

UC San Diego

UC San Diego Electronic Theses and Dissertations

Title

This is not a Drill: The Siren as a Symbol and Musical Instrument

Permalink

<https://escholarship.org/uc/item/564552p1>

Author

Nestor, Ryan Douglas

Publication Date

2018

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA SAN DIEGO

This is not a Drill: The Siren as a Symbol and Musical Instrument

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Musical Arts

in

Contemporary Music Performance

by

Ryan Douglas Nestor

Committee in Charge:

Professor Steven Schick, Chair
Professor Anthony Burr
Professor Steven Cassedy
Professor Amy Cimini
Professor Lei Liang

2018

Copyright

Ryan Douglas Nestor, 2018

All rights reserved.

The Dissertation of Ryan Douglas Nestor is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

Chair

University of California San Diego

DEDICATION

I would like to thank Professor Steven Schick for his guidance, encouragement, and wisdom over the past six years. I have learned so much from our interactions, conversations, and shared musical experiences and will be forever grateful. I would also like to thank my committee members Professor Anthony Burr, Professor Steven Cassedy, Professor Amy Cimini, and Professor Lei Liang, for their support and insight.

I am appreciative to the creative community of musicians at UCSD and to my supportive colleagues in Red Fish Blue Fish. I have learned so much from each of you and have enjoyed our time together. I am especially thankful to Brian Archinal, Dustin Donahue, Sean Dowgray, and Todd Moellenberg, who have challenged me and developed my musicianship in unique ways which will stay with me forever. A very special thank you to Lydia Winsor Brindamour and Daniel Pesca who proofread the final draft of this dissertation – you are truly generous, brilliant, and wonderful people.

Above all, thank you to my incredibly supportive family for whom I am so grateful. My parents, Barbara and Steven Nestor, my sister, Rachael Halvorson, and my grandparents, Jean and Eugene Miller, have supported me every step of the way. This dissertation is dedicated to them.

EPIGRAPHS

“Often during the scientific, chemical 'cubist' warfare, on nights made terrible by air raids, I have thought of Le sacre.”

Jacques-Émile Blanche

“These Martians did not advance in a body, but in a line, each perhaps a mile and a half from his nearest fellow. They communicated with one another by means of sirenlike howls, running up and down the scale from one note to another.”

The War of the Worlds, H.G. Wells

TABLE OF CONTENTS

Signature Page.....	iii
Dedication.....	iv
Epigraph.....	v
Table of Contents.....	vi
Table of Figures.....	viii
List of Supplemental Videos.....	ix
Vita.....	x
Abstract of the Dissertation.....	xi
Part 1: The Siren as a Symbol and Musical Instrument.....	1
Wave-like Shape.....	1
Scientific Origin.....	1
The Siren as Alert Signal.....	2
The Siren in the Musical Repertory.....	3
The Siren as a Symbol.....	3
The Siren as a Musical Instrument.....	7
Siren-like Sounds.....	12
Mouth Sirens.....	16
Part 2: This is not a Drill.....	19
Sonic Materials.....	20
Video Materials.....	24
Structural Analysis.....	29

Creative Process.....	34
Conclusions.....	37
Bibliography.....	39

LIST OF FIGURES

Figure 1.1:	Wave-like sonic shape.....	1
Figure 1.2:	<i>Dies Irae</i> , the siren roars to a climax.....	7
Figure 1.3:	<i>Ionisation</i> , low siren is followed by high siren.....	9
Figure 1.4:	<i>Ionisation</i> , rapid crescendo followed by the thumb brake.....	9
Figure 1.5:	<i>Triadic Iteration Lattices</i> , siren crescendo.....	11
Figure 1.6:	<i>First Construction</i> , piano notation for siren-like sounds.....	14
Figure 1.7:	<i>The Children</i> , siren-like sounds softly rise and fall.....	15
Figure 1.8:	<i>The Children</i> , siren-like sounds loudly rise and fall.....	15
Figure 1.9:	<i>Persephassa</i> , six mouth sirens enter simultaneously.....	17
Figure 1.10:	<i>Persephassa</i> , mouth sirens stop simultaneously.....	18
Figure 2.1:	Text message alert sent to Hawaiians.....	19
Figure 2.2:	Members of the Royal Air Force demonstrate the gas rattle.....	23
Figure 2.3:	<i>This is not a Drill</i> , materials and architecture.....	24
Figure 2.4:	<i>This is not a Drill</i> , falling bomb footage.....	26
Figure 2.5:	<i>This is not a Drill</i> , a baking soda solution is poured across the body.....	27
Figure 2.6:	<i>This is not a Drill</i> , footage of a spinning ratchet.....	29
Figure 2.7:	Bass drum canon with a wave-like shape.....	31
Figure 2.8:	Augmenting visual waves.....	32
Figure 2.9:	Visual waves subjected to augmentation and diminution.....	33
Figure 2.10:	Edited siren recordings produce a sustained scream.....	34

LIST OF SUPPLEMENTAL VIDEOS

1. nestor_this_is_not_a_drill.mov

VITA

- 2009 Bachelors of Music Degree in Music Education, University of Kentucky
- 2011 Master of Music Degree, Stony Brook University
- 2018 Doctor of Musical Arts Degree, University of California San Diego

ABSTRACT OF THE DISSERTATION

This is not a Drill: The Siren as a Symbol and Musical Instrument

by

Ryan Douglas Nestor

Doctor of Musical Arts in Contemporary Music Performance

University of California San Diego, 2018

Professor Steven Schick, Chair

This dissertation examines the use of the siren in musical works of the past century. Within the musical repertory, the siren always functions symbolically and sometimes also functions as a musical instrument. An exploration of these two functions, their definitions, and relevant musical examples is followed by an analysis and explanation of my multimedia work, *This is not a Drill*.

Part 1: The Siren as a Symbol and Musical Instrument

About a century ago, composers brought the outdoor siren indoors for use in their musical works. Composers were attracted to the siren's association with emergency vehicles, severe weather, and warfare, among other things, which make it powerfully symbolic – when we hear the wail of a siren, we understand it as a *warning*. The unique sound of the siren has also appealed to composers, who made use of its wave-like sonic shape, distinct timbre, and ability to cut across the twelve tones of the Western system. Within the musical repertory, the siren always functions symbolically and sometimes also functions as a musical instrument.

Wave-like Shape

All pneumatic sirens generate a wave-like sonic shape, wherein frequency and decibel levels are inextricably linked. The higher a siren's tone, the louder the sound. The sonic shape of the siren sounds like this: from silence, a soft, low frequency rises smoothly along a continuum until it reaches the apex, where the highest frequency and decibel resound. From there, the frequency tone retraces its path, descending in retrograde towards its silent starting point. The siren's wave-like shape begins and ends always with silence; its apex, maximum frequency and decibel. Like the roller coaster, the siren's wail must always ascend before it descends.



Figure 1.1: A graphical representation of the siren's wave-like shape.

Scientific Origin

Invented and named by Charles de la Tour in 1818, the siren has its origin in the laboratory, where it was used to take measurements of frequency.¹ After discovering that his

¹ "The Acoustic Siren," Smithsonian, accessed February 13, 2018. <http://americanhistory.si.edu/science/sirens.htm>.

instrument functioned equally well beneath water, de la Tour named it Sirène, a reference to the singing Sirens of mythology, who resided always near the sea.² From the very beginning, de la Tour asserted that the unique sound of his Sirène would function well as an alert signal. He later demonstrated the instrument to be an effective warning sound for seafaring ships.³

A few years later, Heinrich Wilhelm Dove invented a siren capable of generating multiple frequency tones simultaneously. His siren was useful for studying interference tones and later assisted in the discovery of binaural beats, an auditory phenomenon where the simultaneous sounding of two similar frequencies causes the listener to perceive a third.⁴ Hermann Helmholtz used two of Dove's sirens to study the phenomenon of interference effects.⁵ Using their sirens, De La Tour, Dove, and Helmholtz greatly advanced the field of acoustics. A common laboratory instrument until the mid 20th century, the siren was eventually rendered obsolete by computer technologies.⁶

The Siren as Alert Signal

It did not take long for the siren's cutting tone and wave-like sonic shape to be repurposed as an alert signal, just as de la Tour once imagined. Since the early 20th century, the outdoor siren has warned large numbers of people during emergency situations. Sirens range in size from portable, hand-held models to enormous, tower-mounted units and have overtime acquired numerous use-specific names such as fire siren, tornado siren, air raid siren, police siren, missile siren, among many others. The siren keeps us out of the path of the speeding fire

² Ibid.

