's work was a bowed crotale with a single sine-tone sliding around it so as to create beats and interesting harmonies. I imagined a similar meandering process occurring here. Like Pisaro's work, the sliding tone of the electric guitar is not a linear process but a meandering - the guitar is a wanderer within the piece rather than a scientist examining it. As the guitar wanders upwards it maps out strange and familiar harmony alike. Since a glissando contains an infinite number of pitches, my idea was that the guitar could effectively explore an infinite number of possible consonances along its journey. My hope was that interesting and obscure consonances would jump out of the texture unexpectedly. The idea of investigating all of the infinite harmonic relations between a sliding pitch and a fixed pitch was further explored in a slightly different light in 'Dissonance'.

---

[69] Pisaro, Michael. "Closed Categories (excerpt from Part 1)," from 'Closed Categories in Cartesian Worlds' / Gravity Wave 010. Recorded 2013. Soundcloud link. Accessed November 2, 2019, https://soundcloud.com/michael-pisaro/closed-categories-excerpt-from

Figure 8: Page two of ‘Immobile #1’:



Without Sky

"We founded the Society and prepared a revolt of the simple, two-dimensionals against the complex and sly, against those who do not answer "yes" or "no," who do not say "white" or "black," who know some third word, many, many third words, empty, deceptive, confusing the way, obscuring the truth. In these shadows and spider webs, in these false complexities, hide and multiply all the villainies of the world. They are the House of Satan. That's where they make bombs and money, saying: "Here's money for the good of the honest; here are bombs for the defense of love.[70]"

We will come tomorrow. We will conquer or perish. There is no third way." - Vladislav Surkov 'Without Sky[71]'

The title of this work comes from a short story of the same name by Vladislav Surkov, who (at the time of writing this story) divided his time between writing and being Vladimir Putin's propaganda minister (a position he has since lost). The story 'Without Sky' is about a loss of perspective. *"There was no sky above our village"* the metaphor begins. It is a kind of manifesto from the perspective of a member of a class of people traumatized by war, who's experience robbed them of the ability to perceive the third dimension. I realized that the instruments within the work, and in truth most of the instruments in my work, have a

---

[70] Natan Dubovitsky trans. Bill Bowler, "Without Sky," *Bewildering Stories,* 582, http://www. bewilderingstories.com/issue582/without_sky.html

[71] Ibid.

similarly myopic view. Like the '*two dimensionals*' they cannot truly communicate with the world around them, they understand only their process, their role.

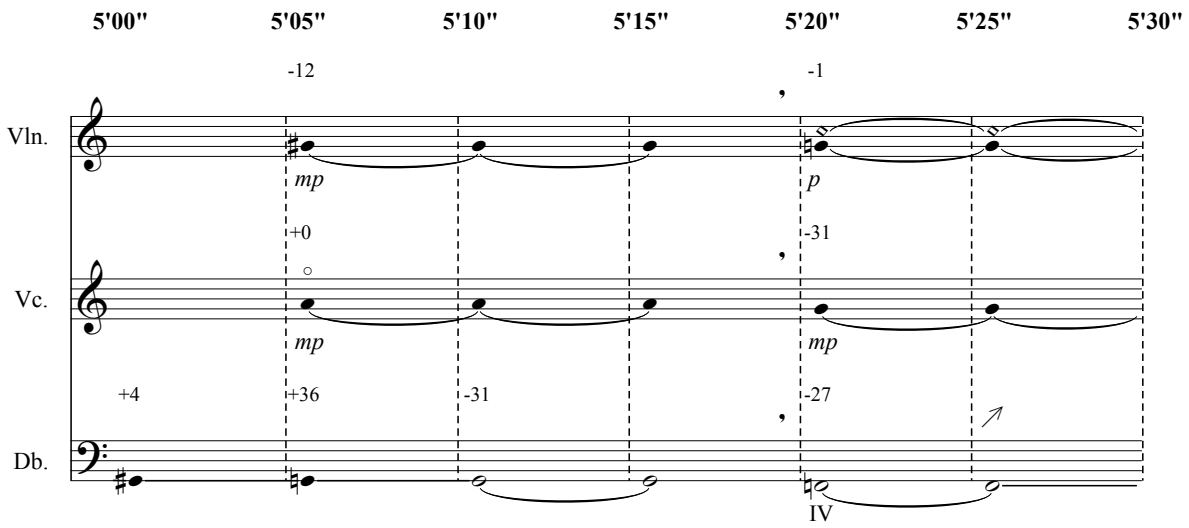
'Without Sky' was initially conceived as a piece for solo double bass before the addition of the violin and cello. Inspired by James Tenney's 'Beast'[72] its main focus is the exploration of different beating frequencies. Like 'Beast' it began life as a graphic score (inspired by another Tenney piece, 'Cellogram'[73]) for convenience, but was eventually notated more traditionally. From listening to the sine-tone installations of La Monte Young (and rumination on the matter), it was my experience that a chord could contain within it beating, yet in some way remain consonant. Thinking about this from the arithmetic perspective of difference tones, it occurred to me that a beating frequency within a chord could perhaps in some (possibly psycho-acoustic) way 'belong' to the rest of the chord if it were either a note or difference tone of the chord transposed down several octaves. In the same way in which Young's 7.5 Hz pulse is two octaves below 30 Hz, which lies very near the lowest audible frequency, 'Without Sky' uses transpositions of the constantly changing beating frequency of the double bass as the basis for the other two parts. The violin part is composed of octave transpositions of the various summation tones of the double bass, while the cello part is octave transpositions of its difference tones. While the violin and the cello offer two different views on the pitches of the double bass, they are both ultimately only arithmetic machines.

---

[72] James Tenney, "Postal pieces 1954-1971" (Baltimore, MD: Sonic Art Editions, 1984)

[73] Ibid.

Figure 9: Sample system of ‘Without Sky’:



Narratives of Technique: 3. Grids and The Movement Towards Installations

La Monte Young’s ‘The Well-Tuned Piano’

In the same way that Bach’s ‘Well-Tempered Clavier’ was a demonstration of new possibilities offered by a new tuning system (access to all keys without jarring differences between them), La Monte Young's ‘The Well-Tuned Piano’ also aimed to expand the harmonic and melodic horizons of the instrument (the allusion in the title) albeit within a single mode. However, while the tuning for ‘The Well-Tuned Piano’ offers a greater number of interval sizes, it nevertheless adheres to one major tuning convention in that it remains the same across all octaves (all Eb’s will be octave relationships to one another, and octaves are where you would expect them to be). This seems at odds with Young’s affection for the different 'feelings[74]' different tunings and harmonies create. However, because improvisation

[74] Gann, 175.

is at the core of the work one can understand the practicality of Young's decision. A non-octave tuning would give the performer the extremely difficult and complicated task of memorizing literally thousands of different interval possibilities - one which could span multiple lifetimes. The tuning of 'The Well-Tuned Piano' is then a compromise between a desire for greater intervallic invention (nineteen possible intervals instead of six[75]) and improvisational playability.

The Mapping Problem

Deriving harmony on the piano from a mathematical or acoustic framework will always entail some degree of compromise due to the tuning of the instrument. This is in essence a mapping problem - how best to fit one set of numbers (the harmonic series) onto some arbitrary grid (e.g. the twelve equal-tempered pitches of the piano). The degree of allowable compromise (leniency in fitting to the grid) in this process largely determines the manner of the tuning and the character of the sounds it creates. In this regard La Monte Young (who tuned his piano extremely precisely and composed modally so as to avoid compromise) and Horatiu Radulescu (who allowed the mapping of the 11th and 13th harmonics, which lie in the cracks between keys, onto the normal equal-temperament of the piano[76]) are opposites. My attitude on this issue has gradually shifted from the naturalistic, 'pure' perspective of Young and Tenney towards a more nuanced approach which allows for some degree of tuning

---

[75] Gann, Kyle. "La Monte Young's The Well-Tuned Piano." *Perspectives of New Music*, Vol. 31, No. 1, (Winter 1993) p. 140. doi:10.2307/833045

[76] Gilmore, Bob. "Spectral Techniques in Horatiu Radulescu's Second Piano Sonata." *Tempo*, 64, (2010) p. 70. doi:10.1017/S0040298210000197

compromise. Just as I came to search for dissonance in my work, I gradually became frustrated with music enamoured only with pure sounds.

'The Gates of Los Angeles'

'The Well-Tuned Piano' is an important demonstration of how just intonation can be effectively (and relatively simply) mapped to a grid. While looking at this process more closely, I realized that the 31-tone-per-octave Huygens-Fokker organ in Amsterdam would be a good candidate for the same process. However, rather than thinking of the keyboard in terms of ease of modulation and treating all octaves the same (as in the 'WTP'), I thought of the instrument as one of Young's sine-tone installations - as a giant static library of harmonics. One great advantage of this instrument over the piano is that the sheer number of keys (31 per octave) offers more choice of keys with which to approximate the tuning of each harmonic (compromises will be fewer and smaller).

'The Gates of Los Angeles' for the Huygens-Fokker organ is made up of a single 19-note chord. It takes its title from a newspaper article I read many years ago about the hypothetical construction of a public art project which would function as a gate for the city of Los Angeles. I remember thinking that this was a hilariously stupid idea since what characterizes Los Angeles is a lack of clearly defined borders. The title of the work is then a reference to the idea of creating an arbitrary restriction on something that by its very nature is unrestricted - in this case the harmonic series. Because the chord is only an approximation of pure just-intonation, it lacks the kind of pure sound found in La Monte Young's sine-tone installations. There is both a subtle rubbing within the chord (as some of harmonics beat against each other

slowly) and a hard beating caused by the central cluster of adjacent keys (harmonics 78, 80, 82, and 84). While the chord shares these two characteristics with the works of Young, it is in some ways more floating and difficult to characterize - the chord is stable but unstable, static but shifting.

Figure 10: Keys used in 'The Gates of Los Angeles':

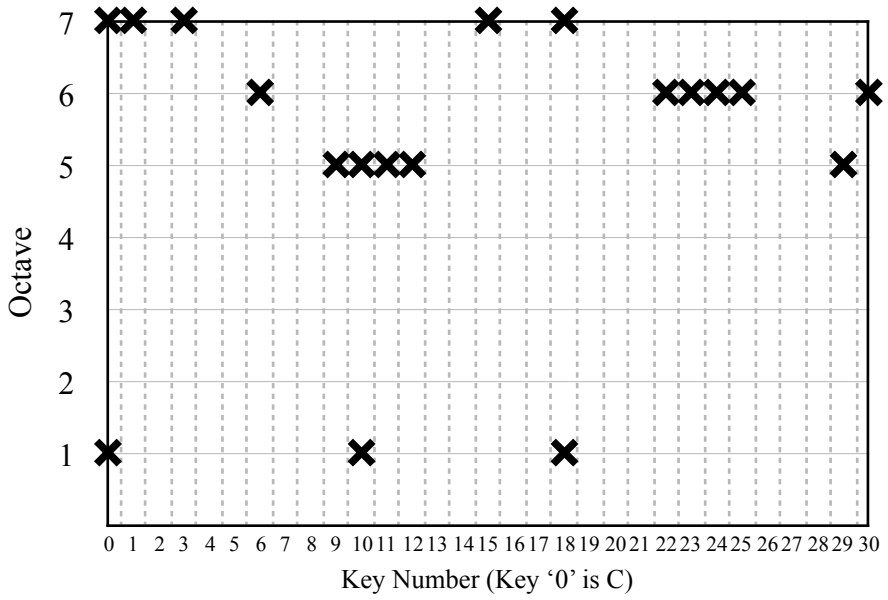
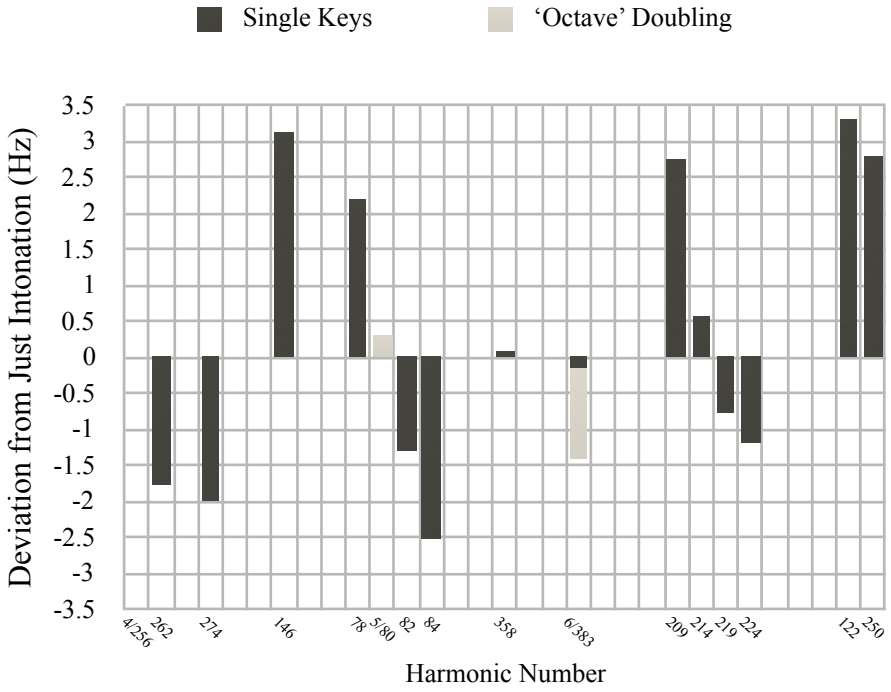


Figure 11: Deviation of keys from just intonation:



The chord takes as its imagined fundamental a C two octaves below the lowest pedal tone (8.2775 Hz). All of the notes in the chord were made to correspond closely (+/- 10 cents) with the harmonics of this C. Because the chord contains clusters of harmonics, and because the fundamental is so low, the resulting difference tones between harmonics separated by two (also an allusion to Young's affinity for 'twin primes' (primes separated by two)) are heard as a beating frequency of 16.555… Hz (twice the frequency of the fundamental) rather than a tone. Furthermore, the chord, while not adhering to the strict 7 - 9 region restrictions of the majority of Young's installations, nevertheless shares some of the characteristics of those installations. The low pedal, central cluster, near-octave relationships, and the distribution of the various harmonics within the space (the banks of pipes are spread across the length of a long room) are all aspects typical of Young's installations.

