

SIMONEAU, ABIGAIL H., D.M.A. Luening's *Invention in Twelve Tones*: Transcription and Max Patch for Performance by the Contemporary Flutist. (2020)
Directed by Drs. Ashley Barret and Erika Boysen. 57 pp.

The purpose of this project was to provide a transcription and Max patch for Otto Luening's *Invention in Twelve Tones*. Composed in 1952, *Invention in Twelve Tones* was presented at the first public concert of electroacoustic music in the United States at the Museum of Modern Art in New York. Luening's original work was prerecorded without a score, and he presented the premiere to the audience via audiotape.

The transcription and Max patch are used in conjunction for performance of *Invention of Twelve Tones*. This project serves to make *Invention in Twelve Tones* accessible for live performance by a trio of flutists on piccolo, C flute, and bass flute.

Included in this dissertation is information about Otto Luening, a Max patch to be used in performance, a performance guide to set up the patch, and a printed transcription of *Invention in Twelve Tones*. Background information for the project was collected primarily through readings on Otto Luening, the history of electroacoustic music, and study of the original manuscript and subsequent recordings.

LUENING'S *INVENTION IN TWELVE TONES*:
TRANSCRIPTION AND MAX PATCH
FOR PERFORMANCE BY THE
CONTEMPORARY FLUTIST

by

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A Dissertation Submitted to
the Faculty of The Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Doctor of Musical Arts

Greensboro
2020

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3/23/2020
Date of Acceptance by Committee

3/16/2020
Date of Final Oral Examination

ACKNOWLEDGEMENTS

The completion of this degree and dissertation would not have been possible without the guidance and support of many wonderful individuals.

Thank you to Dr. Ashley Barret, Dr. Erika Boysen, Dr. Mark Engebretson, and Dr. Gregory Carroll for being part of my doctoral committee. Endless thanks go out to you for your constant guidance, knowledge, and support through the journey of this degree – I am so grateful to each of you.

Lastly, thanks go out to Jon Goodman, my parents (Rene and Robin Simoneau), brother, and grandparents for their constant love and encouragement.

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CHAPTER I
INTRODUCTION

Introduction

On October 28, 1952, colleagues Otto Luening and Vladimir Ussachevsky presented the first public concert of electroacoustic music in the United States at the Museum of Modern Art in New York¹, sponsored by the American Composers Alliance and Broadcast Music, Inc.² Works played on this concert included Ussachevsky's piano-based *Sonic Contours*, and Luening's *Fantasy in Space*, *Invention in Twelve Tones*, and *Low Speed*. All three of Luening's pieces presented on this concert were constructed using pre-recorded flute sounds. Many flutists are unaware of these early pioneering compositions from the 1950s, which were composed as tape pieces and do not require live human performers.³ This project serves to make one of these works, *Invention in Twelve Tones*, accessible for live performance by a trio of flutists. The notated score and Max patch give the option for a trio of flutists to program, learn, and perform this work.

¹ *Grove Music Online*, s.v. "Electroacoustic Music," (by Barry Schraeder and Marc Battier), <http://www.oxfordmusiconline.com/subscriber/article/grove/music/A2249352> (accessed Jan. 3, 2017).

² Sarah Louise Bassingthwaighe, "Electroacoustic Music for Flute" (Doctor of Musical Arts Dissertation, University of Washington, 2002), 29.

³ *Grove Music Online*, s.v. "Electroacoustic Music," (Schraeder and Battier).

Otto Luening (1900-1996) was an American composer, flutist, teacher, conductor, and innovator of electronic music.⁴ His *Invention in Twelve Tones (ITT)* is considered electronic or electroacoustic music. Electroacoustic music is music produced or altered by electrical means, which differs from traditional “acoustic music” where there is no amplification or electronic manipulation.⁵

Because *ITT* was recorded and composed on reel-to-reel magnetic tape, it was never intended to be performed live by flutists. A facsimile of the score exists, but discrepancies can be found between what happens musically on tape and what Luening notated. The only reason we have some semblance of a score was for copyright purposes.⁶ Before the Sound Recording Act passed in 1971, sound recordings were not granted federal copyright protection. Therefore, Luening needed to create a physical form of the score to gain copyright protection.⁷ Luening described the piece in as much detail as possible using words but very little musical notation, so it is not a score in the traditional sense. It was difficult for him to notate since he utilized improvisation in many

⁴ *Grove Music Online*, s.v. “Luening, Otto,” (by Lester Trimble and Severine Neff), <http://www.oxfordmusiconline.com/subscriber/article/grove/music/17140> (accessed Nov. 11, 2016).

⁵ *Grove Music Online*, s.v. “Electroacoustic Music,” (by Barry Schraeder and Marc Battier), <http://www.oxfordmusiconline.com/subscriber/article/grove/music/A2249352> (accessed Jan. 3, 2017).

⁶ Vladimir Ussachevsky and Otto Luening, *1952 Electronic Tape Music: The First Compositions* (New York: Highgate Press, 1977), 34-35.

⁷ “Copyright Duration for Musical Compositions and Sound Recordings,” Ohio State University, May 13, 2015, accessed March 11, 2018, <https://library.osu.edu/blogs/copyright/2013/05/15/198/>.

of the melodic lines. Additionally, he manipulated his original recordings, so the resulting piece does not reflect the themes he initially notated.⁸ The original manuscript and its discrepancies will be discussed further in Chapter Three.

Procedures

Two essential items were needed to make *ITT* accessible for live performance; an accurately notated score and a means by which to create the electronic effects heard on the recording. For the effects, I decided to use the program Max.⁹

Due to the imprecise nature of Luening's original manuscript, a new score needed to be created. First, I transcribed the piece aurally while also referencing the original manuscript. Then, I entered the transcription into Sibelius music notation software to create a legible, performance-ready edition of the score.

The second essential item needed was a Max patch for use during live performance. This patch was built to recreate mechanical reverberation, which was the musical effect that Luening used in transforming flute sounds in *Invention*.

The program Max, created by Miller Puckette and David Zicarelli, makes it possible for the computer to be a musical instrument capable of live performance. With Max, users can build synthesizers, samplers, and effects processors without any prior experience writing code, making it very friendly to musicians. Users can design

⁸ Vladimir Ussachevsky and Otto Luening, *1952 Electronic Tape Music: The First Compositions* (New York: Highgate Press, 1977), 34-35.

⁹ "Cycling '74." Cycling '74. Accessed February 15, 2020. <https://cycling74.com/>.

instruments, named a *patch*, on a graphical interface by displaying *objects* on the screen and connection paths between objects.¹⁰ Over 170 Max *objects* are available, making it possible for users to create *patches* for their exact needs. To generate reverberation in live performance, performers will use this patch in conjunction with the playing of the transcribed score.

¹⁰ Miller Puckette, *The Theory and Technique of Electronic Music* (Hackensack, New Jersey: World Scientific Publishing Company, 2007), xi.

CHAPTER II
OTTO LUENING

A Brief History: Otto Luening

Otto Luening was a pioneer in electroacoustic music, predominantly using sounds derived from his primary performing instrument: the flute.¹¹ He produced more than 350 compositions in a variety of styles. It was his experimental and electronic arrangements that marked him as an innovator in the field.

Luening (1900-1996) was born in the deeply rooted German-American community of Milwaukee, Wisconsin.¹² He was surrounded and influenced musically by both of his parents, who were of German descent. His mother, Emma Jacobs Luening (1861-1950), was an amateur singer. His father, Eugene Luening (1852-1944), studied at the Leipzig Conservatory and was a composer, conductor, pianist, and professor.¹³ In Leipzig, Eugene studied under Ignaz Moscheles and Carl Reinecke and was even acquaintances with the notable Richard Wagner.¹⁴ Eugene was Director of the Milwaukee

¹¹ Larry Sitsky, *Music of the Twentieth-Century Avant-Garde* (Westport, Connecticut: Greenwood Press, 2002), 275.

¹² Otto Luening Trust, *Otto Luening: Centennial 2000* (Otto Luening Trust), 7.

¹³ *Grove Music Online*, s.v. "Luening, Otto," (Trimble and Neff).

¹⁴ "Otto Luening papers 1800-1996" Otto Luening papers, <http://archives.nypl.org/mus/18617> (accessed Nov. 1, 2016).