³ Ibid.

⁴ Ibid.

⁵ Ibid.

⁶ Ibid.

engine, moves us to shelter during inclement weather, and during war offers a simple message: attack imminent, seek shelter.

The siren's wave-like sonic shape is critical to its effectiveness as an alert signal. Not only is it easily identifiable, it also sweeps the frequency spectrum from low to high and back again, searching for penetrable gaps in the soundfield, thereby ensuring that the siren will be heard even in the noisiest of locations.

The Siren in the Musical Repertory

The Siren as a Symbol

The siren's historical association with fire and police vehicles, tornado sightings and other instances of severe weather, as well as the murderous air raids of the First and Second World Wars, means that the siren's wail is not only piercingly loud, it has emotional weight.

Within a musical work, where the siren functions as a symbol, it is performed at maximum volume, as though it were functioning outdoors in its natural setting. In these instances, little or no effort is made to integrate the siren into the music. The siren is borrowed – symbolism and all – from its outdoor setting and relocated directly to the concert hall. When the siren is used as a symbol, it is employed no more than a few times over the course of the work. This ensures that its sound will be unexpected and jarring, just as it is in the real world.

Many examples of the siren's function as a symbol can be found in repertoire from the early 20th century. In the 1917 ballet *Parade*, which had a musical score composed by Erik Satie, Jean Cocteau, one of Satie's collaborators, advocated for the addition of noises, including typewriter, aeroplane engine, pistol shot, and others, which he felt "helped to portray the feverish

insanity of contemporary life.”⁷ The ballet’s premiere performance was met with controversy. The pistol shot and sirens were, in particular, controversial, given that Europe had for several years been embroiled in the First World War. Just outside the theater walls, firearms and sirens had very real consequences.⁸

During the interwar years of the 1920s, composers utilized the siren’s symbolic function. Sergei Prokofiev harnessed the symbolic power of the siren in his *Cantata for the 20th Anniversary of the October Revolution*. During *Revolution*, the sixth movement of the piece, a cacophony of machine gun fire, a wailing siren, and recordings of marching soldiers and the voice of Lenin pummel the orchestra and listener, alike. As a result, here, the siren, which is not heard at any other point in the piece, embodies the spirit of the revolution.

Arseny Avraamov similarly celebrated the October Revolution with his outdoor spectacle, *Symphony of Sirens* (1922). His piece incorporated thousands of performers along with, among others, the sounds of sirens, foghorns, naval artillery and machine gun fire, hydroplanes, marching infantry regiments, and a ‘steam whistle machine’ built especially for the performance.⁹ Affixed to and powered by a steam locomotive, the steam whistle machine consisted of an array of tuned whistles that could play *The Internationale*, a song synonymous with the revolution.¹⁰

Interestingly, though today commonly known as *Symphony of Sirens*, the title is actually a misnomer. In fact, Avraamov intended for the title to reflect his steam whistle machine, not

⁷ Jean Cocteau, *A Call to Order*, trans. Rollo H. Myers (New York: Henry Holt and Company, 1974), 54.

⁸ Potter, 76.

⁹ “Symphony of Sirens,” Monoskop online, last modified August 2, 2015.

https://monoskop.org/Symphony_of_Sirens#1._Arseny_Avraamov_.E2.80.93_Symphony_of_Sirens.

¹⁰ Ibid.

sirens. Using the Russian term for whistle (gudki), Avraamov called his piece *Sinfonia Gudki*, or in english, *Symphony of Whistles*. The misnamed title may be a result of Avraamov himself, who somewhat confusingly used the terms for whistle and siren (sireny) interchangeably in his writings.¹¹

Symphony of Sirens is interesting in that it does not precisely fit into any single category discussed in this dissertation. While the multitude of noises used in *Symphony of Sirens* had clear symbolic functions, making the piece appropriate for discussion here, it seems clear, too, that the specific arrangements of noises as well as the piece's deep connection to the Futurist movement, whose affinity for noises is well documented, demonstrates a level of complexity deeper than mere symbolism. Near the midpoint of the piece, Avraamov instructed that a "triple chord of the sirens will be accompanied by a 'Hurrah' from the docks."¹² Assuming that the sirens referred to here mean actual sirens and not whistles, Avraamov was considering the siren for its sonic potential, not simply for its symbolic qualities. The harmony generated by the 'triple chord' of sirens nearly qualifies for discussion in 'the siren as a musical instrument,' the next section of this document, but given that the triple siren moment is brief and that the other instances of the siren are characteristically symbolic, *Symphony of Sirens* is best placed in this section with the acknowledgment that it is a difficult work to categorize.

In the United States, composers incorporated the siren for its symbolic function, too. Although George Antheil later removed it, his original conception of *Ballet Mécanique* (1924) utilized a siren, along with airplane propellers and electric factory fire bells.¹³ The score includes

¹¹ Miguel Molina Alarcón, *Sound Experiments in the Russian Avant Garde* (London: ReR Megacorp, 2008), 71.

¹² "Symphony of Sirens," Monoskop online, last modified August 2, 2015.

https://monoskop.org/Symphony_of_Sirens#1._Arseny_Avraamov_.E2.80.93_Symphony_of_Sirens.

¹³ Paul D. Lehrman, "About the Ballet Mécanique" last modified 2003. <http://www.antheil.org/balletmec.html>.

no dynamic markings and the music notation for the siren part indicates only durations. Given the intense noises of the airplane propellers and fire bells – both outdoor sounds – the siren is meant to produce sound as though it too were operating outdoors.

The idea of *Ballet Mécanique*, as Antheil once wrote, was “to warn the age in which I was living of the simultaneous beauty and danger of its own unconscious mechanistic philosophy, aesthetic.”¹⁴ He wrote, also, that the *Ballet Mécanique* was perhaps a “signal of these troubled and war-potential 1924 times...”¹⁵ What better sound to symbolize interwar tensions than that of the siren? For Antheil, even the title was symbolic of the times. “The words ‘*Ballet Mécanique*,’” wrote Antheil, were “... symbolic of the spiritual exhaustion, the superatheltic, non-sentimental period commencing ‘The Long Armistice.’”¹⁶

Krzysztof Penderecki’s *Dies Irae* (1967) provides a later example of the siren’s function as a symbol. The three movement oratorio was given its premiere performance on the Auschwitz grounds and dedicated to the victims who perished there. The siren is heard only briefly during the final measure of *Apocalypse*, the second movement. The climatic ending is replete with dissonant tones, extended techniques, and a large array of percussion instruments, all of which combine to produce a powerful orchestral crescendo. At the peak of this crescendo, a siren roars to life, eclipsing the sound mass and bringing the movement to its end. In a work fundamentally about the victims of the Holocaust, the siren’s wail serves as a warning against the atrocities of genocide and the tyrannical figures who enable it.

¹⁴ George Antheil, *Bad Boy of Music* (Garden City: Doubleday, 1945; reprint, Samuel French Edition, 1990), 139.

¹⁵ *Ibid.*, 140.

¹⁶ *Ibid.*, 140.

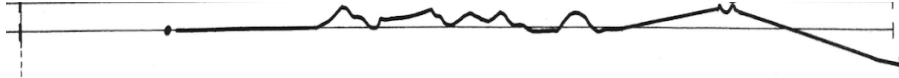


Figure 1.2: Siren notation in *Dies Irae*. The siren roars to a climax and then quickly dissipates.

Unlike the previous examples, which used minimal music notation or none at all, the siren music in *Dies Irae* is notated graphically with a single line that rises and falls to create a series of wave-like shapes. Completely devoid of durational and dynamic information, Penderecki's graphic notation appears to be descriptive rather than prescriptive, a sort of visual representation of how the siren might sound during a performance, allowing the performer some interpretive freedom. In fact, Penderecki used the same graphic notation for the thunder sheet part, which is shaken faster or slower in relation to the rising and falling shapes. Though the graphic notation is unique, the loud, interruptive sound of the siren is consistent with that of a symbolically functioning siren.

The Siren as a Musical Instrument

In pieces where the siren functions as a musical instrument, its sonic characteristics, such as its timbre, ability to cut across the twelve tones of the Western musical scale, and wave-like sonic shape, are critical to the work as a whole. However, even when the siren is used as a musical instrument, it continues to function as a symbol of warning. Though its symbolic strength may not be as potent, the sonic tone and contour of the siren prevent its real world associations from disappearing entirely.