In order to generate many subsets and variations of 'Mersenne Primes' (2p - 1, where 'p' is any prime number), corresponding to near octaves in pitch, Young invented his own subset of prime numbers. These primes (called Young primes[77]) allowed him to deal with this 7 - 9 region in a non-octave manner but without using Mersenne primes exclusively, to create intervals that are always either slightly smaller or slightly larger than an octave of a given harmonic (Young expands the 'Mersenne Prime' formula, allowing 2p +/- 1). While I invented no new set of numbers, the partitioning of clusters (which part of the octave was chosen) was done extremely carefully and my focus on near-octave relationships was done in a somewhat similar manner to Young.

---

77 La Monte Young, "Romantic Symmetry," in *Sound and light: La Monte Young, Marian Zazeela,* eds. William Duckworth and Richard Fleming (Lewisburg, Pa.: Bucknell University Press, 1996), 211.

The strength of Young's restrictive range is that it somewhat grounds the chord to the fundamental and prevents individual harmonics from sticking out above the others. While I also used small bits of clusters related to one another in a near octave fashion (e.g. 122 against 250), the aim of this was not to fully explore the possibilities within a given range, but rather to create a chord which was not so easily rooted to the fundamental. It has been my experience in recreating Young's installations (by using Kyle Gann's descriptions of their harmonics[78] and Max/MSP) that while the restriction of range enables the relationship of the harmonics to the fundamental to be better understood, this has the added effect of grounding these harmonics (however exotic they may be) to the fundamental. This grounded feeling is perhaps an expression of the hierarchical nature of the chords themselves. This hierarchy is nested and expressed both through the obscurity of the harmonic (a higher harmonic is understood to be more obscure than a lower harmonic, and a higher prime-numbered harmonic is understood to be more obscure than a lower prime) and the harmonic distance from the fundamental or from any 'known' harmonic (any harmonic whose number is the product of primes equal to or less than five).

There is an important distinction between the nature of my harmonic construction and Young's. Although neither of us is interested in a traditional narrative harmony, we differ in our fundamental approach to harmonic construction. Because my interest in harmony (or more specifically my use of just intonation) is primarily timbral rather than structural I am not interested in creating harmony which can be easily understood in terms of the vertical relationship between its component parts, but instead the timbral possibilities of harmony in general. That is, to me the nature of the 'feelings' harmony creates is not to be found in how

---

[78] Gann, 179.

the harmonics relate to one another, but rather in the sound of the harmonic construction as a whole. What I am interested in is a harmony which through its internal contradictions becomes ungrounded - a harmony we understand not in a nested hierarchical manner, but which collapses this nested structure.

‘Dissonance’

The open-ended and ever-expanding ‘Dissonance’ series is a good example of how my attitude towards the practice of just intonation has changed and how this has steered my work generally towards installations.

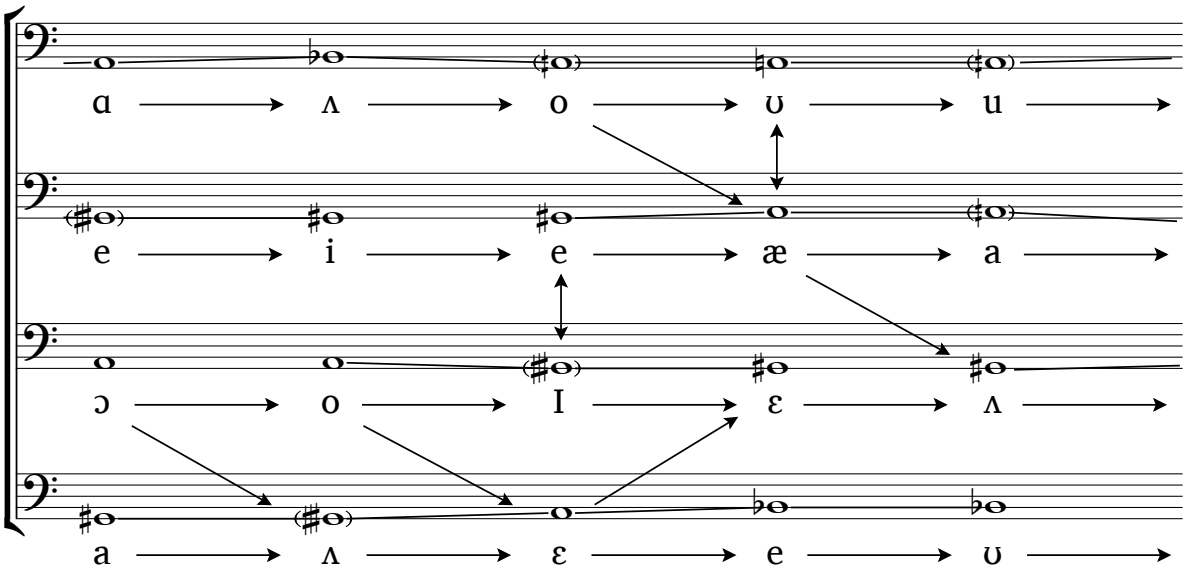
The Structure of ‘Dissonance’

In 2013, I wrote a simple piece for the baritone Tom Buckner (‘Invisible Melody’) which used different vowel sounds and a single sine-tone (an A) to show how the different vowel sounds accentuated the different harmonics. Although I was impressed with the effectiveness of this simple technique, it was a piece almost completely without contrast or dissonance. As such, when Buckner returned the next year I decided to write a piece reusing the same basic elements (baritone and static sine-tones) but which would have the exact opposite effect. If the first piece was effectively consonance, I reasoned, the next piece would be ‘Dissonance’.

In the first version of this piece, the singer navigates a ‘choose-your-own-adventure’ type score, following arrows and picking paths of material to play. The material utilizes the same

different vowel sounds as in the previous work, but with the addition of subtle glissandi up or down a quarter or semi-tone.

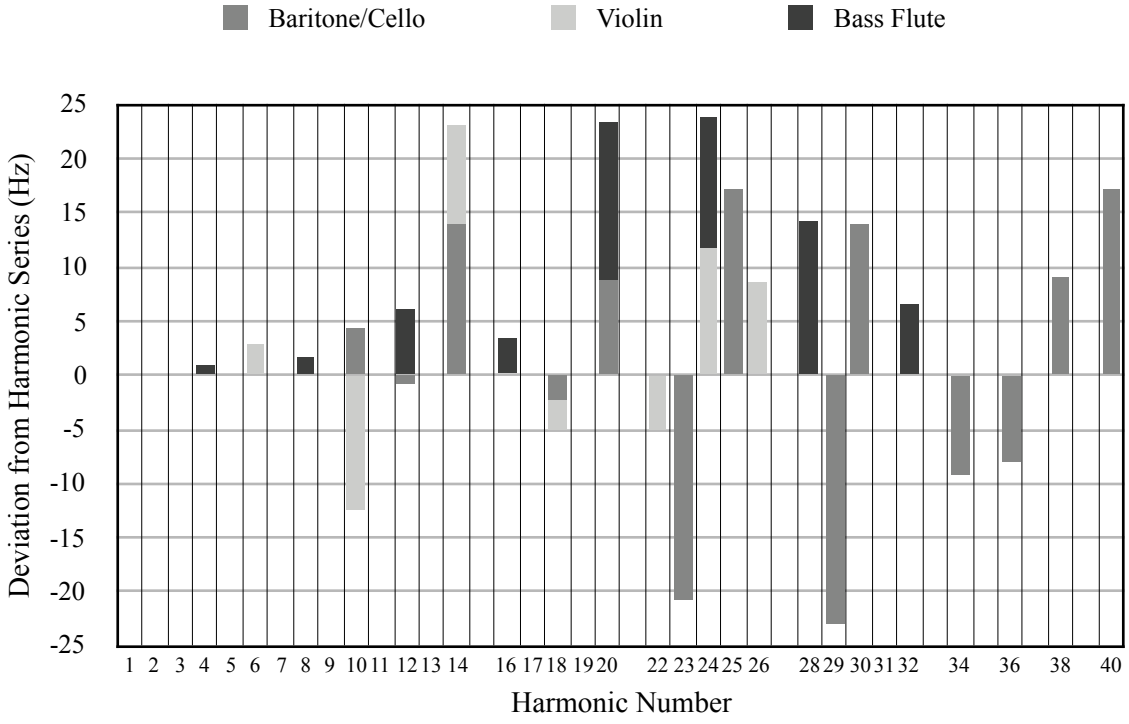
Figure 12: Sample system of ‘Dissonance’ for baritone and sine-tone chord:



The accompanying tone, where previously only a single sine-tone, is now an artificially constructed harmonic series built with sine-tones. This particular harmonic series is modified in two ways: it does not consist of all harmonics in the series, and it is detuned so that a subtle ‘rubbing’ occurs at all times. The idea was that with the addition of an instrument which produces harmonics which more closely resembles a perfect harmonic series, the detuned harmonics of the sine-tone chord would beat against the real harmonics of the instrument. The sine-tone chord therefore functions as what I termed a ‘cage of dissonance’ for the instrument. I was so happy with the sound of this work that I decided to arrange it for solo cello, using the same chord. If anything the effect was even more pronounced. I subsequently composed more versions of this work: for cello, violin, uilleann pipes (without

sines), bass flute, and an open score version for any number of instruments with or without sine-tones.

Figure 13: ‘Dissonance’ sine-tone chords tuning:



Like the original version for baritone, the instruments are given a severely restricted pitch range of about a semitone to move around in. These narrow pitch ranges are crafted based on both the beating frequencies against the sines and on what the performer can reasonably be expected to do. Physical instruments almost always carry with them a certain degree of random pitch fluctuation, for example on a bowed string instrument like a violin there is a constant pseudo-random pitch deviation of at least 3 - 5 cents for a smooth quiet legato stroke (this rises to 30 or possibly even 40 cents with a greater fluctuation of dynamic levels). A further restriction on the pitch range was that the beating frequencies at the edges of the

playing range should not exceed 25 - 40 Hz so as to become an audible and definite pitch. The beatings or rubbings within the chord itself are dealt with in the same way (they do not exceed the 25 - 40 Hz range, and in fact rarely go above 10 Hz).

‘Dissonance’ and Just Intonation

In the works preceding ‘Dissonance’, such as ‘The Gates of Los Angeles’, my compositional process was mainly focused on finding interesting and strange approximations of just harmonies within the limits of specific arbitrary tunings. In 'Dissonance' however the process is reversed. Rather than tempering just intonation (fitting it onto some arbitrary and regular grid), ‘Dissonance’ pits the natural harmonics of instruments against an irregular grid of sine-tones which are deliberately tuned so as to produce beating against any acoustic instrument playing within the designated pitch range. The solo performer is instructed to slowly detune their pitch within a given narrow set of ranges in order to explore beating frequencies, dissonances, consonances, and anything in between. They will hopefully become aware that each subtle gradation of pitch (when played with the sine-tone chord) will result in its own unique beating speed, timbre, summation tones, difference tones, etc. Because of the manner in which the sine-tone chords are detuned, the performer will find that there is no pitch within their allowable playing range in which there will not be beating - the parallel motion of the harmonics of a tone in relation to its fundamental pitch conflict with this artificial harmonic series in which its component harmonics are detuned in different directions. While the sound of the ‘Dissonance’ pieces are definitely what we would normally term dissonant (abrasive), this is not necessarily the case when the elements of the ‘Dissonance’ pieces are heard

separately. Rather, it is the combination of the sine-tones and the harmonics of the instruments which create dissonance.

Zeno's Paradox

Zeno's paradox recalls the story of the tortoise and Achilles, in which the tortoise claims he can win a race against him if only he is given a modest head start[79]. The tortoise reasons that *"if Achilles hopes to overtake it, he must run at least as far as the place where the tortoise presently is, but by the time he arrives there, it will have crawled to a new place, so then Achilles must run at least to this new place, but the tortoise meanwhile will have crawled on, and so forth. Achilles will never catch the tortoise, says Zeno.[80]"* The claim is that to travel from any starting point to a goal, one must first travel half the distance to the goal. Once there, you must travel half the remaining distance. Because there are an infinite number of halfway points to the goal, you can never reach it - the tortoise has already won before Achilles has even set off.

