2018

# The Future of Futurism: From Noise Intoners to Noise Taction

Diana Tosca
dtosca@wellesley.edu

Follow this and additional works at: https://repository.wellesley.edu/thesiscollection

The Future of Futurism: From Noise Intoners to Noise Taction


Diana Tosca




Submitted in Partial Fulfillment
of the
Prerequisite for Honors
In Music
under the advisement of Jenny O. Johnson




April 2018

# Introduction

In the early 20th century, Italian Futurists became interested in expanding the definition of music to include sounds previously considered non-musical--sounds often described as 'noise.' The Futurists embraced a machine-filled, noisy future. The *intonarumori* (noise intoner) were a set of instrument created by the Futurist artist Luigi Russolo. They contained bell-like components, levers, and switches, which produced several categories of noises. Russolo wrote the *Art of Noises* (1913)*, where he categorized noise into six different groups; the *intonarumori* allows for the player to control the pitch and sound of the theses noises. Scores and pieces were created for the set of instruments by Russolo. My thesis project brings an interdisciplinary approach to Futurism, combining Computer Science and Music, by reconstructing the *intonarumori* using new interactive surface technology unavailable to Russolo (implementing the idea of modernity that Futurism embraced) and reflecting on the principles of Futurist music.

I am transforming the implementation of the *intonarumori* from acoustic to purely digital using the MultiTaction surface at the Wellesley College Human Computer Interaction Lab. Unlike Russolo, who only had acoustic technology available to him, we are in a time where digital technology is integrated into daily life. Tabletop surfaces allow for another level of user interaction with the device and are an emerging technology in the world of Tangible User Interfaces (TUI); they have not yet reached availability to the general consumer public. Although large scale interactive surfaces have only been studied in a research environment, they are expected to become integral to the field of Human Computer Interaction. Using the MultiTaction surface for this project allows large scale

collaborative surfaces to be examined in a musical interface context. The MultiTaction surface permits for a level of abstraction between the creation of the instrument and the sounds it creates, similar to the black box structure of the original set of instruments. Using the MultiTaction surface provides a tangible audio interface for the *intonarumori*. Eliminating the acoustic component of the original *intonarumori* by using the MultiTaction surfaces gives it a greater sense of modernity, an essential aspect of the Futurist manifestos.

The significance of the *intonarumori* with regards to both the Futurist movement and music history is in challenging the established idea of what music is, which was mostly comprised of traditional melodic sounds. What was considered music in the early 20th century rarely incorporated noise, until more experimental approaches to sound began emerging with Futurism in the early 1900s. The *intonarumori* was the instrument that defined true Futurist music, breaking away from the past and traditions. The beauty of the *intonarumori* is that it bridges the gap between sound and music. It takes sounds considered to be "noise" and gives the performer control over them. It gives them the power to harness these noises found in nature and make them more "musical." The reconstruction of the instrument would contribute to the music field by implementing the future of sound as Futurists envisioned it.

In the first chapter of this thesis, I will be giving more background on the history of Futurism and its relationship to music, analyzing the founding manifesto of Futurism, the successive manifestos written about Futurist Music, and some Futurist music pieces. In the second chapter, I will discuss the importance of noise in Futurism and how it relates to war,

chance, and the modern musical score. In the third chapter, I will give a background on the technologies used in this thesis project, discuss the code structure and graphical user interface of the application, and briefly discuss my view of Futurism and its impact in this modern age.

# A Destructive Foundation

The founding principles of Futurism revolved around speed, violence, a "scorn for women", and the destruction of the past.[1] In 1909, Filippo Tommaso Marinetti published his Futurist manifesto "Fondazione e Manifesto del Futurismo" in the Parisian newspaper, *Le Figaro*.[2] In the manifesto, Marinetti praises the "beauty of speed" and the "habit of energy and fearlessness," where speed and energy seem to allude to his love of the rapid movement and power of automobiles and the machine.[3] Marinetti proclaims that Futurism is a movement that "[glorifies] war...militarism, patriotism, the destructive gesture of freedom-bringers, beautiful ideas worth dying for, and scorn for woman,"[4] thereby highlighting the problematic nature of Futurism, whose foundations are both sexist and ageist. As Cinzia Blum describes in *Rhetorical Strategies and Gender*(1990)*,* "the feminine principle is associated with everything Futurism is supposed to fight against: all past traditions in art...the parliamentary system, pacifism."[5] Femininity, according to Blum, is

[1] 1. F.T. Marinetti, "The Founding and Manifesto of Futurism, 1909." in *Futurist Manifestos,* ed. by Umbro Apollonio (New York: Viking Press, 1973), 19 - 24. There are quotes within the manifesto which demonstrate this point. In page 21, Marinetti states that "we affirm that the world's magnificence has been enriched by a new beauty: the beauty of speed." In page 21, Marinetti says that "poetry must be conceived as a violent attack on unknown forces…" to demonstrate Futurism's affinity for violence. In page 22, Marinetti writes "we will glorify war - the world's only hygiene - militarism, patriotism, te destructive gesture of freedom-bringers, beautiful ideas worth dying for, and scorn for women."