Edgard Varèse was the first composer to employ the siren not only for its symbolic function but as a musical instrument, as well. While rehearsing his piece *Hyperprism* in 1923, a passing firetruck and its siren interrupted the rehearsal. Varèse was enraptured by the siren's

sound, and later that year, revised *Hyperprism* to include a siren. The story is recounted in Robin Maconi's book *The Second Sense: Music Language and Hearing*.

Rushing to the window, he leaned out and listened intently. Then, turning back to the musicians, he announced, "The rehearsal is over; I'll call you soon." Without waiting for them to pack up their instruments and leave, he clapped on his hat and coat, and dashed out the door and off through the streets to the nearest fire station. There he announced flatly to an astonished fireman, "You must lend me one of yours sirens for a concert."¹⁷

Ultimately, Varèse composed five pieces which included one or more sirens: *Amériques*, *Hyperprism*, *Ionisation*, and *Tuning Up*.

Varèse's 1931 masterpiece, *Ionisation*, is an ideal example of the siren's function as a musical instrument. The sirens in *Ionisation* are utilized extensively and provide sonic and structural meaning – they are a critical element of the composition. In the preface to the *Ionisation* score, Varèse provided a note to specify exactly what type of siren was needed for a performance of *Ionisation*. No composer had ever been so detailed about the specifications for a siren.

Sterling Type H (part No. 73 PU. PB), operated by hand, with a button for instantaneous stopping, (thumb brake). If unobtainable, substitute Theremin's electric instruments, or any similar instruments (see special score) Mouth sirens not to be used.¹⁸

By the time of *Ionisation*, electrified sirens had been around for more than fifteen years.¹⁹ In this context, Varèse's directive that the siren should be "operated by hand" underscores the role of human performance of the siren – it is a musical instrument, not a machine.

¹⁷ Robin Maconie, *The Second Sense: Language, Music, and Hearing* (Plymouth: The Scarecrow Press, Inc.), 231.

¹⁸ Edgard Varèse, *Ionisation*, New York: Ricordi & Co., 1958.

¹⁹ Thomas Derdak and Kepos Paula, eds., *International Directory of Company Histories, Volume 10* (Chicago: St. James Press, 1995.), 295.

Two of the players in *Ionisation* are assigned sirens. Player 5 uses a small, high pitched siren while Player 6 uses a large, low pitched siren. In most instances, the two sirens function as a single entity, wherein the high siren extends the range of the low siren. The high siren is always an addition to the low siren's sound. With one exception, the low siren begins before and ends after the high siren. In effect, the two sirens are utilized as a single, meta-siren.

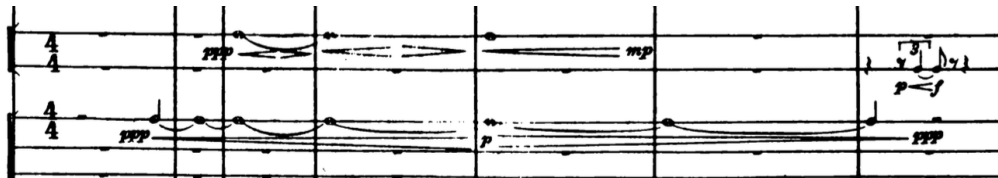


Figure 1.3: *Ionisation*, mm. 1-7. Low siren is followed by the high siren.

Most of the siren music in *Ionisation* is subdued. Soft, nuanced swells rise and fall throughout the short composition. In fact, the only moment the two sirens simultaneously reach peak volume is at measure 71. Both sirens reach fortissimo, the loudest marked dynamic, and then are immediately silenced. The cessation of sound can be quickly accomplished with the ‘thumb brake’ specified in Varèse’s prefatory note. Today, many sirens do not have a thumb brake. To compensate, percussionists have used towels, sound proof boxes, and other similar things to quickly eliminate the siren’s sound.

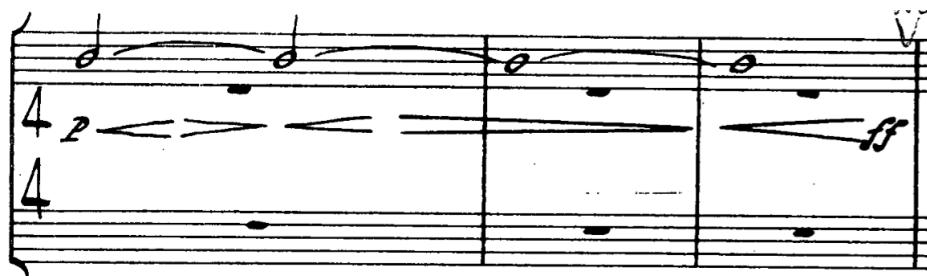


Figure 1.4: *Ionisation*, mm. 69-71. Two soft dynamic swells are followed by a rapid crescendo to fortissimo. A thumb brake should be used to immediately quell the sound.

The siren notation is simple and consistent, denoting only dynamics ranging from *pppp* to *ff*. Crescendo and decrescendo markings are notated between all dynamic markings. Durations are specified with standard rhythmic values on a five-line staff. The notation, like the dynamic gestures and layered use of the two sirens, clearly demonstrates a level of compositional detail unlike that seen in works where the composer utilized the siren for only its symbolic function.

Several of the composer John Luther Adams' works feature one or more sirens: the percussion solo *The Mathematics of Resonant Bodies*, the percussion quartet *Strange and Sacred Noise*, and the outdoor work *Inuksuit*.

Each of the six movements that comprise *Strange and Sacred Noise* (1997) has a distinct timbral identity and formal construction. *Triadic Iteration Lattices*, the fourth movement, requires an instrumentation of four identical sirens to ensure that unison frequency tones are created at moments of convergence.²⁰

Triadic Iteration Lattices is a good example of the siren's function as a musical instrument. Over the course of the piece, the four sirens create a sonic representation of the fractal inspired form. Luther Adams achieves this through the use of strict compositional processes that govern dynamics and rhythmic durations. Five dynamic levels are indicated over the course the piece: pianissimo, mezzo piano, mezzo forte, forte, and fortissimo. The sequence of the dynamic levels is fixed. For example, before a dynamic of mezzo forte can be reached, the siren must first traverse the two softer dynamic levels. Clearly, the dynamic process is derived from the inherent functionality of the siren, which rises and falls along a continuum.

²⁰ John Luther Adams, *Strange and Sacred Noise*, Fairbanks: Taiga Press, 1997.

Additionally, dynamic levels change at two measure intervals, never more or less. Stretching across the two measures, crescendo and decrescendo markings ensure that changes in sound are consistent. Here, the piece's dynamic contours mirror the siren's rising and falling sonic shape.

Nine levels of pitch are indicated across the lines and spaces of a traditional, five-line staff. The siren's lowest pitch is indicated on the bottom line, the highest pitch, the top line. Changes in pitch occur at one measure intervals. While the pitches are relative, the nine notated points of pitch help performers evenly and smoothly traverse the entirety of the siren's frequency spectrum.

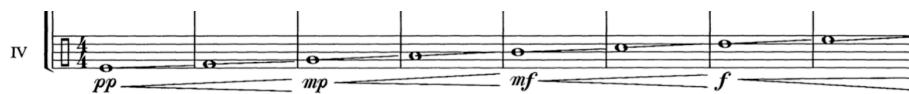


Figure 1.5: Siren music from *Triadic Iteration Lattices*, mm. 1-8.

Over the course of the piece, sirens are heard individually, in pairs, trios, and as a quartet. At the most complex points in the piece, rising and falling glisandi collectively produce an enveloping sound mass of incredible volume.

Luther Adams has long been an environmental activist. His deep appreciation and concern for the natural world are strongly imbued in his musical work. In fact, performances of this work are sometimes staged outdoors, which, interestingly, returns the siren to its outdoor origin while retaining its use as a musical instrument.

Steve Reich's *Different Trains* (1988) is a work for string quartet and tape which includes fragments of spoken text, train bells and whistles, and sirens. The second section of the piece, *Europe—During the war*, features the continuous sound of sirens along with speech fragments from three Holocaust survivors.