Musical Society, later known as the Milwaukee Symphony, and was Director of the School of Music at the University of Wisconsin-Madison. He also founded the Luening Conservatory of Music, a predecessor of the Wisconsin Conservatory.¹⁵

Otto Luening began piano lessons with his father at age four and started composing at the age of six. One of his first compositions included a *Waltz* for piano, which he later reflected on as being a “very modern” waltz for its time.¹⁶ In 1912, Luening’s father decided to move the family to Munich, Germany, where they remained until 1917. From 1915-17, Luening was the youngest student at the Staatliche Hochschule für Musik in Munich. There he studied with Anton Beer-Walbrunn in music theory, Alois Schellhorn on flute, and Josif Becht on piano and organ. In 1916, the young Luening made his first professional debut as a flutist at age sixteen with the Munich Court Orchestra.¹⁷

When World War I began, Luening volunteered as an orderly for the American Red Cross Hospital. Once the United States entered the War, Luening was expelled from Germany, so he and his sister Helene took refuge in Zürich, Switzerland. He enrolled at the Municipal Conservatory of Music in Zürich to continue his studies in conducting, composition, flute, organ, piano, theory, and even branched out to study psychology.¹⁸

¹⁵ Otto Luening Trust, *Otto Luening: Centennial 2000* (Otto Luening Trust), 25.

¹⁶ Otto Luening Trust, *Centennial* (Otto Luening Trust), 6.

¹⁷ Otto Luening Trust, *Centennial* (Otto Luening Trust), 25-26.

¹⁸ *Ibid.*

During his time at the Conservatory, he worked with two of his most influential teachers:¹⁹ Philipp Jarnach (1892-1982) and Ferruccio Busoni (1866-1924), a piano virtuoso and composer of early modern atonal works.²⁰ Busoni became interested in electronic music in the early 1900's, and he was the first to introduce Luening to this genre. Both Jarnach and Busoni influenced Luening's teaching methods, his conception of music, and encouraged his budding modernism.²¹

Luening played flute in the Tonhalle Orchestra and Municipal Opera and spent one season as an actor and stage manager for James Joyce's English Players Company.²² Zürich was an early center of Dadaism, and Luening had encounters with several notable people within this art movement: Hugo Ball, Emma Henning, and Tristan Tzara. Dada was a new, absurdist art movement that began just before World War I and was one of the most influential in the development of modern art.²³

¹⁹ *Grove Music Online*, s.v. "Luening, Otto," (by Lester Trimble and Severine Neff), <http://www.oxfordmusiconline.com/subscriber/article/grove/music/17140> (accessed Nov. 11, 2016).

²⁰ Larry Sitsky, *Music of the Twentieth-Century Avant-Garde* (Westport, Connecticut: Greenwood Press, 2002), 275.

²¹ *Grove Music Online*, s.v. "Luening, Otto," (Trimble and Neff).

²² *Ibid.*

²³ Paul Trachtman, "A Brief History of Dada," *Smithsonian.com*, May 1, 2006, accessed Jan. 11, 2018, <https://www.smithsonianmag.com/arts-culture/dada-115169154/>.

Luening returned to the United States in 1920, where he studied with Wilhelm Middelschulte and conducted the American Grand Opera Company in Chicago.²⁴ He also played flute for the Stratford Movie Theatre Orchestra, a vaudeville house. In need of financial backing, Luening received patronage from Edith Rockefeller McCormick, an American socialite and opera patron, which gave him the ability to devote time to composition. Besides the financial contribution, Edith presented concerts of his music and even helped him establish the Chicago Musical Arts Studio, where he taught music appreciation, theory, and composition until 1925.²⁵

In 1925, Luening moved to Rochester, New York, and served as a vocal coach and later as the executive director of the opera department at the Eastman School of Music. In this position, he had the opportunity to work with the dancer and choreographer Martha Graham, whose style reshaped American modern dance. During this time in Rochester, Luening met Ethel Codd, a Canadian-born soprano, and they wed in 1927. Luening also founded the Rochester Opera Company, later known as the American Opera Company, and conducted there until 1928.²⁶

Luening and his first wife Ethel spent 1928-1929 in Cologne, Germany. They played recitals together, where Luening served as both a flutist and accompanist. He also composed songs based on texts by authors William Blake, Percy Bysshe Shelley, and

²⁴ *Grove Music Online*, s.v. "Luening, Otto," (Trimble and Neff).

²⁵ "Otto Luening papers 1800-1996" Otto Luening papers, <http://archives.nypl.org/mus/18617> (accessed Nov. 1, 2016).

²⁶ Otto Luening Trust, *Otto Luening: Centennial 2000* (Otto Luening Trust), 27.

Walt Whitman.²⁷ After spending that year abroad, Luening worked as a freelance musician in New York until he was awarded several Guggenheim fellowships. He received three Guggenheim fellowships in total: 1930-31, 1931-32, and 1974. The first two fellowships allowed Luening to write the text and compose music for his opera *Evangeline*.²⁸

Luening began teaching at the University of Arizona in 1932, and in 1934 he was selected as chairman of the music department at Bennington College in Vermont.²⁹ He remained at Bennington until 1944, and during this time he became an advocate of American and avant-garde music. He headed the Bennington Composers Conferences, which hosted composers such as Aaron Copland, Henry Cowell, and Paul Hindemith. Luening assisted Henry Cowell in *New Music*, which was a quarterly publication dedicated to modern music compositions.³⁰ Also during this time, Luening was a co-founder of the American Composers Alliance (1938) and the American Music Center (1939).³¹

²⁷ Otto Luening Trust, *Otto Luening: Centennial 2000* (Otto Luening Trust), 27.

²⁸ *Grove Music Online*, s.v. “Luening, Otto,” (by Lester Trimble and Severine Neff), <http://www.oxfordmusiconline.com/subscriber/article/grove/music/17140> (accessed Nov. 11, 2016).

²⁹ *Ibid.*

³⁰ Larry Sitsky, *Music of the Twentieth-Century Avant-Garde* (Westport, Connecticut: Greenwood Press, 2002), 275.

³¹ *Grove Music Online*, s.v. “Luening, Otto,” (Trimble and Neff).

In 1944, Luening was appointed as director of opera productions at Columbia University and also developed a graduate seminar in composition. At the same time, he became a professor at Barnard College.³² He joined the philosophy faculty at Columbia in 1949 and became increasingly interested in electronic music. Luening was co-founder and co-director of the Columbia-Princeton Electronic Music Center (CPEMC) with Vladimir Ussachevsky of Columbia University and Milton Babbitt and Roger Sessions of Princeton. The CPEMC began its operation in 1959 thanks to a \$175,000 grant from the Rockefeller Foundation and was vastly influential to the world of electronic music.³³ It was here that Luening began to experiment with acoustic instruments and electronic sounds in the 1940's and early 1950's. This series of experiments and compositions using the new medium of tape and electronic music was some of the earliest work of its kind in the world. He composed works like *Invention in Twelve Tones* (1952), *Fantasy in Space* (1952), *Low Speed* (1952), and *Incantation* (1954) during this time. Many of these works were programmed on the 1952 Museum of Modern Art concert, which was broadcast live and caused a sensation towards this new electronic music.³⁴

Luening continued his work in electronic music during the 1960's using the RCA Mark II Sound Synthesizer, which was the flagship piece of equipment at the Columbia-Princeton Electronic Music Center. The "Mark II" was the first programmable electronic

³² *Grove Music Online*, s.v. "Luening, Otto," (Trimble and Neff).

³³ Larry Sitsky, *Music of the Twentieth-Century Avant-Garde* (Westport, Connecticut: Greenwood Press, 2002), 275-76.

³⁴ *Grove Music Online*, s.v. "Luening, Otto," (Trimble and Neff).

synthesizer.³⁵ This allowed composers to specify pitch and rhythm, and to sequence events in time without having to tape splice. The Mark II, although not in use, is still housed at the Columbia University Computer Music Center.³⁶

Luening's works *Concerted Piece* (1960) and *Synthesis* (1962) for orchestra and tape opened new horizons for electroacoustic music. In 1964, Luening retired from Barnard College but continued to teach at Columbia as professor emeritus and music chairman until 1970. He then taught at the Juilliard School until his final retirement in 1973.³⁷ Luening was fortunate to be able to meet and collaborate with many of the contemporary artists of the early 20th century. Whether it was a musician, composer, dada artist, or dancer, they all had an impact on his modernism and ingenuity in the field.³⁸

Luening's impact as a teacher and composer was quite profound. Many of his composition students wrote in an array of music styles and genres.³⁹ His diverse group of students included Wendy Carlos, John Corigliano, Mario Davidovsky, Charles Dodge, John Kander, Chou Wen-Chung, and Charles Wuorinen.⁴⁰

³⁵ *Grove Music Online*, s.v. "Luening, Otto," (Trimble and Neff).