When I was living on the outskirts of Cork I frequently walked into town. During one of these 40-minute walks I began to conceptualize this paradox with myself as a constantly moving dot along an imaginary line. First, I thought of the beginning and ending points of this line as my house and my destination. Then I began to imagine the line and its halfway point in shorter and shorter distances. First, a couple blocks, then one block, then the length

---

[79] Huggett, Nick, "Zeno's Paradoxes", *The Stanford Encyclopedia of Philosophy* (Winter 2017 Edition), Edward N. Zalta (ed.), https://plato.stanford.edu/entries/paradox-zeno/#AchTor

[80] Internet Encyclopedia of Philosophy, "Zeno's Paradoxes," accessed December 3, 2017, http://www.iep.utm.edu/zeno-par/#SSH3ai

of one section of sidewalk, then each of my steps. I began to imagine these increasingly frequent halfway points as little clicks inside my head. As the distances I was measuring shrank, the frequency of these halfway points increased until it approached an audible frequency. Soon, I began to alter my walking speed slightly to mentally explore these virtual halfway points, thereby altering the frequency of these clicks in my head. It was within the exploration within this infinite number of finite spaces and that I came to realize that the small can be infinite.

Explorer/Performer

In ‘Dissonance’ the performer is enlisted as the virtual walker within the conceptual space of pitch. The main aim of a successful performance of ‘Dissonance’ is for the performer(s) to explore their narrow pitch range(s) in a free and curious manner. It is not about completing an objective task but rather about showing us your viewpoint on this small world.

When the performer is genuinely interested in exploring the work thoroughly (by at least considering the whole of the pitch range), the form becomes somewhat similar to the ‘completist’ works of Alvin Lucier or Tom Johnson. In much of the work of both these composers there is a formal egalitarianism in which the material is not weighted in importance in the traditional way (there is no ‘nested hierarchy’ of value within the work). The hierarchical, linguistic methods of musical organization are substituted for a scientific cataloguing of the musical material in which it is weighted equally across time - the end of the musical form resulting from non-linguistic or non-narrative rationales (all of the musical material has been heard, or the process is exhausted). In Alvin Lucier’s ‘Music on a Long

Thin Wire'[81], the performer is instructed to systematically explore the harmonics of a homemade long string instrument using an electromagnet. However, as was initially the problem with Zeno's paradox, the string has infinitely many points and halfway points, and the manner of their exploration is left up to the performer. It is only the limitations of the laws of physics (the mass of the string) which prevent many of the potentially infinite number of harmonic nodes from sounding (as the string, like the distance of Zeno's race, can be divided an infinite number of times).

The distinction between Lucier's attitude and the attitude of 'Dissonance' is that while Lucier wants us to hear all that there is (as does Tom Johnson), I am more interested in the personal attitude of the performer. 'Dissonance' then functions simultaneously in two ways: on the one hand a demonstration of the infinite possibilities of an extremely limited space - a laser focus on acoustic effects which usually go unnoticed, while on the other hand the piece is a demonstration of the individual will of the performer. There is no compulsion to explore all possible degrees of intonation as in a completist work, but rather a mandate to explore as you see fit. The performer is not a vehicle for carrying out some scientific form, but becomes the immediate director of it. I am interested in the musical result of their viewpoint on this virtual space, what they find, and what they like.

---

[81] Alvin Lucier, "Music On A Long Thin Wire, part 1/4 (1977)" YouTube video, 18:42, posted by "architectureaboutdancing," Mar 9, 2013, https://www.youtube.com/watch?v=SAaXSsoKVQg

Different Kinds of Listening within ‘Dissonance’

Because this work is somewhat of a Swiss-army knife style of composition, this presents the audience and performers with three different attitudes towards listening: as solo pieces these are works about the solo performer listening intently to acoustic space and their place within it, as ensembles without sine-tones these are works about the performers listening intently to each other (as in classical chamber music), and as ensembles with sine-tones these are works about both listening to one another and to one's (and the ensemble's) place within the acoustic space.

Narratives of Technique: 4. ‘Interval Linking’

The Intimacy of the String Quartet

The concept of ‘chamber music’ has always been inextricably linked in my mind to the string quartet. For most of my life I have enjoyed playing in string quartets, and it has always been in some sense my home. As such the string quartet is the testing ground for almost all of my new ideas and techniques. Not only is the quartet (with its great degree of malleability) a perfect tool for composition, but it has always seemed to me to be the largest ensemble that feels truly intimate. The quartet defines what chamber music is (traditionally speaking a small ensemble playing music for the enjoyment of a small group of friends in an intimate setting, or for the enjoyment of the ensemble itself) because it is more inwardly focused than outwardly.

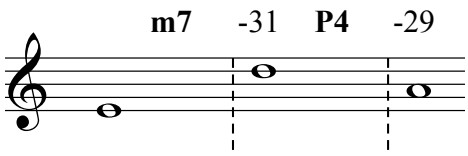
Because of its small size the quartet is able to concentrate intently on minute aspects of performance, such as subtle tuning deviations, which occupy less of a central role in larger ensembles. As common practice, a competent string quartet will often make these subtle tuning adjustments ‘on the fly’ - the middle voices of the quartet will often change their tuning of held notes midway through (classically, these are usually common tones between adjacent chords) to suit a change in the outer voices. In tonal harmony this means altering pitches to maintain a close approximation with just intonation. Mathematically speaking, complex tuning ratios (larger numbers) are constantly being made simpler (smaller numbers). This practice would eventually lead me towards what I would later term ‘radical consonance’.

As stated before, my fascination with the sine-tone installations of La Monte Young led me to study both the technical means of their construction (especially his use of sum and difference tones) and the broader philosophical questions about the nature and definitions of consonance and dissonance. What I term ‘radical consonance’ operates under the premise that harmony can simultaneously contain elements of both consonance and dissonance. Louis Andriessen’s ‘time chord’, from his work ‘De Tijd’ (‘Time’), which contains both a dominant seventh and the tonic is an example of this concept in narrative terms - conflict and resolution occurring simultaneously. My concept of ‘radical consonance’ is the same kind of simultaneity, but one which substitutes the notion of conflict for mathematical and cultural unfamiliarity and the notion of resolution for mathematical and cultural familiarity.

Whereas I previously explored this idea in purely vertical terms (as a response to the sine-tone installations of La Monte Young), I then explored it as a process in time. This process is

one in which pitches are tuned to one another slowly via a small number of simple ratios. As each pitch is tuned to the one previous (whether tuning to oneself or to others), this chain of intervals becomes increasingly complex. This is not traditional just intonation (using a small set of whole number tuning ratios) but one in which the mathematical definition of the pitch set as a whole requires the ever-expanding use of larger and larger numbers. This is because the intervals may be used to create a linkage which is above the previous pitch (in Partch's language 'otonality[82]') or below it ('utonality[83]') - the interval is either in its primary form or its inversion. From this simple arithmetic process, a four note chord which contains both otonality and utonality can already become extremely complex if it contains simultaneous and contradictory elements of consonance and dissonance. For example, pitch 'a' may relate to 'b' by a simple ratio, and 'b' to 'c' by a simple ratio, yet the relationship of 'a' to 'c' (through simple multiplication of fractions) will likely involve larger numbers.

Figure 14: Interval linking example from 'Walk Until Morning':



In the above figure, the relationship between the first two pitches is 7:4. The relationship between the third and second pitches is 3:4, making the relationship between the first and the third pitches: 7:4 * 3:4 = 21:16. Expressed as a decimal, this ratio is 1.3125, just shy (27

---

[82] Partch, Harry, *Genesis of a music; an account of a creative work, its roots and its fulfillments* (New York: Da Capo Press, 1974). 69.

[83] Ibid.

cents) of the simple 4:3 ratio (1.333…).

To further complicate matters, because the pitch material of pieces which utilize interval linking is defined by a finite set of intervals rather than a finite set of pitches, the relationships between the constituent parts are fluid. Pitches within the chord can change their harmonic ratio, the direction of this relationship (‘otonality’ or ‘utonality’), and also the pitch or voice to which they relate - with only one or two changes of ‘partner’ (relating pitch) the relationships become extremely complex extremely quickly.

The cumulative sound of the chord becomes one of multiple identities, made up of a mixture of simple and complex ratios. The term 'radical consonance' therefore defines a consonance which is somewhat obscured and conflicted, it is a harmony in which multiple conflicting consonances are simultaneously present. It is a fractured harmony made up of many conflicting perspectives - it does to the concept of harmony what cubism did to the concept of perspective.

‘Writing for the First Time Through “An Coulin”’

I first explored the technique of interval linking in my string quartet ‘Writing for the First Time Through ‘An Coulin’’. The title is both a reference to the process of utilizing a traditional Irish song as its foundation and a tongue-in-cheek reference to Cage’s ‘Writing for the Second Time through Finnegan’s Wake’[84].

---

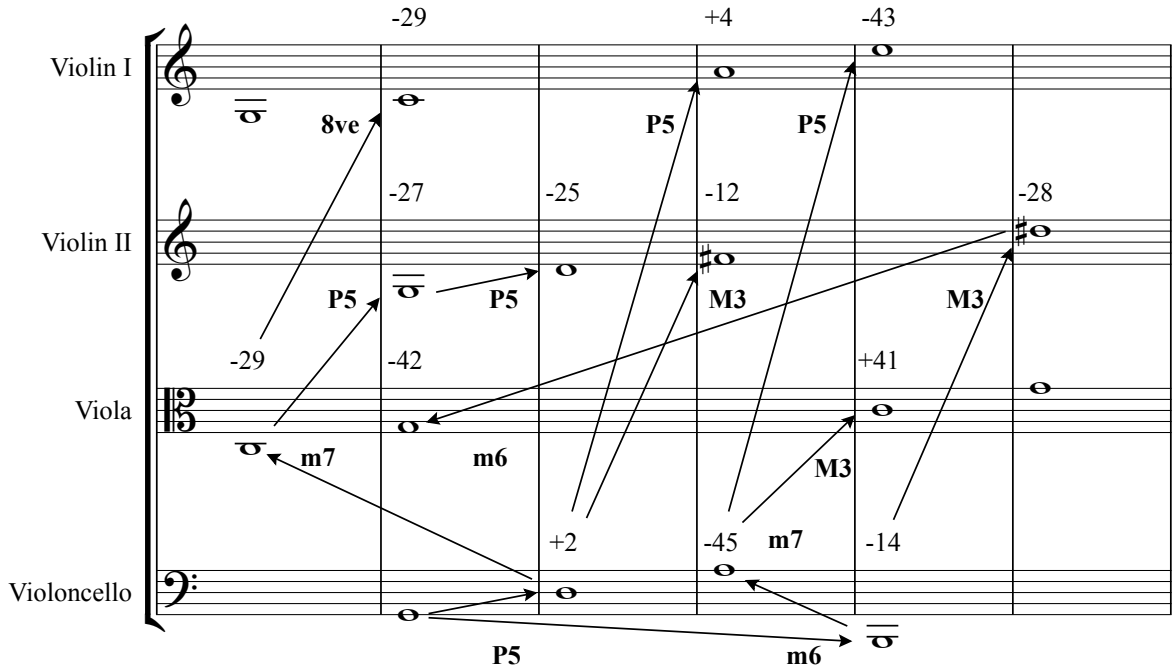
[84] John Cage, *Writing for the second time through Finnegans wake,* with John Cage, speaker, recorded 1979, on *Roaratorio; Laughtears; Writing for the second time through Finnegans wake*, on Mode Records: mode 28/29, 2002, compact disc.

While researching the folksong on which this piece is based I stumbled upon a recording of Leo Rowsome playing it on the uilleann pipes[85]. The sound of the uilleann pipes interested me because it contains both just intonation (the chanter is a basic just scale) and strange dissonance. The drones (three pipes usually tuned to three octaves of D) are typically slightly out of tune, and the chanter is able to bend its pitches in both subtle and obvious ways. The complex and bizarre scordatura used in this piece (see Figure 15) mirrors the characteristics of the uilleann pipes in that it enables the quartet to play, using only natural harmonics and open strings, a mixture of just intonation chords in the key of G (the key of the folksong) and also obscure dissonances - containing several different tunings of pitches which are of vital importance to tonal harmony in the key of G (such as G, C, and D). These near-unisons are used to imitate the tuning of the drones of the uilleann pipes. This quartet is then an exploration of two things: best-fit tuning solutions using only natural harmonics and open strings, and the use of dissonance as a programmatic or imitative device.