The sirens have two important functions. The first function is symbolic. The sirens represent the Second World War, and more specifically, the suffering caused by the countless air raids. The two sirens used in the tape also have a distinct function as a musical instrument. The first siren is placed in the right audio channel, the second, in the left audio channel. The two sirens function independently of each other, producing separate wave-like shapes and varying frequency tones. Often, one siren is louder than the other, creating a spatial foreground and background. The effect is similar to how one would have experienced the multitude of air raid sirens, some close, others far, their sweeping tones rising and falling past each other. The sirens, furthermore, have an important harmonic function. The root of each harmony is determined by the tone at the siren's apex. Therefore, the string quartet and sirens modulate simultaneously, creating, in effect, a single musical instrument comprised of the two components.

'Siren-like Sounds'

Just after composers began experimenting with the outdoor siren, others began creating musical gestures which imitated the sound of the siren instead of using a physical device. These gestures, which John Cage referred to as "siren-like sounds," feature the characteristic wave-like shape of the siren and often mimic its timbre and repetitiveness.

In John Cage's *First Construction (in metal)* (1939), siren-like sounds are made with a metal rod which is drawn across the strings of the piano as well as with a water gong, which is raised and lowered into a bucket of water. In the prefatory note to the *First Construction*, Cage provided this comment:

The assistant applies a metal rod firmly on the strings... slow slides of the rod away from or toward the center of the string's length, producing, respectively, ascending and descending siren-like sounds.²¹

²¹ John Cage, *First Construction (in metal)*, New York: Henmar Press / C.F. Peters, 1962.

The following year, Cage used the same terminology in the *Second Construction* (1940). The performer “produces a siren-like sound, through the use of a metal cylinder which slides along the strings.”²² The primary way in which John Cage mimics the sound of the siren is through the use of glissandi. In both works, the metal implement slides across the strings, evoking a saturation of harmonic rich tones and a rising and falling pattern similar to the siren.

In addition to the siren-like sound of the piano strings, the pitch of the water gong rises and falls as it is submerged in, and withdrawn from, the water, creating a glissando effect similar to that of a siren.

Siren-like sounds are not bound by the mechanics of the pneumatic siren. For example, the pneumatic siren must always ascend in pitch before descending and will always (except when stopped with a thumb brake) produce the full wave-like shape. In *First Construction*, siren-like shapes ascend and descend freely, oftentimes descending before rising, thereby creating sounds reminiscent of the siren but which do not adhere to the characteristic wave-like shape.

In addition, dynamics are not bound to frequency, as they are with the pneumatic siren. A siren-like sound does not necessarily begin with a soft, low tone. On the contrary, high frequencies may begin softly, low frequencies, loudly. In this piece, dynamics are determined not by pitch but by how forcefully the piano keys are depressed. Therefore, dynamics function independently of the wave-like sonic shape.

²² John Cage, *Second Construction*, New York: Henmar Press / C.F. Peters, 1978.

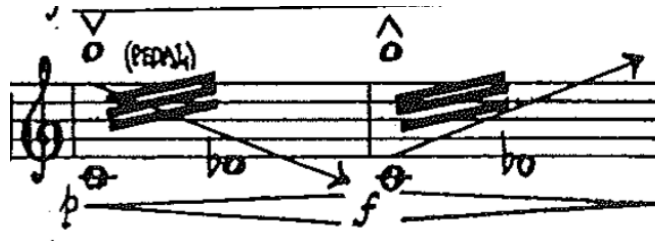


Figure 1.6: Piano notation for siren-like sounds in *First Construction*. Arrows show the direction of the pitch.

Cage's notation system for siren-like sounds uses durational rhythmic values, dynamic markings, and arrows that point upwards and downwards. The above figure shows the first two measures of a siren-like sound produced by sliding a metal rod across the piano strings. Cage used the same notational conventions for the water gong.

Siren-like sounds are woven into Benjamin Britten's *The Children*, from his song cycle for piano and tenor, *Who are These Children?* (1969). This cycle features settings of twelve poems by William Soutar, several of which contain dismal subject matter. In particular, Soutar's "The Children" recounts the devastating effects of an air raid which resulted in children losing their lives.

Recalling the wail of London's World War Two air raid sirens, Britten set Soutar's bleak prose to a piano accompaniment of siren-like sounds. The siren-like sound of the piano is far different from those previously discussed. Britten's siren-like sound utilizes neither glissandi nor dynamic swells. Instead, a simple pattern of two minor triads, separated by an interval of a tritone are connected, one after another, with ascending or descending gracenotes.



Figure 1.7: Siren-like sounds rise and fall in *The Children*.²³

The wave-like shape is constructed with the two triads. The low triad demarcates the low point of the shape, the higher triad, the top of the wave. As the grace notes ascend and descend, a glissando-like effect is created. The wave-like shape unfolds over three quarter notes of time. Beginning with the lower of the two dyads, gracenotes ascend in pitch towards the higher dyad. From there, descending grace notes lead back down to the lower dyad, the third quarter note.

A second, more complex siren-like sound occurs later in the piece. Though the notes are different, two minor triads, separated by a tritone, are once again used. In place of the grace notes, however, are sixteenth note triplets which rise in fall by intervals of minor thirds. This siren-like sound is more intense and is played at a dynamic of forte. However, like the other, this siren-like sound is performed without the dynamic swells characteristic of the pneumatic siren.



Figure 1.8: Siren-like sounds rise and fall as triplets.

²³ Benjamin Britten, *The Children*, London: Faber Music, 1997, ©1972.

While the song's pattern of rising and falling triads is a clear reference to the siren's shape, the absence of glissandi and readily apparent dynamic waves make Britten's siren-like sounds more abstract than those previously discussed.

Mouth Sirens

First produced in 1895 by J. Hudson & Co., today known as Acme Whistles of Canada, the mouth siren is a small, whistle-like device that when blown, produces the same wave-like shape as the siren. The Acme mouth siren was originally marketed to bicyclists as an alert signal and was later referred to as 'the cyclist's road clearer.'²⁴

The faster one blows into the mouth siren, the higher the pitch rises, thereby creating a wave-like shape. Besides this similarity, however, the mouth siren is far different from the sirens previously discussed. A fraction of the size of the outdoor siren, the mouth siren produces a small, tinny sound. While perhaps effective as a warning sound in small, localized areas, the sound is limited and produces an effect far from that of the outdoor siren. Though originally marketed as an alert signal, the mouth siren has completely lost its identity as such and is today associated with vaudevillian humor, cartoons, and musical theater.

While the mouth siren is often used as a humorous sound effect in classical music, the composer Iannis Xenakis used it in a purposeful and serious way in several of his works, including *Oresteia*, *Terretektorh*, and the percussion sextet *Persephassa*.

In *Persephassa*, the mouth siren allows the percussionist to produce the sound of the siren while continuing to hold sticks and strike the appropriate percussion instruments. Players often wear the siren on a string around their necks so that it can be accessed quickly. The first

²⁴ "Acme Whistles," Acme Whistles of Canada, accessed February 14, 2018. <http://acmewhistles.ca/history/>.

entrance of the mouth sirens is particularly cacophonous, as each percussionist performs music at a specific tempo. At the cue of player 1, with the percussive music continuing, all six players begin blowing into their mouth siren. The glissando of sound crescendos to a climax and suddenly stops.



Figure 1.9: First entrance of the mouth sirens in *Persephassa*.

The mouth sirens are used at several points during the second half of *Persephassa*. Near the end of the piece, when the percussive vortex reaches its maximum velocity, the six mouth sirens resound for a final time. A crescendo develops over ten measures until the final climax is reached. At this point, Xenakis notes in the score that the sirens should be “brutally” stopped to allow for two bars of silence.²⁵

The mouth siren is something of an outlier. Difficult to place, though clearly worth discussion, the mouth siren’s petite sound and relative lack of power, place it in a category of its own.

²⁵ Iannis Xenakis, *Persephassa*, Paris: Éditions Salabert, 1970.



Figure 1.10: Sirens are simultaneously stopped to create a silence in *Persephassa*.

Though the siren has been incorporated into musical works for over a century, it has not been assimilated to any significant degree. This is in contrast to the drum, for instance, which though having outdoor, military origins, has entirely been integrated into the musical ensemble. The siren, perhaps, remains too ubiquitous in society. Its sound too relevant to our everyday experiences. In an age when school shootings, violent crime, and terror attacks plague the world – events accompanied by the siren’s wail – it is no surprise that assimilation has not occurred. This idea along with my research on the siren and its functions inspired the creation of my multimedia work *This is not a Drill*.