[2] 2. Geert Buelens, Harald Arno Hendrix, and Michelangela Monica Jansen, *The History of Futurism: The Precursors, Protagonists, and Legacies*. (Lexington Books, 2012), 2.

[3] 3. Marinetti, "The Founding and Manifesto of Futurism, 1909", 21.

[4] 4. Marinetti, "The Founding and Manifesto of Futurism, 1909", 22.

[5] 5. Cinzia Blum. "Rhetorical Strategies and Gender in Marinetti's Futurist Manifesto." (*Italica* 67, no. 2, 1990), 198.

described by the Futurist's as "a mark of impotence, disease, and fragmentation".[6] Marinetti "advocated the masculinization of social ethos through war," glorifying violence and denouncing femininity.[7] He describes art as ideally "[being] violence, cruelty, and injustice," stripping it of its feminized and romanticized associations; poetry becomes nothing more than "a violent attack on unknown forces".[8]

The fact that an Italian man wrote the Futurist manifesto seems ironic given that Italy's identity as a nation is intertwined with the past. Marinetti addressed this in his founding manifesto of Futurism, saying "for too long has Italy been a dealer in second-hand clothes" and Futurists must rid Italy of museums that "cover her like so many graveyards."[9] From this perspective, Futurism becomes construed as "an aspect of Italian nationalism," since for Marinetti the destruction of the past was integral to freeing Italy; Futurism was the way to ensure Italy would no longer be held back by its past.[10] Marinetti wishes to save Italy from the past through "the destruction of all those cultural organizations that tend to perpetuate a life already lived and a culture that has no longer a meaning; museums, art schools, libraries, universities, etc".[11] Marinetti's solution to rid the world of remnants of the past and femininity was violence and destruction. He claimed war is "the world's only

---

[6] 6. Blum, "Rhetorical Strategies and Gender in Marinetti's Futurist Manifesto," 198.

[7] 7. Blum, "Rhetorical Strategies and Gender in Marinetti's Futurist Manifesto," 200.

[8] 8. Marinetti, "The Founding and Manifesto of Futurism, 1909", 21.

[9] 9. Marinetti, "The Founding and Manifesto of Futurism, 1909", 21.

[10] 10. Rosa Trillo Clough. *Futurism: The Story of a Modern Art Movement: A New Appraisal*. (Greenwood Press, 1969), 16.

[11] 11. Clough, *Futurism: The Story of a Modern Art Movement: A New Appraisal,* (Greenwood Press, 1969), 16.

hygiene" and calls for the destruction of institutions that are monuments to the past.[12]

Marinetti questioned why we should look back on the past if what "we want is to break

down the mysterious doors of the Impossible," a phrase in which, once again, Marinetti

makes use of violent rhetoric.[13] He described any effort to connect with the past as a futile

effort in which "you emerge fatally exhausted, shrunken, beaten down."[14] Marinetti even

goes so far as to say they, the Futurists, should be "[thrown] in the wastebasket like useless

manuscripts" by younger men when they turn 40.[15] There is no room for nuance with

Marinetti; he "produced a rigidly binary construction of reality," where femininity and the

past must be abolished.[16]

There are some contradictions within Futurism as articulated by Marinetti and

others. For them, violence is a cleansing mechanism; they are supposedly saving Italy

through the obliteration of the past. Because the past is something so intimately connected

to Italy, they are ultimately destroying part of Italy's identity through their dissociation

with its past. Despite Futurism's staunch opposition to traditionalism, Blum notes that their

"rhetoric and thematics of gender strive to establish more rigid gender codes" which are in

line with past norms.[17] Futurists will only advocate for "the disruption of codes in modern

---

[12] 12. Marinetti, "The Founding and Manifesto of Futurism, 1909", 22.

[13] 13. Marinetti, "The Founding and Manifesto of Futurism, 1909", 21-22.

[14] 14. Marinetti, "The Founding and Manifesto of Futurism, 1909", 23.