---

[85] Rowsome, Leo. “An Chúilfhionn (Leo Rowsome)”. Original recording, 1969. YouTube video, 2:30. Posted by "Eoghan Rua Ó Néill," September 25, 2011, https://www.youtube.com/watch?v=-4EPTDKT9Gc

Figure 15: Scordatura for ’Writing for the First Time Through “An Coulin”’:



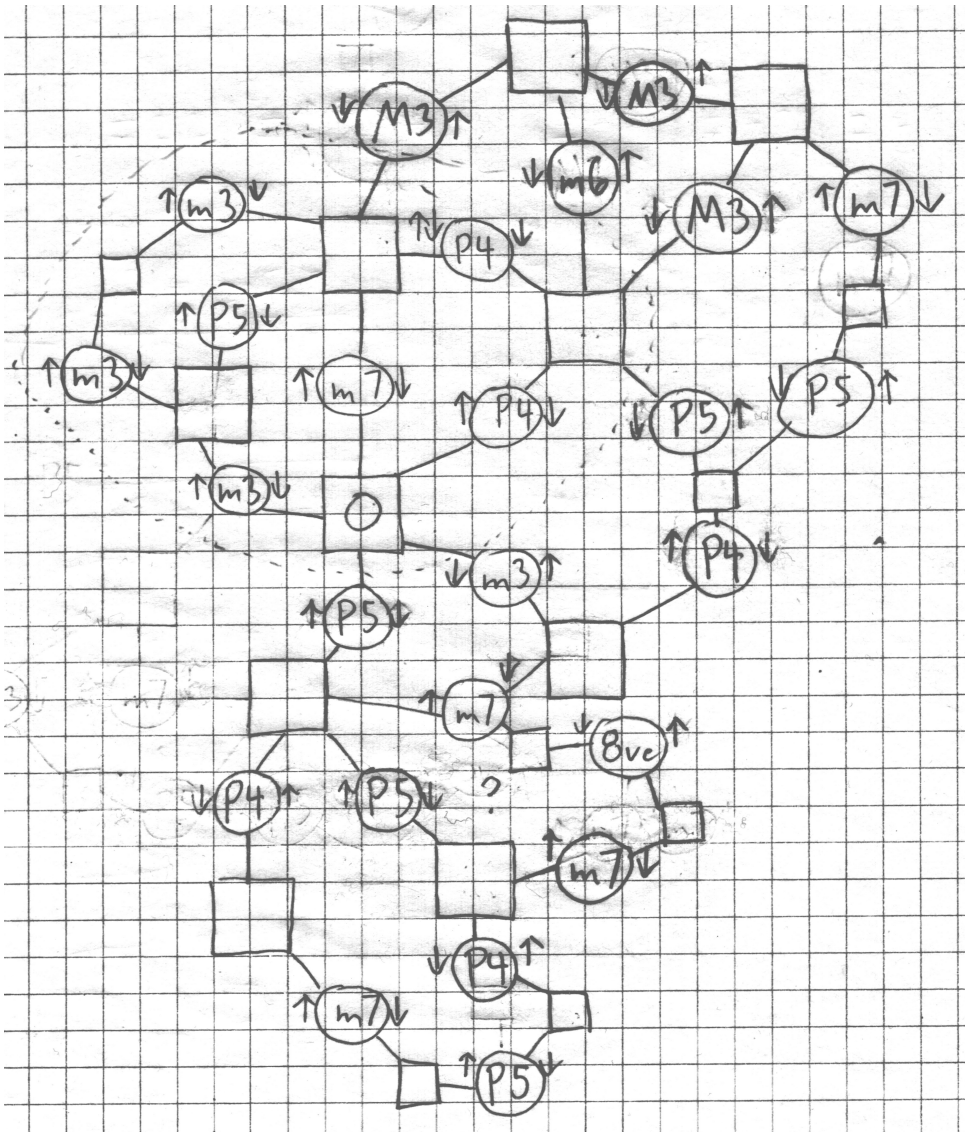
Graphic Representations of the Interval Linking Technique

I started writing the string quartet ‘Walk Until Morning’ during my first year in Cork. After working on it for nearly a year I eventually became frustrated and halted the composition. During this hiatus I composed a number of sketches of quartets which utilized the same interval linking technique, the most successful of which was in graphic form. In keeping with the idea of intimate chamber music, this particular iteration of the technique gives the performers only the relationships between pitches rather than naming any of the pitches themselves. Even more daunting, the performers are given the freedom to decide the order of entrances (who links with whom). Since this sketch was concerned with the relationship between pitches and players, rather than the specific pitches themselves, a graphical representation of these relationships seemed the most effective notation for it.

The following ‘Figure 16’ is the interval linking graphic sketch. Instructions are as follows:

Players move from box to box along connecting lines. Circles indicate intervals (e.g. M3 is a just major 3rd (5:4), m7 is a just minor 7th (7:4)). When you cross a circle you change your pitch by the interval in the circle up or down according to the arrows on the side of the circles (as you navigate through the various intervals you must stay on one side of the circles (left or right). Players should leapfrog over one another in two groups of two.

Figure 16: Interval linking graphic sketch:



‘Walk Until Morning’

‘Walk Until Morning’ was my first earnest attempt at utilizing this interval-linking technique (an earlier string octet was not finished). The technique in 'Walk Until Morning' is a combination of the interval-linking I described earlier (utilizing the ratios: 5:4, 4:3, 3:2, 8:5, 5:3, 7:4, and their inversions) and the use natural harmonics and open strings (without scordatura). Although the rate of change in this piece is slow (the pace is set mainly by the performers ability to tune their pitches), one can think of the interval-linking as essentially the narrative element, as the idea of progression. The natural harmonics and open strings serve to break up the possible harmonic cohesion of the linked intervals by existing outside of the harmonic structure created by the process of interval linking - the possible harmonic complexity expanding greatly through the addition of nine open strings (five different pitch classes) and 54 natural harmonics (30 different pitch classes). The harmonics seem to come out of nowhere and often create jarring and dissonant collisions with the existing harmony. Although the harmonics and open strings often serve to break up the homogenous texture and the present feeling of forward progress, they can also serve as the beginning of a new chain of intervals. This creates the possibility of an even bolder, more complex, and contradictory harmony because it opens up the possibility of simultaneous interval chains started at any time from any place. The harmonic possibilities become almost limitless.

Because of these complicated considerations, the pseudo-improvisatory composition of 'Walk Until Morning' occurred slowly. Over the course of the year in which I completed the work I gradually found that the kind of harmonies I was writing dictated ever slower change. The range of the total harmony also gradually became restricted as I became more attracted to

subtle beating and harmonies which contained a slow throbbing sensation (similar to the ‘rubbing’ I would later compose in the sine-tone chords of the ‘Dissonance’ series). In a vague and unsystematic homage to the formal methodology of Tom Johnson, the piece ends with an exploration of the on/off permutations of the various pitches inside a single chord - the intervals inside this complex chord are taken apart and examined in groups of two or three. After composing this short section I realized that it had, to paraphrase Cage, ’died a natural death[86]’.

‘Just Intonation Method for Violin’

As I worked on ‘Walk Until Morning’ I realized that in order for this new performance practice be fully realized (which is really an expansion of the common tuning practice of chamber music discussed earlier), the performers would have to learn how to hear just intervals - especially those using the 7th harmonic. I thought back to my experience of slowly practicing chords while listening for or trying to feel a lower tone (the difference tone) and composed a series of rudimentary scales and studies which aim to teach a violinist to hear difference tones. In these scales, the difference tones are indicated so that the player at least knows what to listen for. Moreover, a second player is allowed to assist the first by playing them. In my own experience with these scales and difference tone chords (which I later termed ‘perfect chords’) I found that this extra player helps a great deal, especially so with the unfamiliar 7th harmonic. Because the interval linking technique often results in obscure dissonances and ‘commas’ (the minute difference between two pitches arrived at through the

---

86 John Cage and David Tudor, *Indeterminacy: New Aspect Of Form In Instrumental And Electronic Music / ninety stories by John Cage, with music,* with John Cage, speaker, originally recorded 1959. Washington, D.C.: Smithsonian/Folkways, 1992, compact disc.

multiplication of different intervals), I have written further studies for two players in which these commas are built step-by-step. This method is included in the ‘Ancillary Works’ section of my portfolio of works.

Part 3: Detailed Analyses of Four Specific Works

The following four works are in some sense a culmination of the techniques and attitudes explored during my three years in Cork. They effectively illustrate the techniques, forms, and philosophical ideas which have been the focus of my work.

Violin Caprice: Harmonic Catalogue

Acoustic Space as Instrument

It was probably Alvin Lucier who came up with the idea that the 'instrument' for a piece could be an acoustic space. Rather than the audience observing the instrument from the outside, they would instead observe it from the inside. While it may seem radical, this leap is similar to the concept promoted by Cage and his followers - that music and art could be immersive and that the traditional roles of audience and performer could be inverted, merged, or done away with altogether. However, whereas Cage let those observing the piece become the instrument (4'33", happenings), Lucier put you physically inside the instrument. Lucier's 'I Am Sitting In A Room'[87], in which a speaker's voice is gradually filtered through the performance space over and over is the greatest example of this idea. The resonances of the room are reinforced with each successive repetition of the recording until the comprehension of the speech gets overpowered by the natural resonances of the room. It is important to note that the room itself is not designed by Lucier to be resonant in any particular way. Although

---

[87] Alvin Lucier, *I am sitting in a room: for voice on tape,* with Alvin Lucier, speaker, originally recorded October 29 and 31, 1980. New York: Lovely Music, 1990, compact disc.

Lucier made the decision to use his own speech as the sound coming out of the speakers, he has no control over how this will interact with(in) the space. Lucier is interested in the beauty of how a room sounds, rather than a particular room sounding beautiful to him.

Idea/Concept

My caprice for solo violin 'Harmonic Catalogue' is useful to analyze more in depth because it amalgamates, in the small package of a work for solo violin, many different techniques that have run through the fabric of my work. In ‘Harmonic Catalogue’ the material is made up solely of the natural harmonics and resonances of the violin. This idea comes directly from Alvin Lucier’s ‘I Am Sitting In A Room’, but with the situation turned around once again. The acoustic resonances of the violin have become Alvin Lucier's ‘Room’. The performance space is enlisted as a kind of sustain pedal to accentuate the peculiarities of the instrument’s tuning and resonances. In keeping with Lucier's acoustic egalitarianism, this caprice explores the natural harmonics and resonances of the violin in the manner of a catalogue - my aim was to let the violin as a physical object speak for itself.

The formal genesis of ‘Harmonic Catalogue’ is Tom Johnson's famous ‘Chord Catalogue’ for solo piano in which, as discussed earlier, all the chords within one octave are played through a rudimentary linear process. ‘Harmonic Catalogue’ uses a variation of the form of ‘Chord Catalogue’ which is actually closer to the form of another Johnson piece: a movement of his ‘Rational Melodies’[88]. This form is a relatively simple process of addition: 1/ 1,2/ 1,2,3/

---

[88] Tom Johnson, *Rational melodies,* with Dedalus (musical group), recorded October 6, 2008, on New World Records 80705, 2010, compact disc.

1,2,3,4/ 1,2,3,4,5/ 1,2,3,4,5,6/ etc., where each number is a size of dyad (1 is the smallest). Whereas the 'Chord Catalogue' is a series of rising scales, 'Harmonic Catalogue' is a series of widening dyads. One can imagine this form as a series of horizontal wedges which get successively longer and wider.

With the form of the piece settled, it then became necessary to define all the possible dyads of the violin. This meant defining the limits of the harmonics used in order to define and limit the dyad possibilities. From the preliminary work done on mapping for 'The Gates of Los Angeles' and on defining the harmonics and open strings of the string trio as a single harmonic series in 'Some Perfect Chords' (which will be discussed later), I managed to define the set of open strings and harmonics 1 - 7 on all four strings of the violin (minus the mostly inaudible 7th harmonic on the E-string) as a single harmonic series. From this imagined series I defined the 24 dyad sizes possible within one octave, ranging from less than a semitone (65 cents) to its inversion of almost an octave (1135 cents). While some dyads are only possible in one specific pitch range (using two specific pitches), the vast majority of these dyads are transposable (playable on multiple combinations of strings). This means that although the dyad widths are constrained to less than one octave, the pitch range of the work as a whole (and between dyads) is much larger, encompassing nearly the entire range of the violin. Even with such limitations as the four strings of the violin and a limited number of playable harmonics on each string, the selection of possible dyads is vast and exotic (77 in total with 24 different interval sizes). The complete set dyad possibilities is included in the score.