Part 2: *This is not a Drill*



Figure 2.1: Text message alert sent to Hawaiians on January 13, 2018.²⁶

On January 13, 2018, this emergency alert was sent by the Hawaii Emergency Management Agency to cellular devices across the Hawaiian Islands. A North Korean missile would reach the Hawaiian Islands in approximately twenty minutes.²⁷ During that time, fear and confusion swept Hawaii. Thirty-eight minutes later, a second text message was transmitted declaring the missile threat a false alarm.²⁸

In the months preceding this incident, nuclear tensions between North Korea and the United States had escalated. In response, officials in Hawaii enacted precautionary measures including a “nuclear preparedness campaign.” One tenet of the campaign was to reinstate regular testing of the Island’s Cold War era “attack warning sirens,” which had not sounded in decades.²⁹ The recent nuclear provocations between North Korea and the United States, the revitalization of

²⁶ “Ballistic Missile Threat Inbound to Hawaii...This is Not a Drill,” Common Dreams, last modified January 13, 2018.

²⁷ Doug Chris, “For the first time since the end of the Cold War, Hawaii will test nuclear sirens,” *CNN* online, last modified December 1, 2017. <https://www.cnn.com/2017/11/28/us/hawaii-nuclear-warning-trnd/index.html>.

²⁸ “‘This Is Not A Drill’: A False Ballistic Missile Alert Shakes Hawaii,” *NPR*, last modified January 13, 2018, <https://www.npr.org/sections/thetwo-way/2018/01/13/577871075/this-is-not-a-drill-a-false-ballistic-missile-alert-shakes-hawaii>.

²⁹ Heidi Chang, “Hawaii reinstates ‘attack warning’ siren to prepare for possible North Korean missile,” *NBC* online, last modified November 26, 2017.

<https://www.nbcnews.com/news/asian-america/hawaii-reinstates-attack-warning-siren-prepare-possible-north-korea-n-missile-n823821>.

Cold War era sirens and precautions, as well as the recent chemical weapons attacks in Syria, imbued my work with a sense of urgency.³⁰

This is not a Drill incorporates original music with footage from United States civil defense films and a 1960s nuclear bomb test. It has a runtime of 22:30 and was screened for the first time on April 11, 2018 as part of SD Soundings, in the University Art Gallery on the campus of UC San Diego. *This is not a Drill* was created primarily with the applications Reaper and iMovie; Audacity and Final Cut were utilized minimally.

This is not a Drill was an attempt to connect my work as a contemporary musician with my research on the siren and its functions in the musical repertory. The following program note was provided at the first screening.

At a time of heightened nuclear rhetoric and provocations, anxieties of the Cold War are reemerging. After decades of silence, the sirens are again sounding. This multimedia work, like the siren, recalls an ominous past while warning against the dangers of the present.

Sonic Materials

The musical score to *This is not a Drill* was created with four pre-recorded sounds:

Emergency Alert System, ratchet, bass drum, and siren.

Emergency Alert System

The jarring noise of the Emergency Alert System (EAS) was implemented in 1997 by the government of the United States as a way for the President to quickly communicate with the citizenry during national emergencies. While that is its primary purpose, the EAS is commonly

³⁰ “Syria ‘chemical attack’: Russia warns US against military action,” BBC online, last modified April 11, 2018. <http://www.bbc.com/news/world-middle-east-43721057>

used by state and local officials to circulate severe weather information, AMBER alerts, and other critical information.³¹

The Emergency Alert System has a specific form: “digitally encoded header, attention signal, audio announcement and digitally encoded end-of-message marker.”³² The attention signal consists of three, brash noise-tones followed by a high frequency, similar to a dial tone. The attention signal is the only portion of the EAS utilized in *This is not a Drill*. To avoid confusion, I refer to the ‘attention signal’ generally as ‘Emergency Alert System’ or ‘EAS’.

Ratchet

Although, the ratchet is commonly associated with sound effects, sporting events, and child’s play, its history as a warning device is less well-known. For hundreds of years, the ratchet was used as an alert signal by guards and police. In the mid-17th century, Peter Stuyvesant, the director-general of New Netherland, dispatched overnight patrols to protect the city from looters and vagrants. These patrols were referred to as the ‘Rattle Watch,’ since they carried with them wooden ratchets to sound the alarm.³³

British police officers carried ratchets through the mid-19th century. In addition to functioning as alert signals, their ratchets were oftentimes weighted with lead ingots, so that they could be used as blunt weapons.³⁴ During the mid-19th century, the whistle was discovered to be more effective than the ratchet over long distances, rendering the ratchet obsolete, at least for a

³¹“Emergency Alert System,” FEMA, accessed April 2, 2018. https://www.fema.gov/media-library-data/1465326763240-4152791226bbd49cf46aff8cd5f43bb1/Emergency_Alert_System_Fact_Sheet_2016.pdf.

³² Ibid.

³³ David Zvi Kalman, “The Strange and Violent History of the Ordinary Grogger” last modified March 20, 2016. <https://forward.com/culture/335491/the-strange-and-violent-history-of-the-ordinary-grogger/>.

³⁴ Ibid.

time.³⁵ During the First World War, the ratchet was used by British and American soldiers as an alert signal for poison gas attacks. The whistle was not a practical choice, since the soldiers had to wear protective gas mask.³⁶ Today, the ratchet has totally shed its identity as an alert signal. No longer do we associate the rattle with the roaming patrols of city watchmen, police emergencies, or gas attacks at the Somme.

The ratchet recorded for use in *This is not a Drill* was a small, wooden variety common amongst percussionists. Like the siren, the ratchet's sound fluctuates in relation to the speed of the handle, the faster it is cycled, the more frenzied the sound. The recording made for *This is not a Drill* features the brazen sound of a ratchet operating at a high rate of speed. The recording features a brazen ratchet cycling at a high rate of speed. In *This is not a Drill*, the ratchet sounds nearly always in polyphony with the noise-tones of the Emergency Alert System. The combination of the ratchet and EAS is primarily symbolic in that an alert signal of the present – the EAS – is linked with one from the past.

³⁵ Edward Steenberg, "Police Rattles & Whistles," Accessed April 4, 2018. <http://www.spphs.com/history/whistles/index.php>.

³⁶ Ibid.



Figure 2.2: Members of the Royal Air Force demonstrate the gas rattle during the Second World War.³⁷

Bass Drum

For thousands of years, on battlefields around the world, drums were used for regulating the march, communication, and intimidating enemy forces.³⁸

The bass drum recordings were used for both sonic and symbolic reasons. Two contrasting bass drum recordings were used in *This is not a Drill*. The first features a simple, sustained roll at a soft dynamic level. The persistent, low frequencies of the drum roll provide solidity and contrast to the abrasive noise of the ratchet and EAS polyphony. The second recording is of a sustained roll which gradually crescendos and decrescendos, imitating the wave-like sonic shape of a siren. The bass drum music is typically soft and sustained and devoid of any of the rhythmic tropes which might be associated with military music.

³⁷ Kalman.

³⁸ William R. Trotter, "The Music of War" last modified June 12, 2006.
<http://www.historynet.com/the-music-of-war.htm>

Siren

As discussed in detail previously, the siren’s penetrating power and capacity to sweep a large section of the frequency spectrum have made it a highly effective warning signal. Closely associated with emergency vehicles, severe weather, and warfare, the siren has for over a century been used during emergency situations.

The siren used for *This is not a Drill* was a small, hand-operated model of a common variety capable of producing sustained, loud tones. Several recordings were made especially for *This is not a Drill*. One recording features a flat, static tone with minimal changes to frequency and decibel, while the other features the characteristic wave-like shape. The recordings were subjected to forms of editing such as pitch modulation, cropping, and splicing. Additionally, multiple copies of a single recording were generated in order to create canonical forms. In many cases, and particularly in the final minutes, the beginnings and endings of the recordings were cropped so that only a static, high pitched tone is audible.

Video Materials

Extracts from two civil defense films and footage from a hydrogen bomb test were used in the creation of *This is not a Drill*. Each section of the work incorporates footage from only a single film source.

Section 1	Section 2	Section 3
<i>What to do in a Gas Attack</i> (1942)	<i>Let's Face It</i> (1954)	<i>Housatonic test footage</i> (1962)
EAS, Ratchet, Bass Drum	Bass Drums	Sirens

Figure 2.3: Materials and architecture of *This is not a Drill*.