[15] 15. Marinetti, "The Founding and Manifesto of Futurism, 1909", 23.

[16] 16. Blum, "Rhetorical Strategies and Gender in Marinetti's Futurist Manifesto," 200.

[17] 17. Blum, "Rhetorical Strategies and Gender in Marinetti's Futurist Manifesto," 200.

chaotic, fragmentary reality" when it fits their rhetoric.[18] Another clear contradiction is in

the question of how Futurism could continue to be about the future, even 110 years later.

Does it become a relic of the past that must be supplanted by a new system? Perhaps there

is a way to revise the ideals of Futurism for the 21st century, reconciling its need to

progress.

## Futurism and Noise Music

Futurism's relationship to noise began with the Futurists' fetishization of machines.

We can observe Marinetti's colorful description of sounds in his Futurist Manifesto: "the

sleek flight of planes whose propellers chatter in the wind like banners and seem to cheer

like an enthusiastic crowd," racing cars are described as "roaring" with "explosive breath,"

and, as Marinetti proclaims in his manifesto, Futurists "will sing of the multicolored,

polyphonic tides of revolution in the modern capitals."[19]

Manifestos were written which addressed Futurism in terms of music. The first was

published by the composer Francesco Balilla Pratella on 11 January 1911 titled *Manifesto of

Futurist Musicians.*[20] In this manifesto, Pratella describes the state of music in Italy at the

time and Futurism's goal of destroying the traditional institution associated with music. In

March of 1911, Pratella went on to write "Futurist Music: Technical Manifesto", wherein he

describes more concretely what can be done to create Futurist music.[21] In this technical

---

[18] 18. Blum, "Rhetorical Strategies and Gender in Marinetti's Futurist Manifesto," 200.

[19] 19. Marinetti, "The Founding and Manifesto of Futurism, 1909", 22.

[20] 20. Francesco Ballila Pratella. "Manifesto of Futurist Musicians." in *Futurism: An Anthology,* ed. by Lawrence Rainey, Christine Poggi, and Laura Wittman, (Yale University Press, 2009), 75.

[21] 21. Francesco Ballila Pratella. "Futurist Music: Technical Manifesto." in *Futurism: An Anthology,* ed. by Lawrence Rainey, Christine Poggi, and Laura Wittman, (Yale University Press, 2009), 75.

manifesto, Pratella endorses the use of *enharmony* in Futurist composition, doing away with consonances and dissonances.[22]  In 1914, Luigi Russolo, a Futurist painter turned musician, wrote *The Art of Noises*, addressed to "Balilla Pratella, Great Futurist Composer," to give his take on Futurist music and the need to expand the field of sound.[23]

Pratella's focus in his manifestos is different from Russolo's, arguing more generally for a breaking away from traditionalism rather than discussing a specific vision for "noise-sound". He begins his "Manifesto of Futurist Musicians" by very blunty stating that he "[addresses himself] to the young" because they are more inclined towards "things that are new, alive, and contemporary."[24] Pratella expresses dissatisfaction with Italian music in its current form, calling it an "almost invariable form of vulgar melodrama, resulting in our absolute inferiority in the face of the futurist evolution of music in other countries."[25] In his conclusion, he emphasizes how Futurist music should remove itself from the past: young composers must "desert musical lyceums, conservatories, and academies," stay away from academia, and "free [their] own musical sensibility from all influences or imitation of the past."[26] Here, we see Pratella's rhetoric is very focused on what he is working against (i.e.

---

[22] 22. Pratella, "Futurist Music: Technical Manifesto," 81. Pratella defines enharmony as the "minute subdivision of a tone." He goes on to elaborate on enharmony, stating that it "makes possible enharmonic intervals that have natural and instinctive intonation and modulation, something unachievable within the present tempered system that we wish to overcome."

[23] 23. Luigi Russolo, *The Art of Noises*, trans. by Barclay Brown, (Pendragon Press, 1986), 23.

[24] 24. Pratella, "Manifesto of Futurist Musicians," 75.

[25] 25. Pratella, "Manifesto of Futurist Musicians," 77.

[26] 26. Pratella, "Manifesto of Futurist Musicians," 79.

traditionalism), but he does not actively provide a clear vision of what he is working

towards.