Figure 17: Sizes of dyads used in ‘Harmonic Catalogue’:

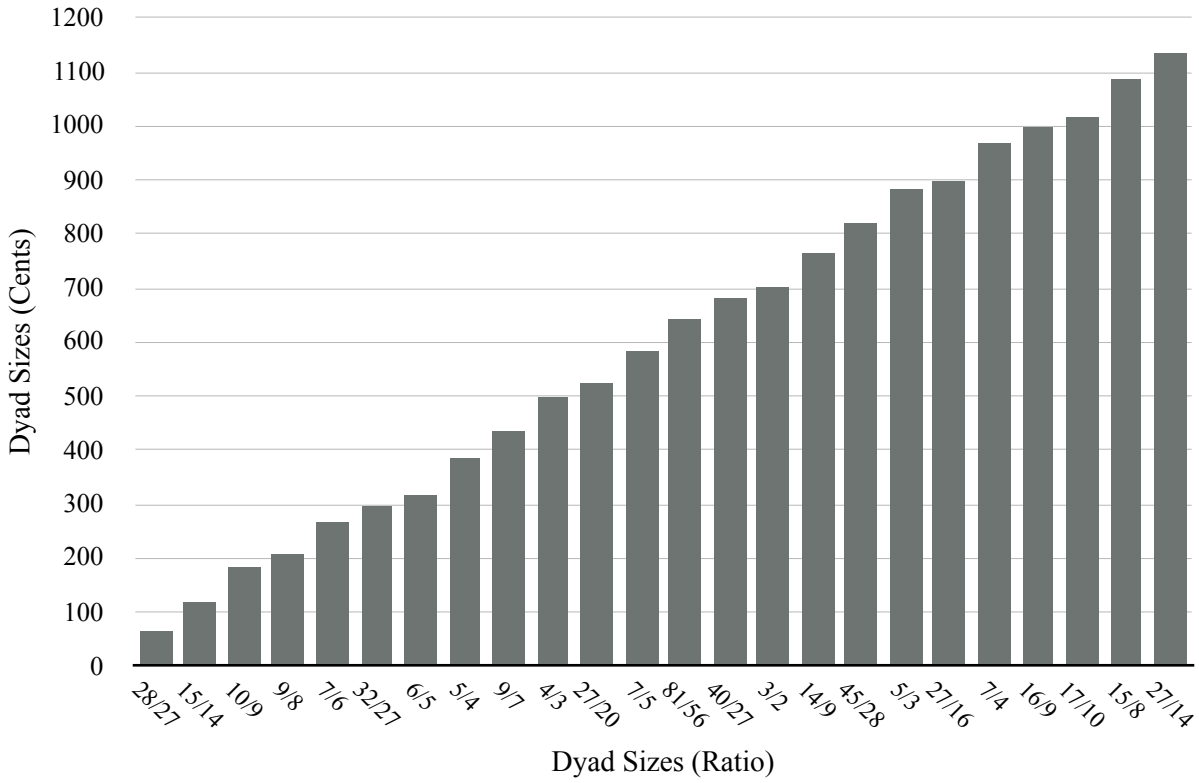
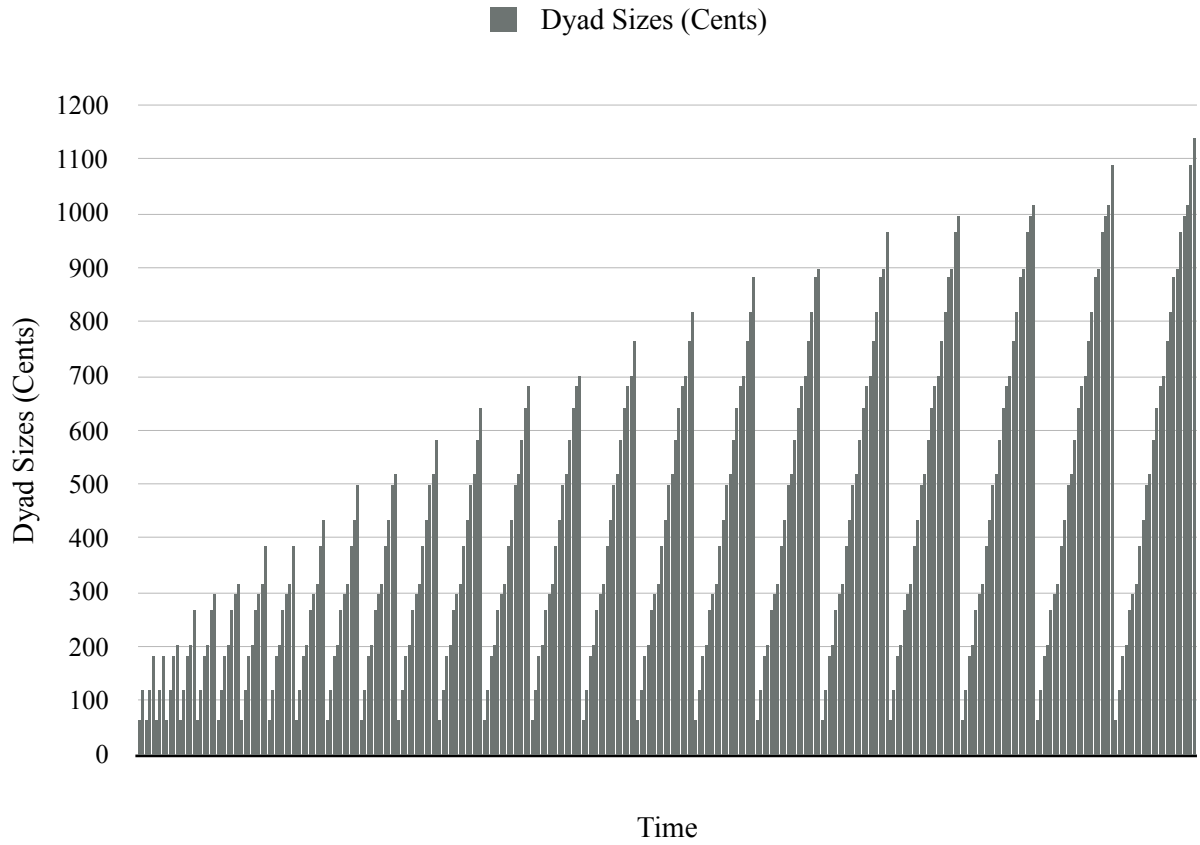


Figure 18: Form of ‘Harmonic Catalogue’:



As noted before, some dyads have only one possible method of execution (a particular pitch class in a particular octave). Rather than thinking of these points as obstacles to harmonic variation I chose to think of them as stable points along an otherwise strange and unfamiliar harmonic progression. Both with and without these stable points, I generally tried to find elegant and smooth voice leading from one harmony to the next. This was done through a combination of the use of common tones, range similarity, and/or movement of a pitch up or down a perfect fifth between adjacent chords (I tested the efficacy of my voicing using a simple Max/MSP patch which played this dyad progression using sine-tones). My job as a composer was to find a balance within these restrictions between repetition, variation, and the technical possibilities of the violin.

A Technical Consideration

One of the obvious technical problems in this piece is the fact that many of the dyads occur on non-adjacent strings, and so cannot be played as true dyads. Because of this, the dyads (even those which occur on adjacent strings) are to be arpeggiated rather than played as real chords. My hope was that the quick oscillations between the notes of the dyads would (with the help of the resonances of the violin and a somewhat reverberant performance space) create the illusion of true simultaneous harmony.

Notation

Initially the notation of this piece was rather strict and exact, but stemming primarily from the technical considerations of the violin I opted for the less punishing option of spatial

notation. Time is defined loosely on a per-system basis, using open noteheads (as a small homage to Couperin's 'Unmeasured Preludes'[89]) as a means of avoiding panic on the part of the violinist. The most important aspect of the notation is perhaps my use of large phrase markings (also found in Couperin), which determine the general pace and flow of the already spatially-defined rhythms. All of these little notational devices are designed to mitigate the obvious technical difficulties faced by the violinist and to create the sense of a swirling kaleidoscope of exotic harmony. The relationship of a whimsical and inexact notation with a predictable and linear form is another important aspect of my work. In this example the performer is left to be human inside the restrictions of the rigid linear form.

Figure 19: Notation example from Louis Couperin's 'Unmeasured Preludes':

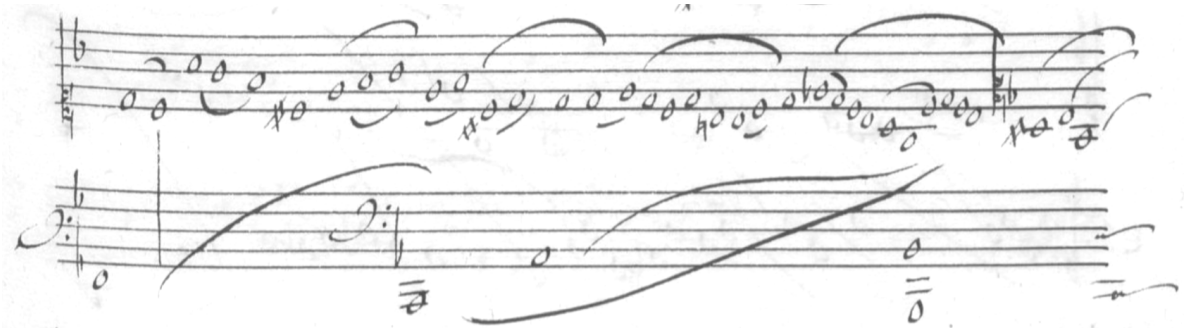


Figure 20: Notation example from 'Harmonic Catalogue':



[89] Couperin, Louis, c. 1660. *Unmeasured Preludes* in Bauyn Manuscript. Bibliothèque nationale de France, Musique (F-Pn): Rés. Vm7 674-675 Available: http://imslp.org/wiki/Bauyn_Manuscript_(Various)

String Trios: Some Perfect Chords/Some Imperfect Chords

‘Some Perfect Chords’ and its sister piece ‘Some Imperfect Chords’ are one half of the culmination of my work with harmony derived from sum and difference tones. This body of work began as an examination and criticism of La Monte Young’s sine-tine installations, but eventually evolved and married itself to other aspects of my compositional practice. ‘Some Perfect Chords’ was written as an examination of consonance within the harmonic constraints of the string trio.

Perfect Chords

In 'Some Perfect Chords' I enlist sum and difference tones in the creation of a theoretical and mathematical definition for consonance; the end goal of which was to find new chords which, despite their unfamiliarity, contained a consonant quality. As the title suggests the work is made up entirely of 'perfect' chords, which are defined by the formula: a + b = c, where ‘a’, ‘b’, and ‘c’, are harmonic numbers, and where c > b > a > 0. This formula also carries with it the restrictions that: a ≠ b * 2^n, b ≠ c * 2^n, a ≠ c * 2^n (where n is any integer). This means that no specific pitch class and cent deviation combination may be repeated within a chord - chords which contain octaves and unisons are therefore excluded from the set of ‘perfect chords’.

Imperfect Chords

An ‘imperfect chord’ uses the same mathematical logic as a ‘perfect chord’ albeit with a slight alteration. Rather than the pure simplicity of a + b = c, where c > b > a, an ‘imperfect chord’ allows for ‘a' to be transposed by any number of octaves. The formula for an ‘imperfect chord’ is therefore c - b = a * 2^n. Since including negative values of n in the formula allows us to transpose ‘a’ up as well as down, ‘a’ is therefore not necessarily a lower pitch than ‘b’ or ‘c’.

Harmonics as Catalogue

In thinking further about Lucier’s musical egalitarianism and Johnson’s catalogues, I decided that these pieces would be an exploration of some whole set of things - a kind of jumbled catalogue that presents all of the material created by some arbitrary rule. I realized however, that even with the restrictions imposed by these formulae, any whole set of possible chords which fit these formulae would be too large to be practical. This is in part because of the realization, stemming from the ‘Dissonance’ series, that there exist an infinite number of pitches within any pitch range - any whole set of chords which fit these definitions would contain an infinite number of chords. To further limit the number of possible chords I found inspiration in John Lely’s 'Harmonics of Real Strings’[90], which presents the harmonics of a string through the linear physical process of sliding one’s finger extremely slowly along its length. Although this process could theoretically produce an infinite number of harmonics,

---

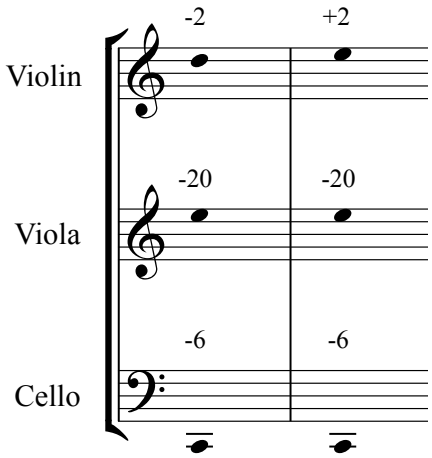
[90] John Lely, “The Harmonics of Real Strings (Anton Lukoszevieze, Cello),” Recorded 12 October, 2006. Accessed October 23, 2017. https://soundcloud.com/john-lely/the-harmonics-of-real-strings-anton-lukoszevieze-2006

the weight of the string and the width of the finger severely limit the number of audible harmonics. From this I decided to limit the pitch material to only open strings and natural harmonics, further restricting the possible harmonics on each string (counting the open string as harmonic ‘1’) to an even more limited set (harmonics 1,2,3,4,5, and 7). This was done mostly for practical reasons, since the 6th and 7th harmonics are somewhat unreliable (with harmonics above the 7th becoming becoming even less so). The 7th harmonic on the violin's E-string was omitted for this same reason. Even with this restriction however, the number of possible chords which fit the definition of a 'perfect chord’ was more than enough material to sustain a piece (‘Some Perfect Chords’ is 118 bars, while ‘Some Imperfect Chords’, with its slightly more relaxed formulae, is 290 bars). A discussion of the form of these works is on the following pages.

Figure 21: Harmonic series of the string trio:



Figure 22: First ‘Perfect’ and ‘Imperfect’ Chords:



The figure above shows the lowest ‘perfect’ and ‘imperfect’ chords. As per the formulae, the ‘a’ of these two chords is a low note (C). However, whereas the C of the ‘perfect chord’ is in the correct octave (harmonic numbers are: 80 - 72 = 8), the lowest pitch of the ‘imperfect chord’ (the ‘a’ of the formula) is transposed up by three octaves ((c - b = a * 2^3) or 81 - 80 = 8 (8 = 1 * 2^3)). The difference between the upper two voices in this example (harmonics 81 and 80) is heard as a beating frequency of 8.15 Hz. Although this chord is dissonant, it is not as dissonant as one would expect - possibly owing to the octave relationship between the beating frequency and the low C.

Form

The inspiration for the form of these two works comes from a piece by my father Michael Longton, called ’Piano Diary’. As his title suggests, the form of ‘Piano Diary’ was composed in the manner of a diary. Everyday for a month he wrote a little bit of music, sometimes a lot and sometimes very little. After this month he combined the material so that *“Each idea would be required to recur, first two days later, then three days after that, then four, then five,*

etc. In this way, ideas accumulate, collide, and interact with each other, yet at the same time everything eventually fades, is forgotten. The result is, that while there is a great deal of repetition in the piece, it is more about forgetting than remembering[91]*."* However, while 'Piano Diary' allowed the 'days' to *'accumulate, collide, and interact with each other',* the chords of these trios are arranged one after another - as a chordal progression.