“What to do in a Gas Attack”

The civil defense film, “What to do in a Gas Attack,” was produced in 1942 by the Clorox Chemical Company, during the early years of the Second World War. The didactic film provides information about how best to shelter against gas attacks and treat victims of gas exposure. The film furthermore provides demonstrations of objects that may be used as alert signals, in the event of a gas attack. The demonstrated objects include a spinning ratchet, resonant metal bowl struck with a hammer, and a traditional emergency siren.

Footage of these alert signals was excerpted and used throughout the first section of *This is not a Drill*. The most prominent visual is the spinning ratchet. In the original 1942 film, the spinning ratchet appears on the screen for only a few seconds. This short clip was repeated numerous times for *This is not a Drill* to create a visual loop, analogous to the cyclical nature – and sound – of a spinning ratchet.

Another important sequence excerpted from “What to do in a Gas Attack” shows poison gas bombs being dropped from an aircraft.



Figure 2.4: Falling bomb footage from section 1.

In *This is not a Drill*, the sequence is shown several times and is always followed by footage showing responses to the effects of poison gas. These include:

- 1.) The mixing of a baking soda solution in a pitcher.
- 2.) A man washing out his eye with the baking soda solution.
- 3.) A close up shot of the baking soda solution being poured into a man's eye.
- 4.) A man showering and pouring the baking soda solution over his head and chest.
- 5.) Men in protective rubber suits sweeping and sanitizing the street.



Figure 2.5: A baking soda solution is poured across the body to combat the effects of poison gas. This footage appears at the end of section 1.

“Let’s Face It”

The 1954 civil defense film, “Let’s Face It,” provides information about how to shelter against a nuclear attack. A small amount of footage from this Cold War era film was used in the second section of *This is not a Drill*.

In marked contrast to the the spinning ratchets, falling bombs, and the other high energy images featured in the first section, the footage excerpted from “Let’s Face It” contains low energy imagery that shows only slow moving and static subjects. During the second section, a sequence of slowly rotating and station sirens is followed by children assuming the duck and cover position.

“Housatonic Test Footage”

Footage from a 1962 hydrogen bomb test codenamed Housatonic, was used in the third section of *This is not a Drill*. Detonated in the atmosphere at 12,130 feet high above a military

test site in the Pacific Ocean, the Housatonic bomb had an explosive yield of 8.3 megatons, about 550 times more powerful than the atomic bomb dropped on Hiroshima.³⁹

Housatonic was one of 210 atmospheric nuclear tests conducted by the United States between 1945 and the early 1960s. These tests were filmed with up to fifty sophisticated, high speed cameras which, in some cases, shot at around 2,400 frames per second. The incredible amount of footage allowed scientists to study the explosive effects in slow motion from every conceivable angle.⁴⁰ The films are silent and were shot in both black and white as well as color.

Several years ago, scientists at Lawrence Livermore National Laboratory (LLNL) discovered inaccuracies in the data collected from these atmospheric tests, so they reexamined the original footage. Over a five year period, LLNL scientists tracked down about 6,500 of the estimated 10,000 test films. At the time of this writing, over 4,200 of these films have been digitized, 20% of which have been reanalysis. Only 750 of the films, however, have been declassified by the United States government. Once a film has been digitized and obtained the necessary, declassified status, LLNL uploads it directly to YouTube for public consumption.

The Housatonic footage used in *This is not a Drill* was captured at around 2,400 frames per second. When this footage is viewed at the standard twenty four frames per second, it takes nearly two minutes to see what in reality, occurred in a second's time. The seven minute Housatonic film, by the same calculation, indicates that the entire explosive event was only a few seconds in length.

³⁹ Thomas B. Cochran and Robert S. Norris, "Nuclear Weapon" last modified April 20, 2018. <https://www.britannica.com/technology/nuclear-weapon#ref988610>.

⁴⁰ "Physicist declassifies rescued nuclear test films," Lawrence Livermore National Laboratory, Last modified March 14, 2017, <https://www.llnl.gov/news/physicist-declassifies-rescued-nuclear-test-films>.

Structural Analysis

Section 1

The final section is short and abrasive. At only five minutes in length, section 1 is the shortest of the three sections. Recording of the Emergency Alert System, wooden ratchet, and bass drum accompany excerpts from the civil defense film “What to do in a Gas Attack.”

This is not a Drill begins with a black screen and two iterations of the polyphonic sounds of the EAS and ratchet. Following this, the footage of the spinning ratchet appears for the first time and is accompanied by the soft sound of a bass drum roll. Over the next several minutes, the ratchet footage is several times interrupted by bursts of the EAS / ratchet combination and black screen. Each successive segment of ratchet footage is proportionally shorter than the one before. This process of durational diminution generates momentum until finally, the shortest segment – and fastest speed – is reached.



Figure 2.6: Footage of a spinning ratchet is repeated numerous times during section 1.

The last forty seconds of the section features a frenetic sequence of film clips, some no longer than a 1/10 of a second, and bursts of noise from the EAS and ratchet. As fragmentary as this section is, the high pitched EAS tone provides a sense of form. Each time the EAS tone sounds, the falling bomb footage is followed immediately by a reactionary measure or treatment to the poisonous gas.

Section 2

In the second section, wave-like shapes manifest sonically and visually. The wave-like shape is heard in the dynamic swells of the bass drum, modeled in the structure of a density canon, and visually experienced, through a process of durational augmentation and diminution. The sonic and visual materials used in section 2 are markedly different from those of section 1. The noisy EAS polyphony is gone; in its place are sustained, understated bass drum rolls.

The first clips from “Let’s Face It” show rotating and static sirens. Between each clip, an intervening black screen appears. The durations of these black screen segments follow a strict process of diminution and augmentation. Following the first clip of the rotating siren, the black screen appears for a duration of ten seconds. Each subsequent black screen segment is shortened by one second until a duration of three seconds is reached.

Following the three second black screen, the siren clips are replaced by footage of children in the ‘duck and cover’ position. Simultaneously, the black screen segments begin a sequence of augmentation, each one second longer in duration than the last. Once a duration of ten seconds is reached, the black screen segments are subjected to diminution one final time.

The diminution process creates a sense of energy and speed. The augmentation process, on the other hand, is akin to rallentando, wherein momentum is lost. Through the process of durational augmentation and diminution, the black screen segments create a wave-like shape.

Section 2 has a ternary form of ABA. The form is delineated by the footage. Sirens are the subject of the ‘A’ sections, while children are the subject of the ‘B’ section. Sandwiched between the sirens, the ducking children are, in effect, trapped.

The ‘B’ section features a density canon made with multiple iterations of a bass drum recording. The recording features a bass drum with a wave-like sonic shape – from silence, the drum crescendos to a climax before slowly returning to silence

The density canon itself unfolds in a wave-like shape. Beginning with a single bass drum track, additional copies are added at regular intervals until the highpoint of the wave – the apex – is reached. From there, the bass drum canon dissipates until only one bass drum remains.

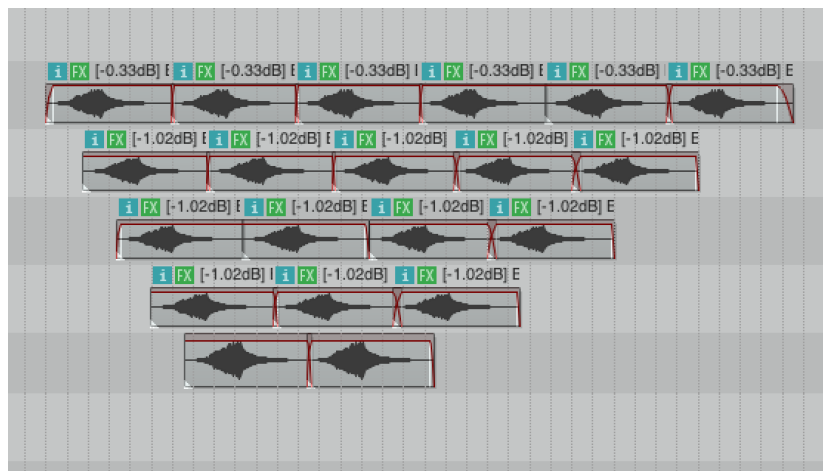


Figure 2.7: Bass drum canon with a wave-like shape. Assembled in Reaper.