³⁶ Nick Patterson, "The Archives of the Columbia-Princeton Electronic Music Center," www.jstor.org/stable/23012776 (accessed March 1, 2020).

³⁷ *Grove Music Online*, s.v. "Luening, Otto," (Trimble and Neff).

³⁸ Larry Sitsky, *Music of the Twentieth-Century Avant-Garde* (Westport, Connecticut: Greenwood Press, 2002), 277-80.

³⁹ *Ibid.*

⁴⁰ Otto Luening Trust, *Otto Luening: Centennial 2000* (Otto Luening Trust), 8.

Luening should be recognized as one of the transitional composers of the twentieth century. His contributions include pioneering electronic music and exploring the possibilities of combining acoustic with electro-acoustic sounds.⁴¹

Luening's Electronic Music

Luening's music is varied in style, including diatonic, serial, polytonal, improvisatory, and electronic music. He is best known for his contributions to electronic music, which thrived while he was at Columbia University in the 1950's. In 1952, he and Vladimir Ussachevsky began collaborating to produce electronic music using tape recorders.⁴² He and Ussachevsky realized that this new tool at their disposal could ultimately change sound production and the future of music. They were able to use their imaginations to discover and arrange the new sounds using this medium.

My own decision about experiments with the new sound medium was first to extend the resonance of existing instruments through electronic transformations of their sound. This meant choosing an existing instrument as a sound source and then extending the sound, changing it, mixing it with other sounds, studying its effect on me as I listened to it. The flute was my instrument since childhood, so it seemed logical to begin with that instrument and make a careful study of its possibilities in connection with the new medium.⁴³

⁴¹ Larry Sitsky, *Music of the Twentieth-Century Avant-Garde* (Westport, Connecticut: Greenwood Press, 2002), 277-80.

⁴² Sitsky, *Music of the Twentieth-Century Avant-Garde*, 277-80.

⁴³ Vladimir Ussachevsky and Otto Luening, *1952 Electronic Tape Music: The First Compositions* (New York: Highgate Press, 1977), 33.

Luening usually sketched his ideas in musical notation to help him remember them, but he would often improvise other parts that would be transformed on magnetic tape. These experimental recordings from 1952 became three new works (*Fantasy in Space*, *Low Speed*, and *Invention in Twelve Tones*) that premiered on October 28, 1952, at the Museum of Modern Art in New York.⁴⁴

Electroacoustic Music

Numerous terms have been used to describe the different genres of music that include sounds produced by some form of technology: tape music, *musique concrète*, electronic music, machine music, computer music, electroacoustic music, live electronics, and so on. The term swapped most often with “electroacoustic” is “electronic.” I have adopted this approach and use these terms interchangeably for the remainder of the paper. Just like the technology itself, it is challenging to establish a term without it becoming dated. This has led to both confusion and ambiguity when referring to some of these terms, and many of them oppose or overlap one another.⁴⁵

Electroacoustic music has been defined in many ways since it blossomed in the second half of the twentieth century. The *Grove Music Dictionary* defines it as “music

⁴⁴ Vladimir Ussachevsky and Otto Luening, *1952 Electronic Tape Music: The First Compositions* (New York: Highgate Press, 1977), 34.

⁴⁵ Sarah Louise Bassingthwaighe, “Electroacoustic Music for Flute” (Doctor of Musical Arts Dissertation, University of Washington, 2002).

produced or altered by electrical means.”⁴⁶ *Grove* also classifies different types of electroacoustic music into sub genres according to two categories: the source of the sound material (acoustic or electronic) and the compositional approach. For example, *Grove* categorizes “live-electronic music” into two classifications, all depending on whether the composition includes pre-recorded electronic material or not. Either way, these subgenres fall under the larger umbrella of electroacoustic music.⁴⁷ Otto Luening provided his own definition of electronic music in his autobiography:

Electronic music is a generic term describing music that uses electronically generated sound or sound modified by electronic means, which may or may not be accompanied by live voices or musical instruments, and which may be delivered live or through speakers.⁴⁸

Following are some of the other various definitions for electroacoustic music:

Music made in whole or in part by electrical instruments, amplified or electronically modified instruments, recording devices or computers.⁴⁹

⁴⁶ *Grove Music Online*, s.v. “Electroacoustic Music,” (by Barry Schraeder and Marc Battier), <http://www.oxfordmusiconline.com/subscriber/article/grove/music/A2249352> (accessed Jan. 3, 2017).

⁴⁷ *Grove Music Online*, s.v. “Electroacoustic Music,” (by Barry Schraeder and Marc Battier), <http://www.oxfordmusiconline.com/subscriber/article/grove/music/A2249352> (accessed Jan. 3, 2017).

⁴⁸ Otto Luening, *The Odyssey of an American Composer: The Autobiography of Otto Luening* (New York: Charles Scribner’s Sons, 1980), 605.

⁴⁹ Herbert Deutsch, *Electroacoustic Music: The First Century* (Miami, FL: Belwin Mills, 1993), 5.

Electroacoustics is a very general term meaning the use of electricity for the creation, processing, manipulation, storage, presentation, distribution, perception, analysis, understanding or cognition of sound. It is the superset of the field, including both live and 'fixed' (as on tape or CD) pieces. Some people consider that it has language limits and defines certain 'styles' of work.⁵⁰

Dr. Sarah Louise Bassingthwaighe, a Seattle-based award-winning flutist and composer, states her thoughts on the latter definition: "Clearly, this definition is extremely broad, and would apply to literally any sound or music ever recorded in history."⁵¹ While her statement is true, it is difficult to simply define electroacoustic music because it has taken on many different forms as technology changed and advanced through the twentieth century.

For this paper, I will use Luening's definition describing music that uses electronically generated sound or sound modified by electronic means. Luening's original *ITT* includes flute sounds that he modified by electronic means, which is delivered through speakers. The original recording is 'fixed,' meaning that the music does not include any live electronics. This project serves to change these elements. Instead, live sound (flute) will be modified by electronic means (computer) in real time. Many of these pioneering tape works are completely unknown or forgotten. The notated score and Max patch gives the option for someone to program, learn, and perform this work.

⁵⁰ Sarah Louise Bassingthwaighe, "Electroacoustic Music for Flute" (Doctor of Musical Arts Dissertation, University of Washington, 2002).

⁵¹ Sarah Louise Bassingthwaighe, "Electroacoustic Music for Flute" (Doctor of Musical Arts Dissertation, University of Washington, 2002).

Electroacoustic music flourished in the second half of the twentieth century and brought us a new branch of instrumental music into the 21st century. Analysis of this type of music has been infrequently discussed in writing, mainly because a majority of electroacoustic works do not have a score. Most compositions for fixed recording do not come with a score. This lack of physical notation makes it difficult to study and analyze. This has resulted in very few analyses and textbooks about electroacoustic music.⁵²

Luening's Other Tape Pieces: *Fantasy in Space* and *Low Speed*

In 1977, Highgate Press released *1952 Electronic Tape Music: The First Compositions*, a short book detailing the Electronic Tape music by Vladimir Ussachevsky and Otto Luening from that year. This historic edition included essays by the composers, facsimiles of the first manuscripts, and a recording of *Sonic Contours* (Ussachevsky), *Fantasy in Space* (Luening), and *Incantations* (Ussachevsky/Luening). Additionally, Luening wrote a short essay specifically about his three tape pieces from 1952 (*Fantasy in Space*, *Invention in Twelve Tones*, *Low Speed*). Luening noted in this essay that he sketched out his ideas in musical notation to help remember them, but he often improvised other parts against his original melodies. He only notated the entire piece in as much detail as possible for copyright purposes (see pp. 2-3). Luening claimed that this was a difficult task because many of the pitches and rhythms within the piece were not designed to fit our traditional notation system. His “scores” for *Fantasy in Space* (Figure

⁵² Thomas Licata, *Electroacoustic Music: Analytical Perspectives* (Westport, Connecticut: Greenwood Press, 2002), xiv-xv.