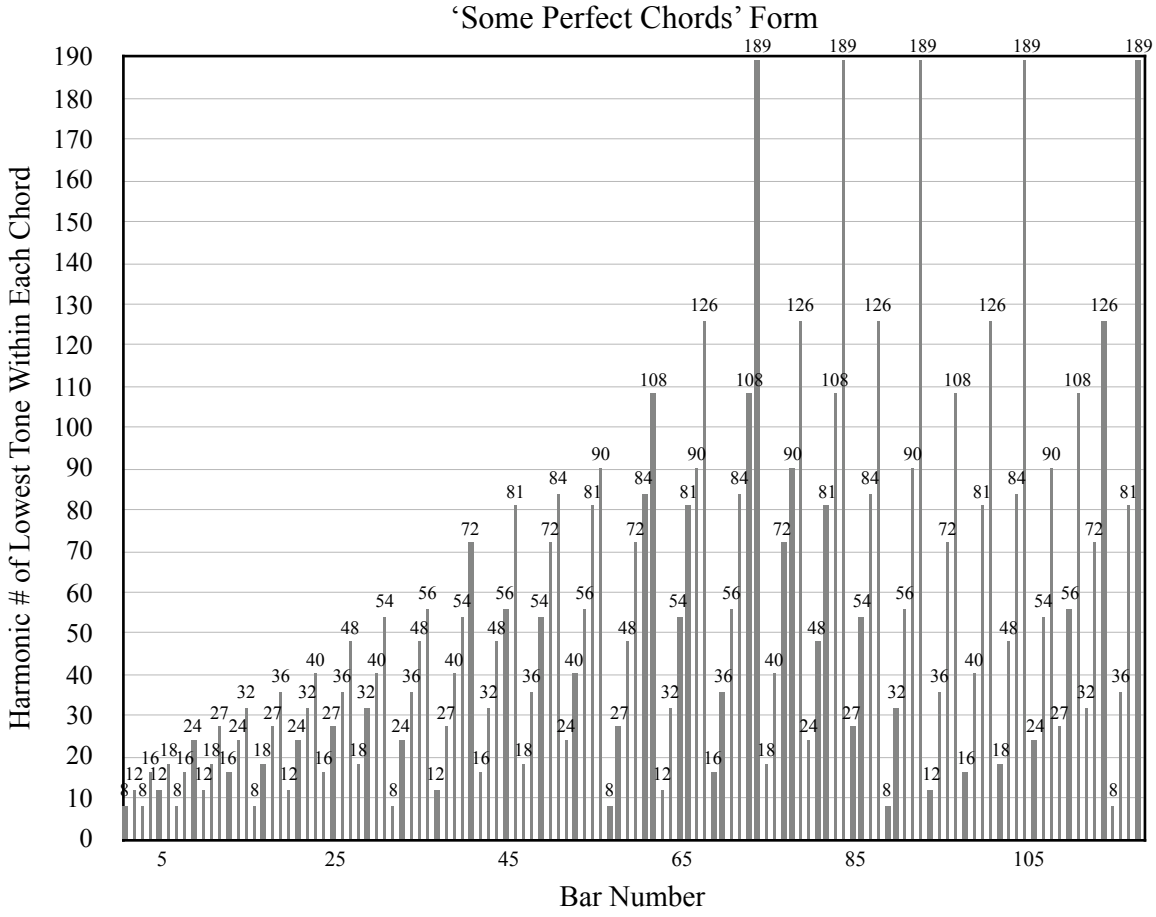
These chordal progressions are defined by the lowest note within a chord. Starting with the chord which contains the lowest note (in the case of 'Some Perfect Chords' the 8th harmonic of the global harmonic series of the string trio), the next chord in the progression has as its lowest note the second lowest note, and then the third, and so on. The chords repeat as in the 'Piano Diary' form first after one other chord, then after two, etc.

The definition of these two sets of chords sometimes defines chords which share a lowest note. In these instances the height of the other pitches is used to order the chords low to high. For example, for chords labelled '16(1)' and '16(2)', chord '16(2)' is a 'higher' chord than '16(1)' but both chords share a common lowest note '16' (this distinction is not reflected in the figure showing the form of 'Some Perfect Chords'). In instances where there are multiple chords sharing the same lowest note (e.g. '16') and this lowest note is repeated, each repetition of the same lowest note should be the next version of the chord ('16(2)', then in the next repetition '16(3', etc.). Once all the identities (versions) of the chord have been played, the chord cycles back to its first identity, and the process repeats (1(1),1(2),1(3),1(1),1(2), etc.).

---

91 Michael Longton, liner notes to *The things in between: new music for piano,* Eve Egoyan, Artifact Music ART 019, compact disc, 1999.

Figure 23: Form of ‘Some Perfect Chords’:



‘Figure 23’ shows the form of ‘Some Perfect Chords’ (numbers show the lowest tone within each chord). As we can see each progression upwards introduces one new chord which is higher than the previous highest chord. The elegance of this form is that while it is generally an upwards progression, each series of upwards steps forms new chordal juxtapositions. This pseudo-random shuffling brings out the harmonic and acoustic subtleties within the chords and makes it very difficult to gain a sense of progression from one chord to the next. It takes us away from any idea of expectation, which is especially important and interesting when the chord is a familiar one (e.g. a major triad). The form helps us to leave our old ideas about consonance at the door and to briefly imagine new ones. While we are only able to determine a gradual upward movement in the form as a whole we are unable to guess the movement of

one chord to the next. Moreover, as each chord occurs less and less frequently as time goes on, newer chords gradually take precedence over old. To put it another way, "*it is more about forgetting than remembering*[92]*."*

Landscape with Train Whistle

'Landscape with Train Whistle' acts as a good summation of my attitudes on a wide range of techniques. This is in large part because it is my most complete application of the 'timbre manufacture' technique with which my time in Cork and my interest in microtonality began. The basic concept of Landscape comes from James Tenney's 'Spectrum' pieces in which a large ensemble is imagined as a single hypothetical instrument and used to create a long attack from an imaginary instrument[93]. The instruments within the ensemble each make up a small part of the harmonic series of this imagined instrument. Because these pieces are also in a very vague sense virtual attacks, the number of harmonics present and their amplitudes are in constant flux. The form of these pieces are therefore like a slowed down recording of a large gong, the spectrum of which changes greatly over time. 'Landscape' borrows from Tenney the idea of the virtual instrument in a number of ways. The piano is imagined as a single harmonic series of its lowest note (A) - much in the same way as the string trio in 'Some Perfect Chords'. However, whereas Tenney composed the change in the harmonic spectrum (both which harmonics are present and their amplitudes) by utilizing the ensemble as a whole, in Landscape the player changes which components of the series are audible (or

---

[92] Longton.

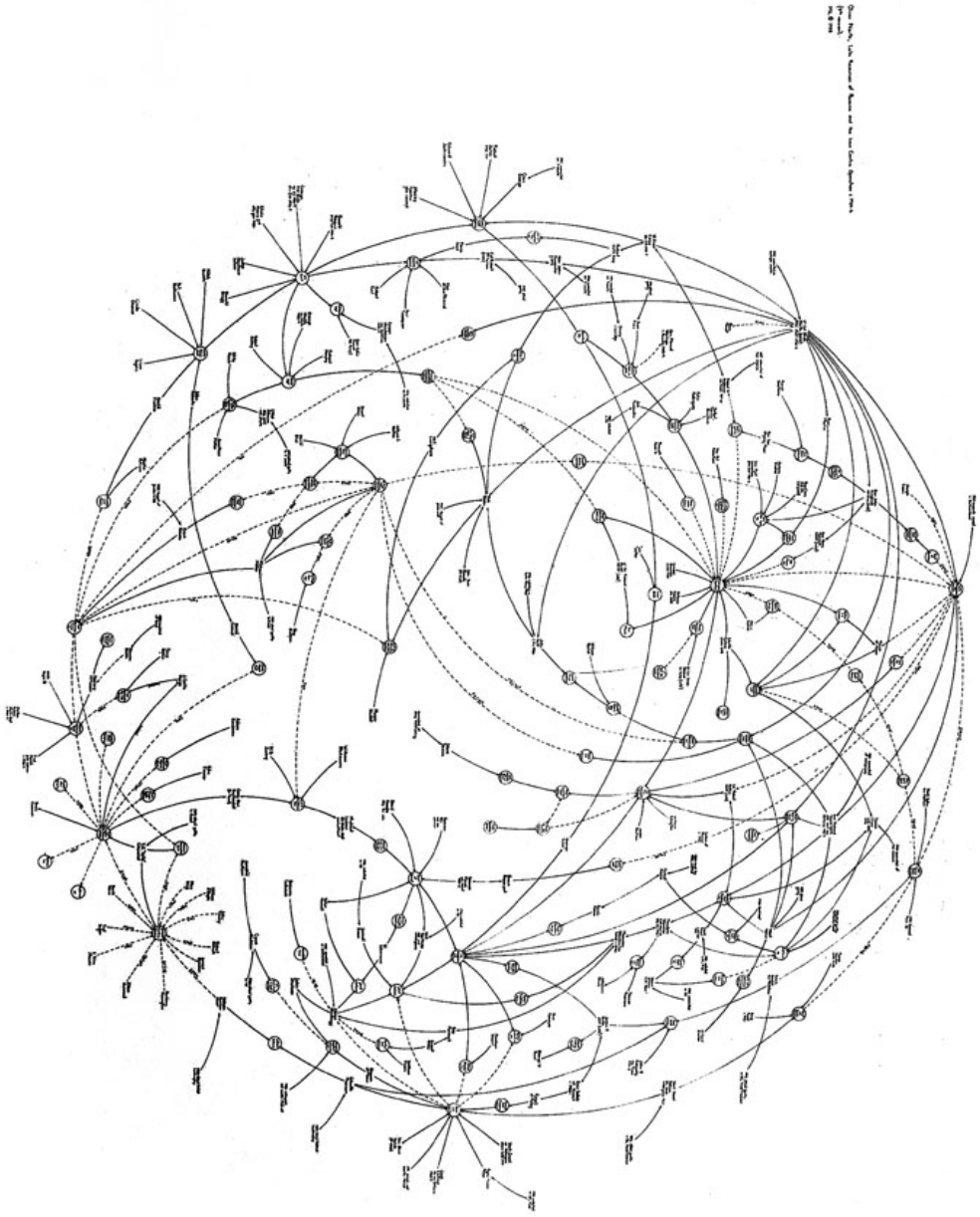
[93] Bob Gilmore, liner notes to *James Tenney: Spectrum Pieces,* The Barton Workshop, New World Records 80692, compact disc, 2009.

are the most audible) by navigating the score and making decisions about which material to play within it. The score is imagined as a compositional (and harmonic) space rather than a compositional narrative.

Form/Notation

In order to construct an attractive compositional space, the notation of this piece needed to be an attractive (or easily navigable) visual space. For this I took inspiration from the world of visual art, specifically the outsider artist Mark Lombardi (although the early works of Earle Brown, John Cage, and Morton Feldman are forever in the back of my mind). Lombardi's works are elaborate and beautiful flow charts which show the connections between money, events, and people. The notation of 'Landscape', like the work of Lombardi, takes the form of a flow chart. To give the player a sense of where they will need to move their hands, the lower chords and pitches generally occupy the lower part of the page, while the higher ones generally occupy the upper part. The pianist may start anywhere on the score, and is instructed to choose two separate lines to play simultaneously - the somewhat random combinations of chords that naturally occur generating a continuously changing harmonic cloud.