Section 3

In the final section, wave-like shapes manifest visually and sonically. The Housatonic test footage, with its immense number of frames per second, allows viewers to see the expanding

fireball in great detail. The footage excerpted for section 3 begins immediately following the weapon’s detonation. The white hot specks visible across the surface of the fireball are fragments from the bomb’s metal casing.

Over the course of section 3, Housatonic’s fireball is slowly revealed through a series of visual waves. These waves are comprised of two parts: a segment of footage followed immediately by the reversal of that footage. Similar to the process used for the black screen segments in section 2, the fireball waves are subjected to a process of durational augmentation. The first wave is made with two three second segments. The first segment shows the fireball’s expanse while the second shows its contraction. This process may be expressed with the pitch sequence shown in the following diagram.

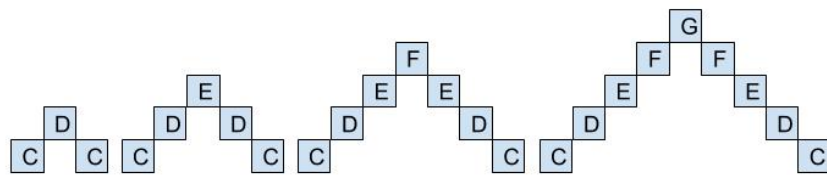


Figure 2.8: A series of visual waves, each longer than the last, are made with the Housatonic footage. Each subsequent wave is augmented by a duration of one second until a segment of twenty seconds is reached. Following this, the formula changes. Segments continue to increase by a second, but upon their reversal are shortened by a duration of one second. The segments no longer return to their points of origin. The musical analog to this process may be expressed with the pitch sequence in the following diagram.

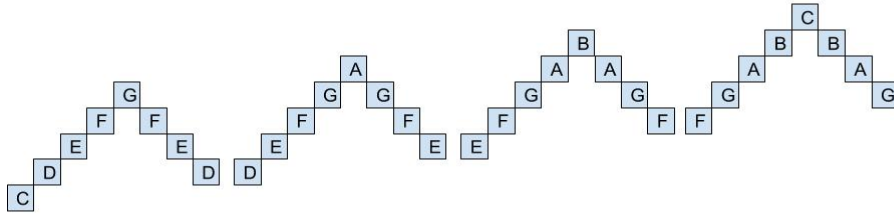


Figure 2.9: A series of visual waves are subjected to durational augmentation and diminution.

This pattern is first demonstrated with a 21 second segmented followed by its reversal for 20 seconds. The next sequence, likewise, has a duration of 22 seconds with a 19 second reversal. This pattern continues until a segment of 26 seconds is followed by a 15 second reversal. At this point, the fireball has reached its maximum point of brightness. A 50 second segment without its reversal concludes the piece. Through a durational formula of augmentation and diminution, the footage unfurls in perfect, wave-like shapes.

While much of the sonic and visual material in *This is not a Drill* was inspired by the siren and its wave-like shape, it is not until the final section that the siren’s wail is actually heard. The unceremonious start to section 3 is marked by a black screen and the final waves of the bass drum canon. Beneath the drums, a soft, slowly cycling siren begins to produce sound. Soon, the wail of several sirens is palpable, the siren timbre clearly audible.

The siren music evolves slowly. Beginning at a murmur, the sirens churn softly and slowly. Climbing in pitch and decibel, sustained, polyphonic harmonies develop and expand until ultimately, a vicious choir of sirens scream.

At several points, up to seven siren tracks sound concurrently. These tracks were often overlapped at irregular intervals to create quasi-canonical sequences. The most prominent of these is the ‘scream canon,’ which occurs during the final minutes of the piece. The recording used for this canon features the sound of a siren quickly rising to its apex and then falling back to

silence. The tracks overlap in free canon, quickly generating an enveloping soundfield. After several iterations, the beginning and ending of each track was cropped so that only the highest frequency tones remain. After the sirens reach a collective scream, the piece ends abruptly with no descent in pitch.

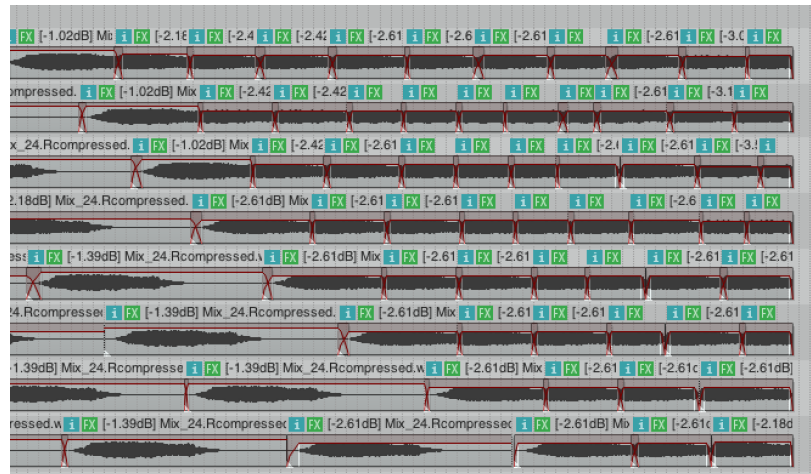


Figure 2.10: Edited recordings produce a sustained scream at the end of *This is not a Drill*.

Creative Process

Originally, *This is not a Drill* was meant to function as a sort of artistic balance to the writing of my dissertation, not become a significant component of it. I discovered quickly, however, that my research on the siren and the creation of my multimedia work were more unified than I originally intended.

Before *This is not a Drill*, I did not have any significant experience with audio or video software, or even composition, so though I knew what I wanted to create, the act of creation itself was a tedious process of trial and error. Over a period of several weeks in March and April 2018, the audio and video files used in *This is not a Drill* were collected, manipulated, and assembled. Despite the learning curve, the creative process felt familiar to me as a percussionist, where trial and error is an inherent part of learning a piece of music. Indeed, percussionists

experiment with instrument selection, finding just the right drum or cymbal; they experiment with their setups, changing the formation of instruments until the best one is found; and they experiment with their sticks and mallets, in order find the one that will produce the proper sound and color.

Relying on my instincts as a percussionist, I adapted my working method throughout the process of creating *This is not a Drill*. Often, after deciding on a particular compositional direction, the materials would challenge me to find different ways to utilize them. For example, during the third section of the piece which shows the explosive fireball of a nuclear explosion, I wanted the footage to adhere to a wave-like shape – playing forward and then in reverse – but soon realized that the reversal of the footage diminished the visual energy, which did not correlate well with the ever intensifying siren music. After numerous experiments, I discovered that if I allowed the forward playing footage to continue to augment in duration, while decreasing the amount of time the footage played in reverse, the film would advance continually while still adhering to a wave-like shape. With this formula, the fireball grows brighter and brighter while the screams of the sirens intensify to a climax.

The ‘scream canon’ was another element that required significant experimentation and trial and error. Once again, I knew *what* I wanted to create but not precisely *how* to create it. My original conception for the end of the piece was to create a single wave-like shape with a multitude of sirens. After creating this shape, however, I determined that the fireball footage, now at its brightest point, demanded an analogous sound from the sirens, a sustained sonic intensity that would combine with the burning image on the screen. The solution that I came up with was to crop the siren files to remove the descending portion of the wave-like shape. In its

place, I used a second edited file which contained only the intense sound of the siren's apex point. Multiple iterations of this file were then joined together, one after another, so that the apex sound was sustained through to the conclusion of the piece. As discussed previously, the end of the work unfolds in a 'scream canon,' where the descending portion of the wave-like shape is eliminated, one siren at a time, until only a unison, high-pitched wail remains.

Though the creative process for *This is not a Drill* was based entirely on my own intuition and experience, there were filmmakers who utilized footage similar to that seen in my work. For example, Bruce Conner's film, *Crossroads* (1976), features footage from an atomic bomb test with an original musical score by Patrick Gleeson and Terry Riley.⁴¹ While my work may appear to be influenced by Conner's film, any similarities are mere coincidence, as I was not familiar with his film at the time and have only now begun to explore experimental films and techniques.

This is not a Drill is a synthesis of my work as a percussionist and researcher. The piece embodies concepts from my dissertation, my background as a contemporary percussionist and interpreter, and interest in the history of the use of sound in warfare, a topic that has been of curiosity to me for years. Aligning my creative and scholarly practices has been a rewarding and important experience for me. Though *This is not a Drill* is complete, I certainly do not feel like I have reached an ending point and on the contrary, believe that this work marks the beginning of a new creative direction for me, one that combines my creative work with historical topics in order to comment on the world today.