2.1) and *Low Speed* (Figure 2.2) are more clear, detailed, and accurate than his score for *Invention in Twelve Tones*.⁵³

FANTASY IN SPACE
FOR TAPE RECORDER OTTO LUENING

The image shows a handwritten musical score for 'Fantasy in Space' by Otto Luening. The title is centered at the top in a bold, sans-serif font. Below the title, it says 'FOR TAPE RECORDER' and 'OTTO LUENING'. The score is written on three systems of two staves each. The first system is in 3/4 time, the second in 6/8, and the third in 5/4. The music features complex rhythmic patterns and various dynamics. Handwritten annotations include 'tempo accel.' above the second system and 'faster' and 'slower' above the third system. The score concludes with a double bar line and a repeat sign.

Figure 2.1. Opening of Luening's Original Score for *Fantasy in Space*⁵⁴

⁵³ Vladimir Ussachevsky and Otto Luening, *1952 Electronic Tape Music: The First Compositions* (New York: Highgate Press, 1977), 34-35.

⁵⁴ Vladimir Ussachevsky and Otto Luening, *1952 Electronic Tape Music: The First Compositions* (New York: Highgate Press, 1977), 36.

In *Fantasy in Space*, Luening wanted to showcase the flute's virtuosic possibilities. He incorporated folk-like, modal melodies, and lines with and without electronic manipulation and reverberation. The score is five pages long, and accurately details pitches and rhythms throughout the work.⁵⁵

Low Speed
for Flute on Tape Recorder

By
Otto Luening

Composed August - October 1952
First performed October 28, 1952, Museum of Modern Art, New York
A.C.A. Concert, Leopold Stokowski, Conductor

Slow

The musical score is written on four staves. The first staff is in treble clef with a common time signature. The second staff is in bass clef. The third and fourth staves are in alto clef. The notation includes various note values, rests, and dynamic markings.

Figure 2.2. Opening of Luening's Original Score for *Low Speed*⁵⁶

⁵⁵ Vladimir Ussachevsky and Otto Luening, *1952 Electronic Tape Music: The First Compositions* (New York: Highgate Press, 1977), 35.

⁵⁶ Vladimir Ussachevsky and Otto Luening, *1952 Electronic Tape Music: The First Compositions* (New York: Highgate Press, 1977), 44.

In *Low Speed*, Luening “used acoustic relationships that, when transferred to the tape recorder, emphasized certain upper partials...this emphasized new characteristics that were not apparent in the natural flute sound.”⁵⁷ Each of these works discovers something different about the flute and how it can be manipulated using the new sound medium.

As seen above, both *Fantasy in Space* and *Low Speed* have well-defined scores. *Invention in Twelve Tones* was chosen for this project because it does not have a clear score like the others. An enhanced score is not only useful for performance but can also aid in the study and analysis of this type of music. It will benefit the flute and electronic repertoire in promoting lesser-known works from this time.

⁵⁷ Vladimir Ussachevsky and Otto Luening, *1952 Electronic Tape Music: The First Compositions* (New York: Highgate Press, 1977), 35.

CHAPTER III

MAX PATCH

What is Max?

The program Max makes it possible for the computer to be a complete musical instrument capable of live performance. Max allows for the real-time processing of live audio. The current version of Max, Max 8, can be downloaded for free and used for a one-month trial period (<https://cycling74.com/downloads>). Users can still access Max after the trial period, but with restricted features.

I was introduced to Max in the spring of 2015 during my first year as a doctoral student at the University of North Carolina at Greensboro. I decided to join GLORK, Greensboro and UNCG's laptop orchestra, having no prior experience using Max. The group met twice a week in a classroom/workshop type session. Some students joined the group as a class for course credit; many of them were undergraduate or graduate composition students. I was one of three students in the group who were not composition majors. We used our classroom meetings to go over different aspects of the Max program, and to brainstorm with one another. We finished the semester with a concert, where we premiered all of the works composed by the group members.

In order to understand Max, our advisor, Dr. Mark Engebretson, recommended for us to start by "reading the tutorials." One could truly spend hours or days looking through them all. The tutorials can be found within the program under the "file browser"

label. Many resources exist within the program itself to help guide a curious learner.

However, once you understand the basic components of the programming language, it is possible to start building patches on your own.

The most basic terms that need to be understood when operating Max in general are *object*, *patcher*, and *patch*. An *object* (see Figure 3.1.) is the primary building block of the Max programming language. Figure 3.1 showcases a “buffer~” object, just one of many possible options. The most basic type of window that Max uses is what we call a *patcher* (see Figure 3.2.). We can relate this to opening a blank document in Microsoft Word. That blank document is our *patcher*. The *patch* refers specifically to the code that we write while using Max (see Figure 3.3.).

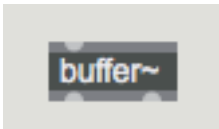


Figure 3.1. Example of a Max *Object*

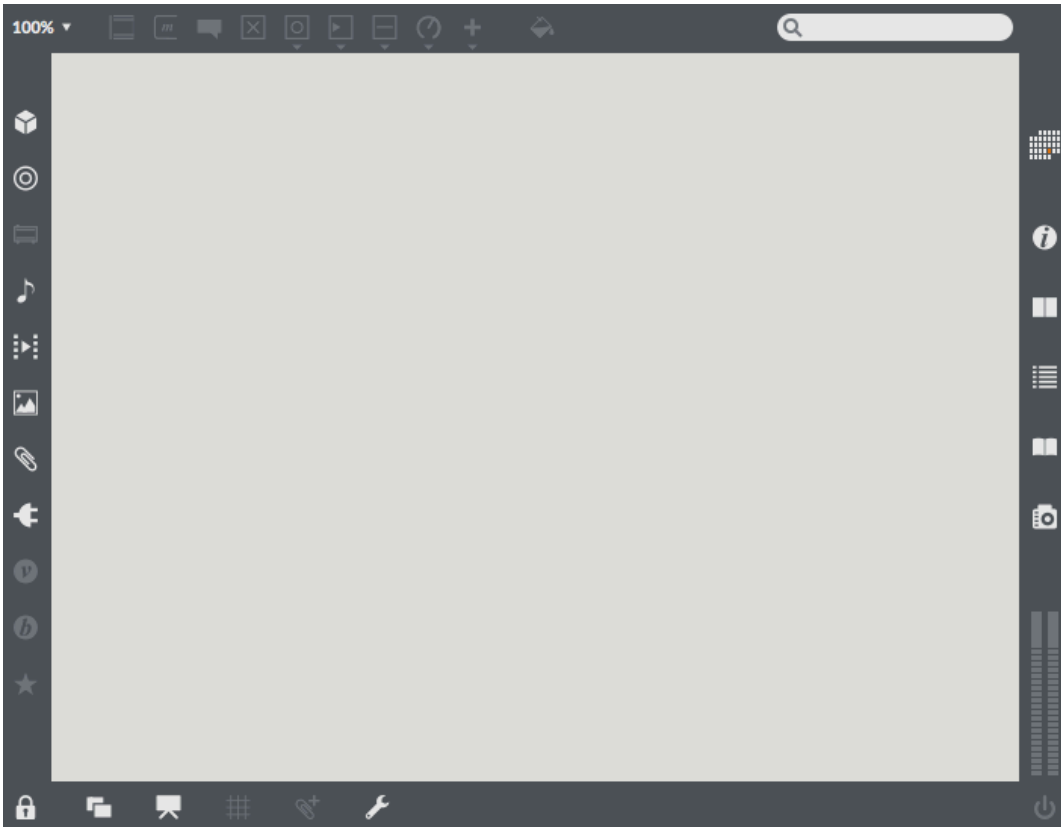


Figure 3.2. Blank Max *Patcher*

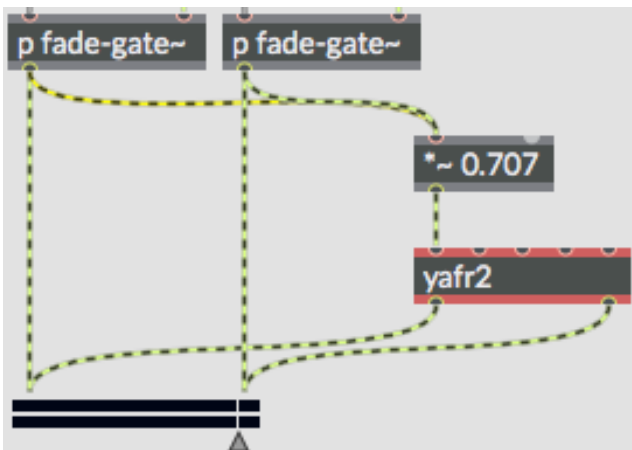


Figure 3.3. Example of a Max *Patch*

Patch for *Invention in Twelve Tones*

The effect of reverberation, or reverb for short, was used in all three of Luening's electronic works composed in 1952. Peter Manning provides a concise definition of reverb in his book *Electronic and Computer Music*:

Reverberation is generally associated with successive reiterations occurring less than 100 milliseconds apart, for our auditory responses will be acting to blur the repetitions into a smooth extension of the original sound.⁵⁸

Another way to describe reverb is when a large number of reflections build up and then decay as the sound is absorbed. Reverberation can occur naturally if someone sings or plays an instrument in a performance space that provides lots of echo.⁵⁹

To recreate the effect of reverberation in real time as the flutist is playing, I decided to build my own Max patch. Luckily, some examples of reverb patches already exist within Max, under the “help” tab. I was able to use those for reference while building my patch. Figure 3.4. is a screenshot of the patch to be used in performance with *Invention in Twelve Tones*.

⁵⁸ Peter Manning, *Electronic and Computer Music* (New York: Oxford University Press, 2013), 57.

⁵⁹ Larry Sitsky, *Music of the Twentieth-Century Avant-Garde* (Westport, Connecticut: Greenwood Press, 2002), 277-80.

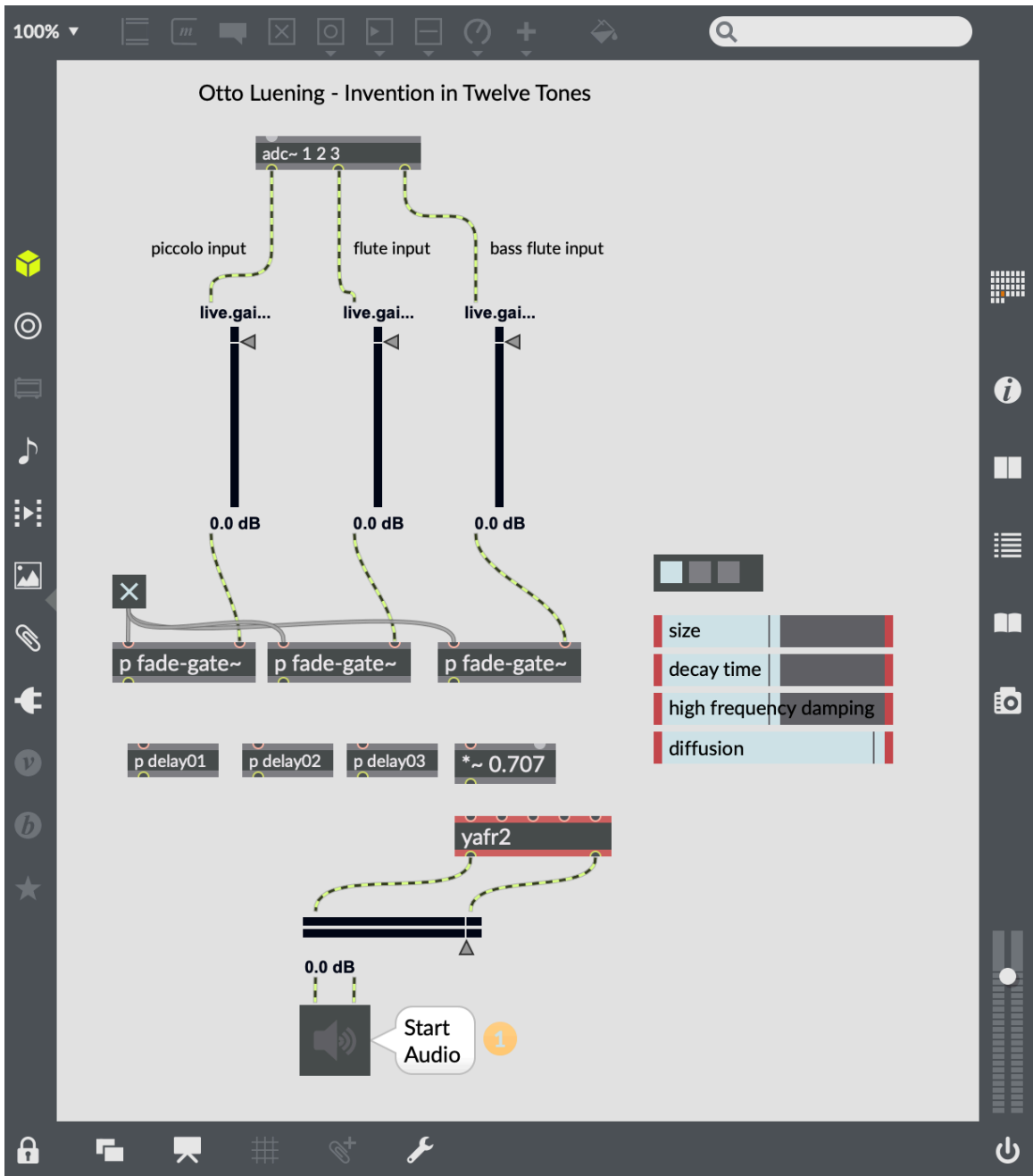


Figure 3.4. Screen Shot of Max Patch to be Used in Live Performance

Using the Patch

For performance, a laptop or computer with adequate processing capabilities and the downloaded Max software are needed. It is not necessary to purchase Max, as it can be run in demo mode, which is free. To use the patch effectively, you must understand a few basic elements within the patch, plus additional elements such as microphones, an interface, and speakers. The patch can be set up for performance in a variety of ways; outlined below is my preferred method.

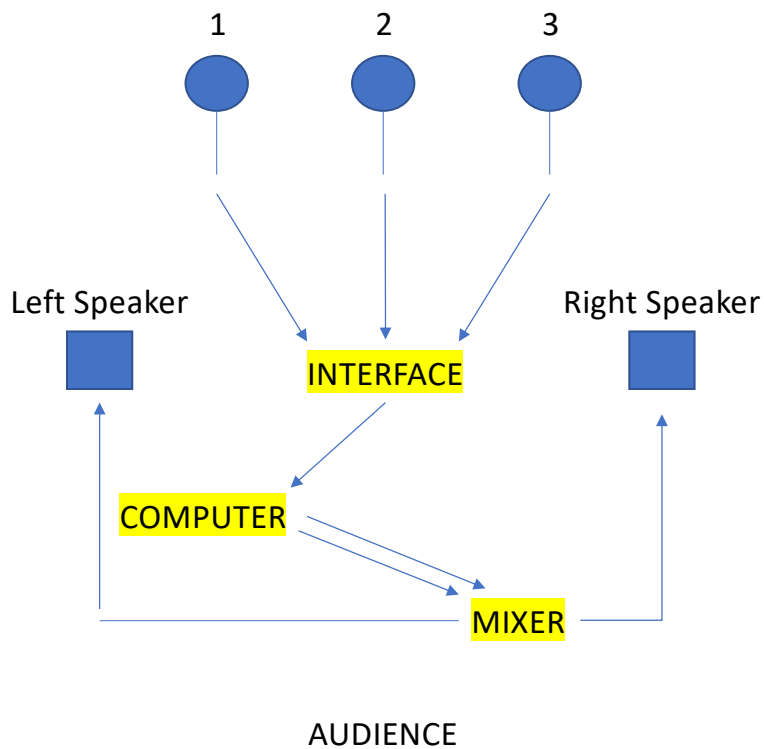


Figure 3.5. Setup Diagram

Sound can enter your computer and into the patch in a couple of ways. First, you can use the computer's built-in microphone. This would be sufficient for rehearsal

purposes only. The second option is to set up additional microphones, which will be utilized for performance situations.