Figure 24: Work by Mark Lombardi[94]:



94 Devon Golden, "Mark Lombardi, 'Oliver North, Lake Resources of Panama, and the Iran-Contra Operation, ca. 1984–86 (fourth version)' (1999)," BOMB Magazine, http://bombmagazine.org/article/2587/mark-lombardi

Figure 25: ‘Landscape with Train Whistle’ (piano part) with harmonic numbers:

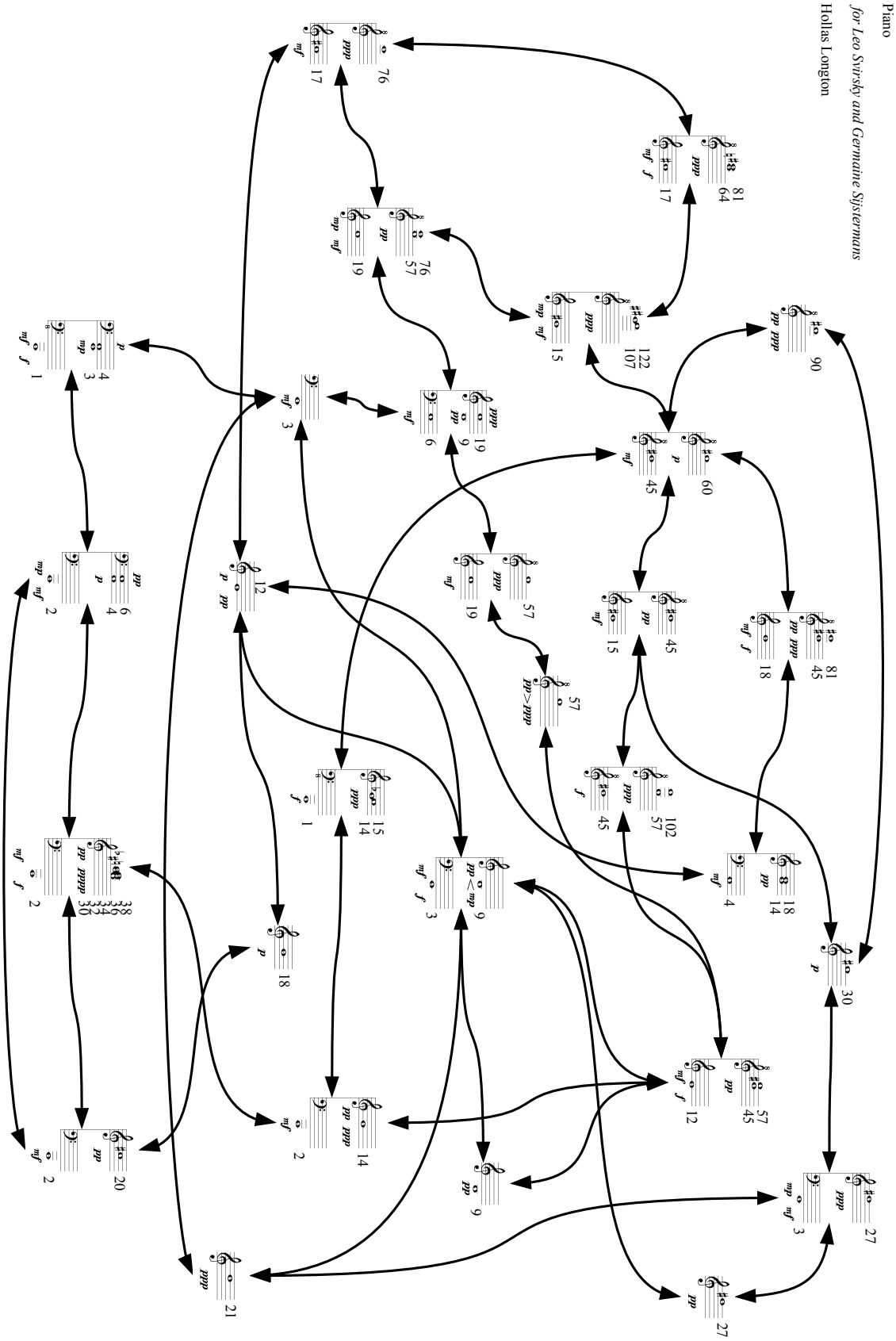
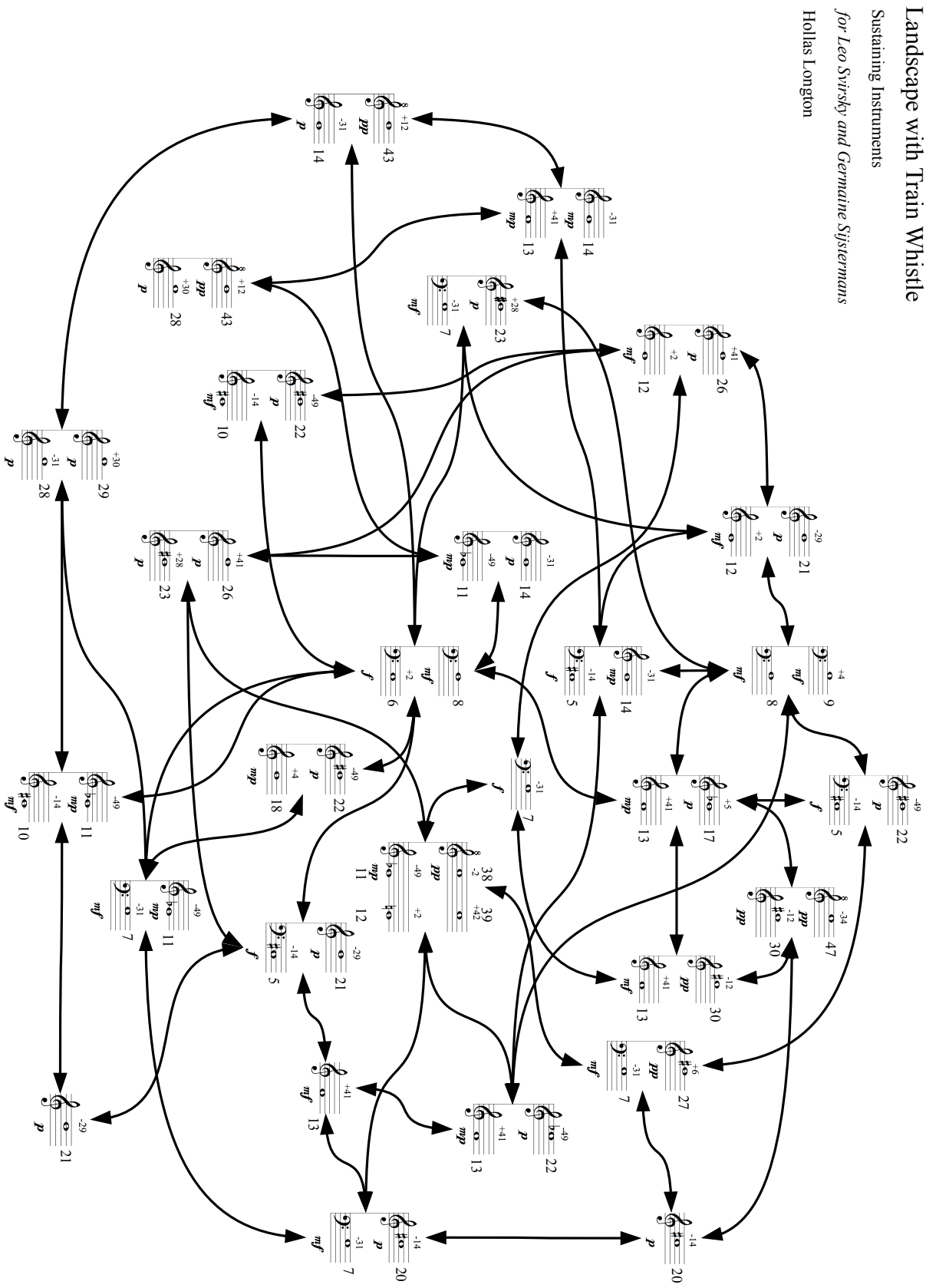


Figure 26: ‘Landscape with Train Whistle’ (ensemble part) with harmonic numbers:



‘Perfect’ Chords in ‘Landscape with Train Whistle’

The chords within ‘Landscape with Train Whistle’ are derived from sum and difference tones (most of which fit the definition of a ‘perfect chord’). In contrast to the earlier applications of this arithmetic device, the ‘perfect chords’ are now enlisted to provide both a vertical (the internal construction of a chord) and a horizontal (how one chord leads to another) formal framework. The movement from one chord to the next (the rationale for the connecting lines) is dictated either through the use of common tones between chords, or the result of the same sum and difference arithmetic process which determined the ‘perfect chords’ in the first place. For example, a chord made up of harmonics 4, 14, and 18 may be adjacent to a chord with harmonic 10 (14 - 4 = 10), or 32 (14 + 18 = 32). The one or two exceptions to the perfect chord rule were constructed as transition chords which incorporate a tone from an adjacent chord into another chord. These chords occur in areas of the score which I felt needed more dissonance or contrast.

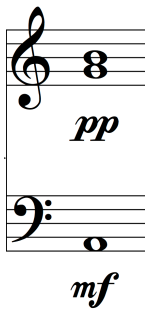
This practice of gently laying my hands on the scales of some arbitrary compositional process is typical of this piece. It is in this sense not a strict catalogue or demonstration as in Johnson or Lucier, but neither is it only a vague allusion to the harmonic series. Higher pitches which blend with the lowest pitch to produce timbre are employed in conjunction with more dissonant ‘stops’ (in which a greater degree of tuning compromise is permitted). Where I previously added chords to some invented melodic line, as in 'For Leo' or 'Mud Filigree', here these chords are related (however obscurely) only to the piano's lowest note. The massive set of chords made up of equal-tempered pitches which could ‘pass’ in their relationship to the harmonic series (+/- 10 cents) was reduced by the 'perfect chord' definition and the

limitations imposed by the size of a typical pianist's hands. Since the mathematical restrictions of the perfect chord definition still produced a set of chords which were too large, using my ear as final arbiter became a vital part of the compositional process. Occasionally, the 10 cent maximum possible deviation from the equal-tempered scale was widened to include the 7th harmonic and its multiples (at -31 cents), and in one instance the 5th harmonic (at -14 cents). While these 'extra' harmonics added some much needed beating and obvious dissonance, the upper note(s) of the stops were less able to hold their timbral attachment to the lower note (which was the basis for constructing the 10 cents deviation rule in the first place). I have found that the more the pitches which make up the 'stops' on the piano deviate from just intonation, the less easily they are able to blend into their lower note and become timbre.

Between Consonance and Dissonance

I am most interested in a harmony which eschews traditional categorization as either consonant or dissonant. It is where these two categories overlap where I feel harmony can best be heard as sound rather than narrative device. The 'Train Whistle Chord' in the aforementioned 'Landscape with Train Whistle' is a good example of this kind of harmony - combining a harmonic which blends easily to the bottom note with a more dissonant harmonic which does not blend so easily.

Figure 27: ’Train Whistle Chord’:



The ‘Train Whistle Chord’ is made up of harmonics 4, 14, and 18 of the piano’s lowest note (A). While the 14th harmonic (one octave above the 7th harmonic) is 31 cents flat and beats heavily with the low A, the 18th harmonic (one octave above the 9th) is only 4 cents sharp and therefore does not beat. The 14th harmonic is effectively softened by the presence of the 18th. In playing this loose approximation of the 14th harmonic together with the 4th harmonic, the natural 7th harmonic of the piano beats against its equal-tempered approximation. Moreover, the 7th harmonic is made more audible because of the presence of these beats. This chord is also an allusion to La Monte Young, in that it outlines the same 7 - 9 range utilized in many of his sine-tone installations (the chord can be reduced to harmonics 2, 7, and 9).

Version for Piano and Ensemble

Not too long after the first performances of ‘Landscape’ were given in The Hague, I was urged by another friend in Holland, Germaine Sijstermans, to write an additional part for her and some of her friends. Initially I had planned for the ensemble part to be wholly in just intonation, as a counterpoint to the equal-tempered piano. I imagined dissonance in this

version of the piece as the collision between equal-temperament and just intonation - the degree of dissonance would vary with each chord. It dawned on me as I worked on it that many of the obscure just chords I had written in the ensemble part were so unfamiliar as to be nearly impossible to hear or play. As I had realized earlier, teaching yourself to play in just intonation is possible, but only to the degree to which you can use your ears or your body to recognize when the tuning is correct. From this I adopted the strategy I had previously used in my 'Dissonance' pieces in which human error and discretion is applied to tuning. Tuning is thus understood as something malleable and human rather than a perfect ideal.

The selection of chords in the ensemble part (which have cent deviations corresponding to harmonics of the piano's lowest note (A)) was made by prioritizing those pitches not possible in the original set (which lie between the keys of the piano). This set also sometimes comprises the chords resulting from sum and difference tones of the piano chords. With the piano part taken as its starting point, the ensemble part is a potentially infinite chain of sums and differences made possible with the addition of instruments of continuously-variable pitch. What brings this part its colour, distinct from the solo piano version, is not these strange added harmonics but rather the degree of freedom afforded to the tuning of its just chords. The performers are instructed that, while there are cent deviations written above the pitches, these deviations may occur to any degree (e.g. the 7th harmonic is 31 cents flat, so the performer has 31 cents of tuning freedom). The performers are encouraged to glissando within this possible playing range between just intonation and equal-temperament. Moreover, as the instructions to the piece dictate *"If performing the ensemble version of this piece, the performers of the ensemble should map out (and probably indicate on the score) a route which they follow together."* and *"...two groups of two or more instruments (one or more*

high and low within each group) pair off and switch off playing the same chord repeatedly. Their entrances should overlap somewhat (by at least a few seconds), but spaces and/or rests may sometimes also occur." The switching between and overlapping of different deviations of the same pitch brings about a slow breathing cycle of consonance and dissonance. This recalls my experience of listening to La Monte Young's sine-tone installations in which my own breathing resulted in a change in the sound. While both this work and 'Some Perfect Chords' use 'perfect chords', the interpretive freedom afforded in 'Landscape' distinguishes it from 'Some Perfect Chords' by abandoning the naturalistic 'purity' of pure just intonation - the degree of purity is left up to the performers.

With the addition of the ensemble part, 'Landscape' becomes the most complete example to date of my attitudes on form, harmony, and the role of the performer. It is furthermore my most concrete example of the relationship between my primary two modes of thought: the logical and the whimsical. It is in this respect where I feel the piece is so successful. One of the things that interests me most about La Monte Young is that while he has a keen interest in mathematics, his music is not *about* mathematics. Like him, I am not seduced by numbers, but by sound. In this work especially, I have tried to amalgamate some of the abstract philosophical tenets of the Experimental School (as epitomized by Cage) with a rigorous focus on the practice and study of tuning systems and rigid processes - paradoxically marrying the idea of perfection (just intonation) with the idea of play (performer discretion).