⁴¹ John Siegel, "Crossroads," accessed June 11, 2018, <http://michelle-silva.squarespace.com/crossroads/>.

Conclusions

Though sirens have changed in shape and size, and in some cases, have been updated with digital technologies, the siren of today is, for all intents and purposes, the same as any before it, uniquely connecting the present with the past.

Growing up in the Midwest, I vividly recall the eerie sound of the tornado siren. Every spring, storm fronts moved across the Indiana plains, bringing with them rain, hail, strong winds, and occasionally, when the air conditions were just right, tornados. During elementary school, there were several occasions when looming funnel clouds triggered the local tornado sirens. These were always fearful times. Rapidly, we would be ushered into the school hallways and placed in the duck and cover position: on our knees, forehead touching the floor, hands over the back of our heads. There, we would wait in silence, afraid. Outside, the winds howled, the sirens wailed. Though I never saw a tornado, the siren's roar was terrifying. To me, the siren *was* the tornado.

A generation before mine, at the height of the Cold War, school children practiced the duck and cover position to prepare for a far more insidious threat – the nuclear bomb. At the sound of the siren or at the teacher's command of 'drop,' children scurried beneath their desks, ducked and covered. There they waited as the sirens wailed. Fortunately, nuclear war was avoided. For those children, though, I imagine that the siren took an emotional toll. For them, the siren *was* the bomb.

During the Second World War, the air raid siren accompanied the destruction of cities. Children and adults, alike, huddled in shelters below ground as aircraft high above released

bombs by the thousands. The sirens wailed as buildings crumbled. For that generation, the siren *was* death and destruction.

Across generations, the siren has remained on guard, a silent sentinel waiting for its voice to be needed. Today, with heightened global tensions, the siren remains ever vigilant. Linking the past with the present, the siren enabled me to consider an ominous past while commenting on the dangers of the present.

Bibliography

- “Acme Whistles.” Acme Whistles of Canada. Accessed February 14, 2018.
<http://acmewhistles.ca/history/>.
- Adams, John Luther. *Strange and Sacred Noise*. Fairbanks: Taiga Press, 1997.
- Alarcón, Miguel Molina. *Sound Experiments in the Russian Avant Garde*. London: ReR Megacorp, 2008.
- Amadinda Percussion Group. *Ionisation*. Recorded 1990. Track 1 on *4'33"*. Compact disc.
- Amadinda Percussion Group. *First Construction (in metal)*. Recorded 2014. Track 9 on *Cage: Works for Percussion, Vol. 1 (1935-1941)*. Compact disc.
- Antheil, George. *Bad Boy of Music*. Garden City: Doubleday, 1945; reprint, Samuel French Edition, 1990.
- “Ballistic Missile Threat Inbound to Hawaii...This is Not a Drill.” Common Dreams. Last modified January 13, 2018.
- Britten, Benjamin. *The Children*. London: Faber Music, 1972.
- Cage, John. *First Construction (in metal)*. New York: Henmar Press / C.F. Peters, 1962.
- . *Second Construction*. New York: Henmar Press / C.F. Peters, 1978.
- Chang, Heidi. “Hawaii reinstates 'attack warning' siren to prepare for possible North Korean missile.” *NBC* online. Last modified November 26, 2017.
<https://www.nbcnews.com/news/asian-america/hawaii-reinstates-attack-warning-siren-prepare-possible-north-korean-missile-n823821>.
- Chris, Doug. “For the first time since the end of the Cold War, Hawaii will test nuclear sirens.” *CNN* online. Last modified December 1, 2017.
<https://www.cnn.com/2017/11/28/us/hawaii-nuclear-warning-trnd/index.html>.
- Cochran, Thomas B. and Norris, Robert S. “Nuclear Weapon” last modified April 20, 2018.
<https://www.britannica.com/technology/nuclear-weapon#ref988610>.
- Cocteau, Jean. *A Call to Order*. Translated by Rollo H. Myers. New York: Henry Holt and Company, 1974.
- Derdak, Thomas, and Kepos, Paula, eds. *International Directory of Company Histories, Volume 10*. Chicago: St. James Press, 1995.

- “Emergency Alert System.” FEMA. Accessed April 2, 2018.
https://www.fema.gov/media-library-data/1465326763240-4152791226bbd49cf46aff8cd5f43bb1/Emergency_Alert_System_Fact_Sheet_2016.pdf.
- Federal Civil Defense Administration. *Let's Face It*. Film. Produced by United States Air Force. 1954. <https://www.youtube.com/watch?v=UwZmzIQfejs>.
- Gould, Christopher. *The Children*. Recorded 2008. Track 23 on *Britten, B.: Who Are These Children? / Winter Words / A Birthday Hanseli*.
- Jarvi, Neeme. *Cantata for the 20th Anniversary of the October Revolution, VI. Revolution*. Recorded 1994. Track 6 on *Cantata for the 20th Anniversary of the October Revolution*.
- Kalman, David Zvi. “The Strange and Violent History of the Ordinary Grogger” last modified March 20, 2016.
<https://forward.com/culture/335491/the-strange-and-violent-history-of-the-ordinary-grogger/>.
- Kronos Quartet. *Different Trains - Europe - During the War*. 1990. Track 2 on *Reich: Different Trains, Electric Counterpoint / Kronos Quartet, Pat Metheny*. Compact disc.
- Lawrence Livermore National Laboratory. *Operation Dominic – Housatonic 120250*. 1962. Film. <https://www.youtube.com/watch?v=cv10r6RVsos>.
- Lehrman, Paul D. “About the Ballet Mécanique” last modified 2003.
<http://www.antheil.org/balletmec.html>.
- Maconie, Robin. *The Second Sense: Language, Music, and Hearing*. Plymouth: The Scarecrow Press, Inc., 2002.
- Percussion Group Cincinnati. *Triadic Iteration Lattices*. Recorded 2005. Track 4 on *John Luther Adams: Strange and Sacred Noise*. Compact disc.
- “Physicist declassifies rescued nuclear test films.” Lawrence Livermore National Laboratory. Last modified March 14, 2017.
<https://www.llnl.gov/news/physicist-declassifies-rescued-nuclear-test-films>.
- Price, Sherman. *What to do in a Gas Attack*. Film. 1943. Filmedia Corp.
<https://archive.org/details/gov.fdr.41>.
- Potter, Caroline. *Erik Satie: A Parisian Composer and His World*. Woodbridge: The Boydell Press, 2016.
- Red fish blue fish. *Persephassa*. Recorded 2006. Track 1 on *Xenakis, Iannis: Complete Percussion Works*.

- Siegel, John. "Crossroads." Bruce Conner. Accessed June 11, 2018.
<http://michelle-silva.squarespace.com/crossroads/>.
- Sonak, Sangeeta M. *Marine Shells of Goa: A Guide to Identification*. Cham: Springer, 2017.
- Steenberg, Edward. "Police Rattles & Whistles." Accessed April 4, 2018.
<http://www.spphs.com/history/whistles/index.php>.
- "Symphony of Sirens." Monoskop online. Last modified August 2, 2015.
https://monoskop.org/Symphony_of_Sirens#1._Arseny_Avraamov_.E2.80.93_Symphony_of_Sirens.
- "Syria 'chemical attack': Russia warns US against military action." BBC online. Last modified April 11, 2018. <http://www.bbc.com/news/world-middle-east-43721057>.
- "The Acoustic Siren." Smithsonian. Accessed February 13, 2018.
<http://americanhistory.si.edu/science/sirens.htm>.
- "This Is Not A Drill': A False Ballistic Missile Alert Shakes Hawaii." *NPR*. Last modified January 13, 2018.
<https://www.npr.org/sections/thetwo-way/2018/01/13/577871075/this-is-not-a-drill-a-false-ballistic-missile-alert-shakes-hawaii>.
- Trotter, William R. "The Music of War" last modified June 12, 2006.
<http://www.historynet.com/the-music-of-war.htm>.
- Varèse, Edgard. *Ionisation*. New York: Ricordi & Co., 1958.
- Warsaw National Philharmonic Orchestra. *Dies Irae II: Apocalypsis*. Recorded January 2008.
 Track 14 on *Penderecki: Symphony 8 - Dies Irae / Aus Den Psalmen Davids*. Compact disc.
- Xenakis, Iannis. *Persephassa*. Paris: Éditions Salabert, 1970.