Each player should have their own individual microphone. Ideally, all three players should utilize the same style of microphone if possible. Headset, dynamic, and condenser microphones are all viable options.

A headset microphone (see Figure 3.6) is worn via an earpiece. The microphone is flexible and can be placed in the proper position. One benefit to this type of microphone is that the headset enables the player to move and the sound will stay consistent. The headset microphone has its own wireless receiver that is then connected directly into the interface.



Figure 3.6. Headset Microphone

The dynamic and condenser microphones can be set up in similar ways. Each should be mounted on a microphone stand. My personal preference is to place the microphone to the left of the player and point it towards the instrument (see Figures 3.7 and 3.8).



Figure 3.7. Dynamic Microphone Setup



Figure 3.8. Condenser Microphone Setup



Figure 3.9. Microphone Setup Comparison

After the microphones are set up, they must be connected to the interface via XLR cables. This applied for all three types of microphones outlined above. The interface used had enough connects for all three microphones (see Figure 3.10). The interface can now be connected to the laptop via USB.



Figure 3.10. Front of Interface with Microphone Connects

Next, we are able to open the patch on the laptop. Once the patch is open, two steps must be completed before playing. First, the audio needs to be turned on. Click the

speaker symbol so it lights up gray; this is labeled with the number “1” in yellow on the patch. This will allow the sound coming in through the microphone to be processed through the patch. Second, the patch needs to recognize the interface. To complete this, click “options” on the dropdown menu, and click “audio status”. Within this window (see Figure 3.11), both the “Input Device” and “Output Device” need to be changed to recognize the interface that you are using. At this point, you are ready to use the patch for rehearsal or performance.

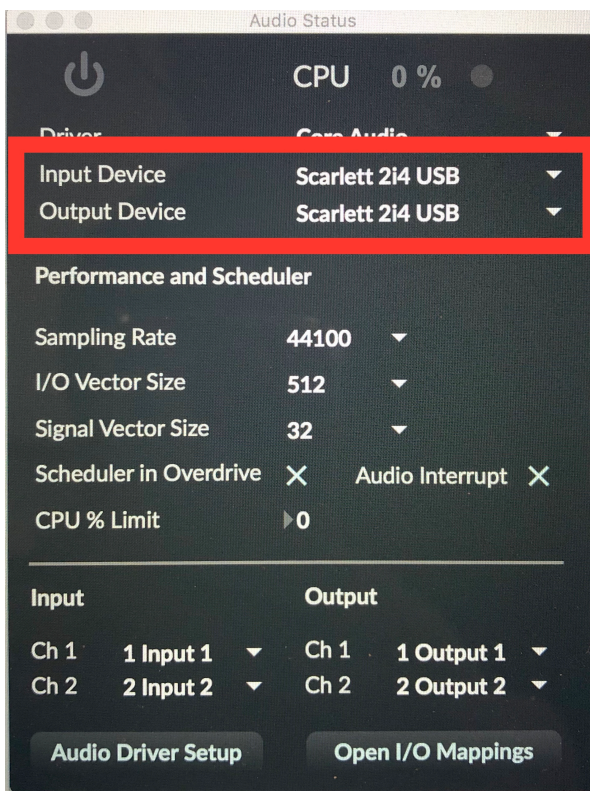


Figure 3.11. Audio Status Dropdown in Max

CHAPTER IV
TRANSCRIPTION

Transcription

My ideas were sketched in musical notation to help me remember them, but I often improvised other parts against such original lead sheets. For copyright purposes, it soon was essential to notate the entire piece in as much detail as possible, a difficult task because pitches and rhythms were not designed to fit our system.⁶⁰

This short quote by Otto Luening gives insight as to why discrepancies occur between what happens musically on tape and what he notated on paper. Luening continued on to describe his approach to composing *Invention in Twelve Tones*:

Invention in Twelve Tones consisted of a row and three variations. These were treated canonically and developed into a triple canon, which was combined later with another triple canon in simple diminution. This was combined with another, culminating in an intricate canonic development. The original entrances were improvised through the use of headphones. This helped to make the sound flexible and the rhythms free and elastic.⁶¹

Luening's original score is presented in its entirety in Figure 4.1. The original draft and final copy of this manuscript can be found within the Otto Luening papers archive at the

⁶⁰ Vladimir Ussachevsky and Otto Luening, *1952 Electronic Tape Music: The First Compositions* (New York: Highgate Press, 1977), 34-35.

⁶¹ *Ibid.*, 35.

New York Public Library in New York City. Luening personally donated most of the items to the collection in the late 1980's and early 1990's, and his second wife, Catherine Luening, donated the rest in 2001.⁶² Another copy of the original manuscript was published in Ussachevsky and Luening's 1952 *Electronic Tape Music: The First Compositions*.

Invention for Flute on Taperecorder. Otto Luening.



Amplifier 14R-8 Switches down Equalization 15.

Theme. Moderato-rubato (reverberated)

Variation I. *

Var. II

Play through Theme and Variations I II & III free in tempo and in canon in free rhythm - enhances marked *.

Repeat this entire pattern to end of piece.

At 63 $\frac{1}{5}$ seconds superimpose this pattern 2 octaves higher (in double diminution).

At 1 minute 52 $\frac{1}{5}$ seconds superimpose this pattern 1 octave higher (in simple diminution).

At 2 min 48 $\frac{1}{2}$ seconds superimpose this pattern 1 octave higher (in simple diminution) + simultaneously superimpose 2 octaves higher (in double diminution).

Figure 4.1. Luening's Original Score of *Invention in Twelve Tones*⁶³

⁶² Otto Luening papers, JPB 94-07. Music Division, The New York Public Library.

⁶³ Vladimir Ussachevsky and Otto Luening, 1952 *Electronic Tape Music: The First Compositions* (New York: Highgate Press, 1977), 43.

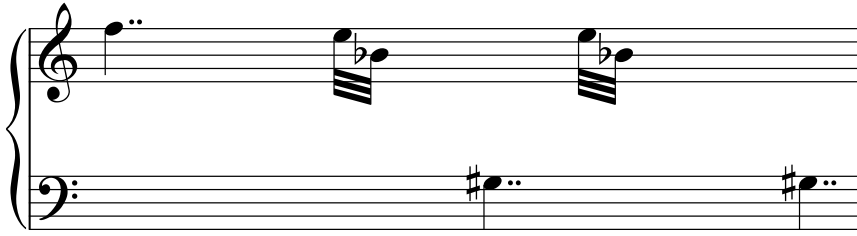


Figure 4.4. First Three Notes in Actual Sounding Pitches

Figure 4.5. First Three Notes in Updated Transcription

The differences between Figure 4.3., 4.4. and 4.5. include pitches, intervals, and repetitiveness. Due to speed variation on tape, it is not uncommon for the line to sound transposed up or down from the initial recording. In this case, the flute line sounds a major 7th lower in pitch than Luening notated. In this example, the intervals are also different between the second and third notes; rather than an octave plus a tritone leap, it is only a tritone between E and B-flat.

⁶⁵ Vladimir Ussachevsky and Otto Luening, *1952 Electronic Tape Music: The First Compositions* (New York: Highgate Press, 1977), 43.

Because of the registers utilized by Luening in his manipulation of the tape (see Figure 4.4.), it was necessary to write the updated score with three different voices of various ranges: piccolo, flute, and bass flute (flute and bass flute only in the opening bars).

Lastly, there is a discrepancy with how the theme is repeated. In Luening's score, he notates three tones (E-D#-A) and then moves directly on to other material in the theme (starting on a G). In the recording, these ideas are repeated twice before moving on to other thematic material.

Based on what we just explored in the opening "Theme," successfully performing this work from Luening's score is not possible. A transcription and new score are absolutely necessary to perform this work live.

Transcribing Process

As mentioned above, in the score, Luening only notated a short theme with three variations (see Figure 4.1.). Throughout the work, the Theme and Variations are not consistently played the same each time. Despite this, Luening's notation gave me some of the musical framework and pitch content to begin the transcription process.