Conclusion

Previously I had thought that artists attempt to make sense of the world by translating ideas into images (painting, music, etc.). Now I think the opposite - that artists think primarily in images and that later on these images are infused with ideas. That is, the artist does not understand and navigate the world through ideas, but through images. Although the image may change over time, the essence of it remains constant. Like a religious icon the ideal of image is unattainable and, to a certain degree, incomprehensible.

The image which still most holds my attention - my idée fixé - is the wild heterophony of the chain gang. At the University of Victoria I explored this image formally, stretching it out in the manner of a gigantic canon. At the Royal Conservatoire at The Hague I explored it more literally, adopting their minute manner of interaction into my own melodic and harmonic language. At the University College Cork I began to explore this idea more metaphorically. Rather than thinking strictly formally or literally I began to think of this image as coming together and splitting apart, like waves forming and crashing on the shore. I soon realized that this same image of coming together and breaking apart could be applied to harmony and that, more radically, this cycle of coming together and breaking apart could happen not as a sequence of events but as a single moment frozen in time. In this regard the work of La Monte Young played a pivotal role, but while he sought to 'make time stand still[95]' and effectively collapse musical form into an instant, my interest in harmony is more capricious - acting against narrative through a subtle and playful unpredictability, as John Cage said 'to

---

[95] Grimshaw, 145.

sober and quiet the mind, thus rendering it susceptible to divine influences[96].' In some respect I am looking primarily for artistic spaces where I can sit; where the very concept of narrative breaks down. Within a harmony which eschews traditional definition (light or dark, consonant or dissonant) and within harmonic spaces which are paradoxically both finely-tuned and infused with human error is where I feel the creation of new musical spaces and new musical ideas becomes the most possible and where I feel most at home.

The Future

I continue to be fascinated by harmony. In the coming years I would like to continue exploring techniques and concepts surrounding it, expanding this already expanded notion of harmony even further. Like all of my recent work this will manifest itself in extremely diverse forms. This includes the composition of more open-ended works in the style of the 'Dissonance' series for instrument(s) and natural drone (e.g. street lights, heaters, car engines, lawn mowers, etc.). My hope is to expand my interest in drones which contain regular periodicity to include the marriage of environmental sounds and instruments (as done by Michael Pisaro). Within the installation framework I would like to compose a version of 'The Gates of Los Angeles' for bowed strings using a similar tuning structure as the ensemble version of 'Landscape with Train Whistle'. The players would be given the freedom to glissando between the just tuning of their given harmonic and the 31-tet tuning of that pitch. My twin string trios 'Some Perfect Chords' and 'Some Imperfect Chords' further occupy a place on the installation side of things (another 'Perfect Chords' style string trio merely needs notation and I am planning a string quartet or quintet in the same vein). Clemens Merkel has

---

96 John Cage, "45' For A Speaker" in *Silence : lectures and writings*, 158.

also requested I write him two more solo violin caprices to complete a set of six. While these pieces are less focused on harmony and more of a workshop for ideas of form and an expansion of the limits of violin technique, I still want to explore notions of harmony within them (as I did in 'Harmonic Catalogue'). In my more concert-oriented works I want to compose pieces which move away from rigid structures and techniques so that what I have learned in my practice can come forward in a more subconscious manner. It is not that I wish to forget these structures but that I want to trust myself enough to let them come through more intuitively. I want to lay my hands even more gently on the artwork - as Pollock said *"...because a painting has a life of its own, I try to let it live.*[97]*"*

[97] Namuth and Falkenberg, "Jackson Pollock 51."

Bibliography

Burke, Edmund. *The Works of the Right Honourable Edmund Burke, Vol. 03 (of 12).* Project Gutenberg, 2005. <http://www.gutenberg.org/ebooks/15679>

Cage, John. *Diary: How to Improve the World (You Will Only Make Matters Worse).* Recorded June 22-24, 1991. Wergo Germany, 2000, Compact Disc.

Cage, John. "Freeman Etudes : For Violin Solo, I-XVI, for Betty Freeman : New York City 1977-1980." New York: Sole selling agents, C.F. Peters, 1981.

Cage, John, and David Tudor. *Indeterminacy: New Aspect Of Form In Instrumental And Electronic Music / Ninety Stories by John Cage, With Music.* Originally Recorded 1959. Smithsonian/Folkways, 1992, Compact Disc.

Cage, John. *Musicage : Cage Muses on Words, Art, Music.* Edited by Joan Retallack. Hanover, N.H.: University Press of New England, 1996.

Cage, John. *Silence : Lectures and Writings*. Middletown, Conn.: Wesleyan University Press, 1961.

Cage, John. "Variations IV : For Any Number of Players, Any Sounds or Combinations of Sounds Produced by Any Means, With or Without Other Activities." New York: C.F. Peters Corp., 1965.

Cage, John. *Writing for the Second Time Through Finnegans Wake.* Recorded 1979, on *Roaratorio; Laughtears; Writing for the Second Time Through Finnegans Wake.* Mode Records, 2002, Compact Disc.

Couperin, Louis. *Unmeasured Preludes,* in Bauyn Manuscript. Bibliothèque Nationale de France, Musique (F-Pn): Rés. Vm7 674-675, c. 1660. Available: <http://imslp.org/wiki/Bauyn_Manuscript_(Various)>

Dia Art Foundation. "Dia Art Foundation Acquires Dream House by La Monte Young, Marian Zazeela, and Jung Hee Choi." Accessed October 23, 2017. <https://www.diaart.org/about/press/dia-art-foundation-acquires-dream-house-by-la-monte-young-marian-zazeela-and-jung-hee-choi/type/text>

Dubovitsky, Natan, trans. Bill Bowler. "Without Sky." *Bewildering Stories,* 582. <http://www.bewilderingstories.com/issue582/without_sky.html>

Friedman, B. H., ed. *Give My Regards to Eighth Street: Collected Writings of Morton Feldman.* Cambridge, Ma.: Exact Change, 2000.

Bibliography cont'd

Gann, Kyle. "La Monte Young's The Well-Tuned Piano." *Perspectives of New Music*, Vol. 31, No. 1, (Winter 1993) pp. 134-162. doi:10.2307/833045 <http://www.jstor.org/stable/833045>

Gann, Kyle. *Sound and Light: La Monte Young, Marian Zazeela.* Edited by William Duckworth and Richard Fleming. Lewisburg, Pa.: Bucknell University Press, 1996.

Gilmore, Bob. "Horatiu Radulescu: Sound Plasma and Spectral Music." Bob Gilmore: Audio Documentaries. <http://homepages.inf.ed.ac.uk/stg/Bob_Gilmore/downloads.html>

Gilmore, Bob. *James Tenney: Spectrum Pieces,* (Liner Notes 2009).

Gilmore, Bob. "Spectral Techniques in Horatiu Radulescu's Second Piano Sonata." *Tempo*, 64, (2010) pp. 66-78. doi:10.1017/S0040298210000197 <http://www.jstor.org/stable/40794446>

Golden, Devon. "Mark Lombardi, 'Oliver North, Lake Resources of Panama, and the Iran-Contra Operation, ca. 1984–86 (fourth version)' (1999)." BOMB Magazine. Accessed October 23, 2017. <http://bombmagazine.org/article/2587/mark-lombardi>

Gordon, Michael. "Michael Gordon - Industry." From 'Bang On A Can All-Stars'. Original Recording, 1992. YouTube video, 15:29. Posted by "beefwelshington," February 13, 2012. <https://www.youtube.com/watch?v=gujb-wyTy5s>

Griffiths, Paul. *Modern Music and After,* 280. New York: Oxford University Press, 2010. <https://labmus.emac.ufg.br/up/988/o/GRIFFITHS_-_Modern_Music_and_After.pdf>

Grimshaw, Jeremy Neal. *Draw a Straight Line and Follow It : The Music and Mysticism of La Monte Young*. Oxford, Oxon, UK; New York, NY: Oxford University Press, 2011.

Huggett, Nick. "Zeno's Paradoxes." In *The Stanford Encyclopedia of Philosophy* (Winter 2017 Edition), edited by Edward N. Zalta. <https://plato.stanford.edu/entries/paradox-zeno/#AchTor>

Internet Encyclopedia of Philosophy. "Zeno's Paradoxes." Accessed December 3, 2017. <http://www.iep.utm.edu/zeno-par/#SSH3ai>

Johnson, Tom. "Chord Catalogue." Editions 75, 1986. Available: <http://www.editions75.com/FreeScores/TheChordCatalogue.pdf>

Johnson, Tom. "Narayana's Cows." Editions 75, 1989.

Johnson, Tom. *Rational Melodies,* with Dedalus (Musical Group). Recorded October 6, 2008, on New World Records 80705, 2010, Compact Disc.

Bibliography cont'd

Joyce, James. *Ulysses*. Project Gutenberg, 2008. <http://www.gutenberg.org/ebooks/4300>

Kurtág, György. *Játékok,* with György Kurtág and Marta Kurtág, piano. Recorded July 1996, on ECM New Series: ECM 1619 (453 511-2), 1996, Compact Disc.

"La Monte Young - Just Charles & Cello in The Romantic Chord." Accessed February 6, 2013. <http://rootstrata.com/rootblog/?p=588>

Lely, John. "The Harmonics of Real Strings (Anton Lukoszevieze, Cello)." Recorded October 12, 2006. Accessed October 23, 2017. <https://soundcloud.com/john-lely/the-harmonics-of-real-strings-anton-lukoszevieze-2006>

Lomax, John and Ruby. "1939 Southern States Recording Trip." (AFC 1939/001), American Folklife Center, Library of Congress. <https://www.loc.gov/collections/john-and-ruby-lomax/about-this-collection/>

Longton, Michael. *The Things In Between: New Music for Piano,* (Liner Notes 1999).

Lucier, Alvin. *I Am Sitting In A Room: For Voice on Tape,* with Alvin Lucier, speaker. Originally Recorded October 29 and 31, 1980. New York: Lovely Music, 1990, Compact Disc.

Lucier, Alvin. "Music On A Long Thin Wire, part 1/4 (1977)" YouTube video, 18:42. Posted by "architectureaboutdancing," Mar 9, 2013. <https://www.youtube.com/watch?v=SAaXSsoKVQg>

Miles, Stephen. "Notes on Cornelius Cardew." NewMusicNewCollege. <http://www.newmusicnewcollege.org/cardew.html>

Nabokov, Vladimir. "On a Book Entitled "Lolita"." In *Lolita*. New York: Vintage International, 1997.

Namuth, Hans, and Paul Falkenberg (Directors). "Jackson Pollock 51." YouTube Video, 3:52. Posted by "facs1900b," Dec 1, 2006. <https://www.youtube.com/watch?v=CrVE-WQBcYQ>

Obrist, Hans-Ulrich, ed. "Interview with Benjamin H. D. Buchloh, 1986." In *The Daily Practice of Painting: Writings and Interviews, 1962-1993 / Gerhard Richter.* trans. David Britt, 132-66. Cambridge, Massachusetts: MIT Press, 2002.

Paglia, Camille. *Break, Blow, Burn.* New York: Pantheon Books, 2005.

Bibliography cont'd

Partch, Harry. *Genesis of a Music; An Account of a Creative Work, its Roots and its Fulfillments*. New York: Da Capo Press, 1974.

Pisaro, Michael. "Closed Categories (excerpt from Part 1)," From 'Closed Categories in Cartesian Worlds' / Gravity Wave 010. Recorded 2013. Accessed November 2, 2019. <https://soundcloud.com/michael-pisaro/closed-categories-excerpt-from>

Plato. ca. 380 BCE. The Republic. Timaeus. The Academy, Athens - in Present-Day Athens, Greece (in Greek).

Rickey, George, and Donald Judd. "Two Contemporary Artists Comment." *Art Journal 41,* Issue 3 (Autumn 1981): 248-250, doi:10.1080/00043249.1981.10792483.

Rowsome, Leo. "An Chúilfhionn (Leo Rowsome)". Original recording, 1969. YouTube Video, 2:30. Posted by "Eoghan Rua Ó Néill," September 25, 2011. <https://www.youtube.com/watch?v=-4EPTDKT9Gc>

Smith, Johnny, and Group of Convicts. *It Makes a Long Time Man Feel Bad.* Recorded May 23, 1939, Parchman Mississippi, from John and Ruby Lomax, "1939 Southern States Recording Trip," American Folklife Center, Library of Congress. <http://hdl.loc.gov/loc.afc/afcss39.2679b1>

Stevens, Wallace. "Anecdote of a Jar." In *Collected Poems.* Ed. Alfred A. Knopf. New York: Knopf Doubleday Publishing Group, a division of Random House LLC, 1990. Available: <https://www.poetryfoundation.org/poetrymagazine/poems/14575/anecdote-of-the-jar>

Stevens, Wallace. "The Idea of Order at Key West," In *Collected Poems.* Ed. Alfred A. Knopf. New York: Knopf Doubleday Publishing Group, a division of Random House LLC, 1990. Available: <https://www.poetryfoundation.org/poems/43431/the-idea-of-order-at-key-west>

Tenney, James. *A History of :'Consonance' and 'Dissonance'*. New York: Excelsior Music Publishing Co., 1988.

Tenney, James. "Postal pieces 1954-1971." Baltimore, MD: Sonic Art Editions, 1984.

Young, La Monte and Marian Zazeela. *Selected Writings*. ubuclassics, 2004. <http://www.ubu.com/historical/young/young_selected.pdf>