When transcribing, it has been helpful to assess whether to slow the speed of the recording down. The theme and variations go through diminution in sections of *Invention in Twelve Tones*, so it sounds at a much faster speed. This made transcribing those particular sections incredibly difficult. I decided it would be worthwhile to slow down the speed of the recording to make the transcribing process easier. Luening's original

recording on tape is 3:47 long. My slowed recording is just over 7:00 long and made it easier to notate the music.

To create my slower version, I used a program called Audacity. Audacity is a “free, open source, cross-platform audio software”⁶⁶ that was first released in 2000 and is easy to download from the web (audacityteam.org). This software can be used to record audio or provide tools to be used post-processing. I primarily use Audacity for its post-processing features, such as trimming audio and creating fades in and out of recordings. For this project, I used the “change tempo” feature, which allows you to change the speed of a recording without it affecting the pitch. In Audacity, this can be found under the “effect” dropdown menu.

Once I slowed down the recording, I was able to begin transcribing. I always write my transcriptions on manuscript paper by hand and then transfer it to music notation software. The only other item I used during the transcribing process was an electronic keyboard or piano to check pitches occasionally. I worked through short sections of music at a time and utilized the slower version of the recording.

Notational Challenges

Once my preliminary transcription was completed on paper, I needed to transfer my score into musical notation software.

⁶⁶ “Audacity | Free, Open Source, Cross-platform Audio Software for Multi-track Recording and Editing.,” Audacity, accessed March 7, 2018, <https://audacityteam.org/>.

My intention for this score was for it to be spatially notated. Spatial, or “proportional” notation occurs when the note duration is indicated through comparison of the relative distance to others. One issue with spatial notation is that it can only be executed if each player can see the whole score. *Invention in Twelve Tones* only requires three players, so it is possible for all three to read off of the full score.

I wanted to write in spatial notation since no tempo or strict rhythmic patterns are used throughout *ITT*. Each line sounds elastic and free, and Luening intended the entrances of each line to sound improvised. If notated spatially, each player could see how their line fits in with the other two.

I decided to employ the use of invisible rests to resolve the spatial notation issue. On each line, I chose a time signature, wrote out the music, spaced it, and then erased the rests. This created a clean looking score and I was able to space out all the notes according to where they fall. Figure 4.6 shows an example of a measure before (with rests and time signature) and after (spatial).

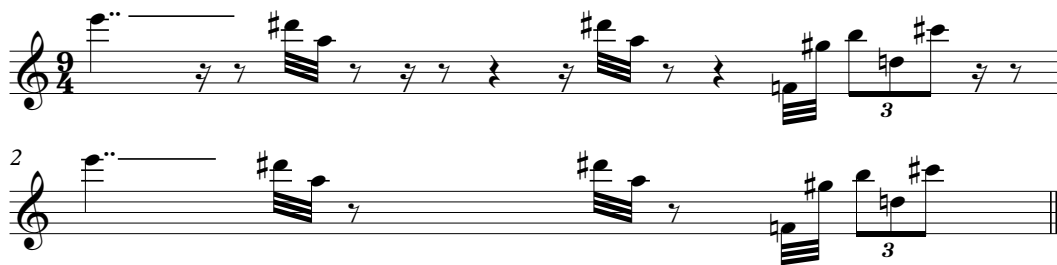


Figure 4.6. Example of How to Achieve Spatial Notation: Before and After

While this process was time consuming, it was necessary in order to achieve the desired score.

First Performance and Edits

The first live performance of my transcription of *Invention in Twelve Tones* occurred on May 2, 2017 at 1:30pm in the Organ Hall at the University of North Carolina at Greensboro. Three flutists performed: Abigail Simoneau on piccolo, Amanda Swaim on flute, and Krisztina Dér on bass flute. All three performers had an individual microphone (attached to a stand), which then filtered sound through the patch and sent out the reverberation effect via speakers (see Chapter 3).

I was informed about any necessary adjustments in notation for my transcription in the rehearsals leading up to the inaugural performance. These rehearsals also offered a chance to workshop and experiment with the Max patch. I used the information gathered from my peers in those rehearsals to modify both the score and patch.

Three versions of my newly notated score exist (Versions 1, 2, and 3). Version 1 was utilized in the first performance in 2017. Version 2 was utilized in a second draft, and Version 3 is seen in Appendix A.

Timing among the three performers was a primary critique of the Version 1 score. Version 1 was completely spatially notated without barlines (see Figure 4.7.). It did not provide information throughout the score to indicate tempo, or how long each section should last. Without any checkpoints along the way, it made the score difficult to follow and adequately execute; a revision was essential.

To approach these issues in Version 2, each line of music became representative of 5 seconds of time. This corresponded with Luening's original recording, and the time was notated on the top left corner of each line. An example of Version 2 can be seen in Figure 4.8.

Figure 4.7. Excerpt from *Invention in Twelve Tones Score*, Version 1

Figure 4.8. Excerpt from *Invention in Twelve Tones Score*, Version 2

Version 3 of the score utilized the idea of timing in further detail (see Figure 4.9). While breaking each line into 5 seconds of music was a good start in Version 2, it left some measures spaced out and still difficult to follow. To resolve that issue, bar lines were utilized, and direct timing is labeled above each measure. Not only does this save space and condense the score, it is streamlined and significantly easier to follow.

It is also important to note that sections of the score are white, displaying blank gaps, but that does not mean no sound is occurring. When a note is played, the Max patch provides reverb. Instead of silence in those gaps, the effect of reverb will still be occurring and sounding through the speakers.

The image shows two staves of musical notation. The top staff is for Piccolo, the middle for Flute, and the bottom for Bass Flute. The first staff has three measures, each labeled with a 5-second timing interval above it. The Flute part has a dynamic marking of *mp* (dynamics same throughout). The Bass Flute part also has a dynamic marking of *mp* (dynamics same throughout). The second staff has three measures, each labeled with a timing interval above it: 8", 6", and 6". The Piccolo part has a dynamic marking of 4. The Flute part has a dynamic marking of 3. The Bass Flute part has a dynamic marking of 3.

Figure 4.9. Excerpt from *Invention in Twelve Tones Score*, Version 3

In Figure 4.9, dynamic markings are seen with the comment “dynamics same throughout”. Luening did not provide any dynamic markings in his original manuscript, nor do we hear many dynamic contrasts in the recording of the piece. The music may naturally become louder when all three flutes are playing. That is why I notate for the players to consistently play at a mezzo-piano dynamic.

Rhythm

Rhythm was another barrier faced when creating this transcription. In his original score, Luening notated the Theme and Variations using specific rhythmic patterns (see Figure 4.1.) Because Luening improvised and then layered the flute lines, the piece itself does not fall into a traditional meter. Additionally, he did not notate barlines or meter in his original manuscript.

I had two options with regards to rhythmic notation. First, I could use traditional rhythmic values and ignore Luening’s altogether. Second, I could use Luening’s rhythmic values but utilize spatial notation. Ultimately, I chose to stick with the rhythmic values that Luening notated in his original score and use spatial notation. I sought to keep the integrity of Luening’s initial notation of the Theme and Variations.

When listening to how Luening plays the “Theme” and “Variations” in his recording, you may notice that he repeats specific gestures and their shape is consistently the same. The overall speed of the gestures (augmentation and diminution) is what changes throughout the work.

CHAPTER V

SUMMARY

Summary

The original recording of *Invention of Twelve Tones* is ‘fixed,’ meaning that the music does not include any live electronics or performers. This project served to provide a different option. Instead, live sounds (flutes) will be modified by electronic means (computer) in real time.

In the beginning stages of this project, three goals came to mind that would serve as the outline in completing the project and evaluating its success.

Question 1: Can *Invention in Twelve Tones* be transcribed? Luening’s original manuscript did not serve as an appropriate score to accompany a performance of this piece. Therefore, a “performance ready” score was prepared through transcription of Luening’s recording. The work was initially performed in 2017, and multiple score revisions were created to improve it further.

Question 2: How do we recreate the reverb that Luening utilized in his recording? To achieve this, a Max patch was built and used in conjunction with performance of the score to create the effect of reverberation.

Question 3: Will *Invention in Twelve Tones* have any impact on the flute repertoire? My overarching hope is that this project serves as inspiration for other musicians to seek out ways to revive lost electroacoustic music of the last century.

Luening's *ITT* is a historically important example of electroacoustic music and the early development of this new medium. The transcription and Max patch can be shared through email (abby.simoneau@gmail.com) or by visiting my website (abbysimoneau.com).

Additionally, although Luening is best known for his electronic works, he wrote a significant number of solo and chamber music. Several works include flute, such as *Ach Wer Bringt die Schönen Tage* (soprano, flute, piano), *Canon per tre Flauti* (flute trio), *Second Suite for Flute* (solo flute), and *Variations on Yankee Doodle* (piccolo, piano), among others.⁶⁷ These works are easily accessible in print form or digital download, making them suitable additions to the flute repertoire.

Implications for Further Research

The processes outlined in this dissertation can serve as a guide for revitalizing other tape music of this time. Further research can begin with the creation of scores and patches for Luening's *Low Speed* and *Fantasy in Space*. Once completed, a performance of Luening's complete "1952" works could take place. Accessible scores and Max patches would provide flutists the ability to perform these works, adding new, diverse repertoire to the catalog.

⁶⁷ "Otto Luening," American Composers Alliance, accessed February 29, 2020, <https://composers.com/otto-luening?>.

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APPENDIX A

TRANSCRIPTION: SCORE TO *INVENTION IN TWELVE TONES*

(begins next page)

Invention in Twelve Tones

Otto Luening
trans. Abigail Simoneau

Instrumentation:

Piccolo
Flute
Bass Flute

Performance Notes:

1. Straight line following notehead indicates to extend the sound beyond the notated rhythm.
2. Notated rests denotes silence.
3. Suggested timing in seconds appears above or before each measure.

Invention in Twelve Tones

Otto Luening
trans. Abigail Simoneau

Musical score for measures 1-3. The score is for Piccolo, Flute, and Bass Flute. Measure 1 has a 5" bracket above it. Measure 2 has a 5" bracket above it. Measure 3 has a 5" bracket above it. The Flute part starts with a whole note G4, followed by a quarter rest, then a quarter note F4, and a quarter note E4. The Bass Flute part starts with a whole note G3, followed by a quarter rest, then a quarter note F3, and a quarter note E3. The dynamic marking *mp (dynamics same throughout)* is present in both the Flute and Bass Flute staves.

Musical score for measures 4-6. The score is for Piccolo (Picc.), Flute (Fl.), and Bass Flute (B. Fl.). Measure 4 has a 4 above it and an 8" bracket above it. Measure 5 has a 6" bracket above it. Measure 6 has a 6" bracket above it. The Flute part has a triplet of eighth notes (G4, F4, E4) in measure 4. The Bass Flute part has a triplet of eighth notes (G3, F3, E3) in measure 5.

Musical score for measures 7-8. The score is for Piccolo (Picc.), Flute (Fl.), and Bass Flute (B. Fl.). Measure 7 has a 7 above it and a 10" bracket above it. Measure 8 has a 6" bracket above it. The Flute part has a whole note chord (G4, F4) in measure 7. The Bass Flute part has a triplet of eighth notes (G3, F3, E3) in measure 8.

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4

9

10"

4"

Picc.

Fl.

B. Fl.

mp (dynamics same throughout)

measures 11-20 are all 5" in length

11

Picc.

Fl.

B. Fl.

12

Picc.

Fl.

B. Fl.

13

Picc.

Fl.

B. Fl.

14 Picc. 3 5

Fl.

B. Fl.

Detailed description: This system covers measures 14 and 15. The Piccolo part (top staff) features a complex melodic line with triplets and slurs. The Flute part (middle staff) is mostly silent, with a few notes in measure 15. The Bass Flute part (bottom staff) plays a simple harmonic accompaniment.

15 Picc. 3 3 3

Fl.

B. Fl.

Detailed description: This system covers measures 15 and 16. The Piccolo part continues with intricate patterns, including triplets and slurs. The Flute part has a few notes in measure 15. The Bass Flute part provides a steady accompaniment.

16 Picc. 3

Fl.

B. Fl.

Detailed description: This system covers measures 16 and 17. The Piccolo part has a more active role with slurs and triplets. The Flute part is mostly silent. The Bass Flute part continues with its accompaniment.

17 Picc.

Fl.

B. Fl.

Detailed description: This system covers measures 17 and 18. The Piccolo part has a very active role with many slurs and triplets. The Flute part has a few notes in measure 17. The Bass Flute part continues with its accompaniment.

6

18

Picc.

Fl.

B. Fl.

19

Picc.

Fl.

B. Fl.

20

Picc.

Fl.

B. Fl.

21

Picc.

Fl.

B. Fl.

5"

5"

23 5" 5" 7

Picc.

Fl.

B. Fl.

This system contains measures 23 through 27. The Piccolo part has two measures, each with a 5-measure bracket above it. The Flute part has two measures, with a 5-measure bracket above the first and a 3-measure triplet in the second. The Bass Flute part has two measures, with a 5-measure bracket above the first and a 3-measure triplet in the second.

25 4" 6"

Picc.

Fl.

B. Fl.

This system contains measures 25 through 29. The Piccolo part has two measures, with a 4-measure bracket above the first and a 6-measure bracket above the second. The Flute part has two measures, with a 3-measure triplet in the first and a 3-measure triplet in the second. The Bass Flute part has two measures, with a 3-measure triplet in the second.

27 5" 5"

Picc.

Fl.

B. Fl.

This system contains measures 27 through 31. The Piccolo part has two measures, each with a 5-measure bracket above it. The Flute part has two measures, with a 3-measure triplet in the first and a 3-measure triplet in the second. The Bass Flute part has two measures, with a 3-measure triplet in the second.

29 5" 5"

Picc.

Fl.

B. Fl.


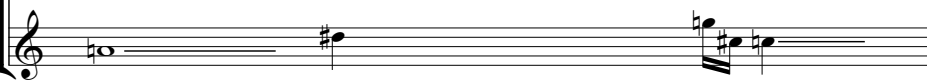
This system contains measures 29 through 33. The Piccolo part has two measures, each with a 5-measure bracket above it. The Flute part has two measures, with a 3-measure triplet in the first and a 3-measure triplet in the second. The Bass Flute part has two measures, with a 3-measure triplet in the first and a 3-measure triplet in the second.

measures 31-40 are all 5" in length

8

Picc. 
 Fl. 
 B. Fl. 

Measures 31-40 are all 5" in length. This system shows measure 31. The Piccolo part features a melodic line with a triplet of eighth notes. The Flute part has a descending eighth-note scale. The Bass Flute part has a simple harmonic accompaniment.

Picc. 
 Fl. 
 B. Fl. 

Measures 31-40 are all 5" in length. This system shows measure 32. The Piccolo part has a more complex melodic line with a triplet. The Flute part has a simple harmonic accompaniment. The Bass Flute part has a simple harmonic accompaniment.

Picc. 
 Fl. 
 B. Fl. 

Measures 31-40 are all 5" in length. This system shows measure 33. The Piccolo part has a melodic line with a triplet. The Flute part has a simple harmonic accompaniment. The Bass Flute part has a simple harmonic accompaniment with a dashed line under the final two notes.

Picc. 
 Fl. 
 B. Fl. 

Measures 31-40 are all 5" in length. This system shows measure 34. The Piccolo part has a melodic line with a triplet. The Flute part has a simple harmonic accompaniment. The Bass Flute part has a simple harmonic accompaniment with a dashed line under the final two notes.

35 9

Picc. 

Fl. 

B. Fl. 


36

Picc. 

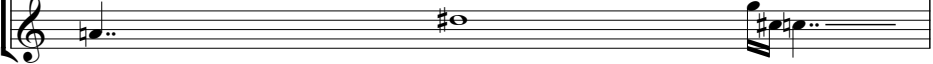
Fl. 

B. Fl. 

37

Picc. 

Fl. 

B. Fl. 

38

Picc. 

Fl. 

B. Fl. 


10 39

Picc. 

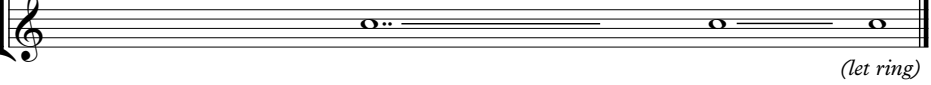
Fl. 

B. Fl. 

40

Picc. 

Fl. 

B. Fl. 

APPENDIX B

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