His second manifesto, the "Futurist Music: Technical Manifesto" describes more

concretely what Futurist music should contain in terms of harmony, rhythm, polyphony,

and noise. Pratella writes that "old scales, the various sensations of major, minor,

augmented, diminished, and even the more recent modes of scales for whole tones are

none other than simple details of a unique harmonic and atonal mode of a chromatic

scale...moreover, we declare that the values of consonance and dissonance are

nonexistent."[27] Here, Russolo is dispelling the notion that these types of chords are nothing

special within the context of Futurist music, but are rather "elements within a single atonal

chromatic mode."[28] Pratella calls the Futurist melody a "synthesis of harmony," using the

term enharmonic to describe the use of microtones within the melody.[29] An internal

contradiction we can observe in this manifesto is how it is constrained by the jargon of

music. Pratella argues that "we must create polyphony in an absolute sense," using "all the

expressive and dynamic values of the orchestra" presuming we are still working in the

context of traditional instrumentation.[30] Pratella goes on to say "we must regard musical

forms as following from and dependent on the generative emotional motifs."[31] In using the

---

[27] 27. Pratella, "Futurist Music: Technical Manifesto," 81.

[28] 28. Pratella, "Futurist Music: Technical Manifesto," 83. With regard to consonances and dissonances, Pratella's idea here is similar to Arnold Schoenberg's later concept of emancipation of the dissonance. However, while Schoenberg is trying to free dissonances, make them more accepted in the musical world, Pratella is advocating for getting rid of the concept of consonances and dissonances all together.

[29] 29. Pratella, "Futurist Music: Technical Manifesto," 81.

[30] 30. Pratella, "Futurist Music: Technical Manifesto," 83.

[31] 31. Pratella, "Futurist Music: Technical Manifesto," 83.

word "motif," however, the Futurists are once again bound to the world of musical jargon. Pratella cannot escape being a musician first and a Futurist second. He wants to push the boundaries of Futurist music, but can only go so far when he is still viewing things in terms of harmonies, dissonances, motifs, and polyphony.

In his manifesto *The Art of Noises*, Russolo states that "this evolution of music is comparable to the multiplication of machines," arguing for the importance of machines in the creation of noises.[32] Compared to traditional musical sounds, Russolo argues that "...we delight much more in combing in our thoughts the noises of trams, of automobiles, engines, of carriages and brawling crowds."[33] It is, therefore, no surprise that some of the first pieces of Futurist noise-music were titled "Meeting of Automobiles and Airplanes" or "Awakening of a city."[34] For the Futurists, noise, the machine, and violence were all related, and "the noises of machine guns, bombs, and shrapnel became new words in a complex poetical vocabulary."[35] Russolo quotes Marinetti's sentiment that it is "a joy to hear to smell completely taratatata of the machine guns screaming a breathlessness";[36] those onomatopoeias created by Marinetti were taken from machines of modern warfare and the industrial age.[37] In Pratella's manifesto "Futurist Music: Technical Manifesto", Pratella also argues that music "must render...the grand industrial factories, trains, transatlantic

---

[32] 32. Russolo, *The Art of Noises*, 24.

[33] 33. Russolo, *The Art of Noises*, 25.

[34] 34. Barclay Brown Introduction to *The Art of Noises,* by Luigi Russolo, trans. Barclay Brown, (Pendragon Press, 1986), 1 - 22.

[35] 35. Brown Introduction to *The Art of Noises,* 3.

[36] 36. Russolo, *The Art of Noises*, 26.

[37] 37. Brown Introduction to *The Art of Noises,* 17.

steamers, battleships, automobiles, and airplanes," and goes on further to say that music must "add the domination of the machine and the victorious reign of electricity to [its] great central motifs."[38] We continuously see Marinetti, Russolo, and Pratella glorifying the machine's ability to create noise.

Throughout *The Art of Noises,* Russolo discusses noise and the machine. In the very first sentence*,* Russolo states that "with the invention of machines, Noise was born."[39] He describes the machine as creating "such a variety and contention of noises" and boldly claims "that pure sound in its slightness and monotony no longer provokes emotion."[40] He argues that musical progress demands sounds that are more dissonant, harsh, and complicated in order to attain music close to "noise-sound."[41]  Russolo believed that in order to "excite and stir our sensibilities," music must move toward "complicated polyphony" and we must expand the "timbres and colors" used in instruments.[42]

Futurism defines a relationship between noise and nature. As Pratella states in "Futurist Music: Technical Manifesto": "music must contain all the new attitudes of nature, always tamed by man in different ways through incessant scientific discoveries."[43] Russolo's instruments created noises similar to those in nature - wind, rain, thunder.[44]

---

[38] 38. Pratella, "Futurist Music: Technical Manifesto," 83.

[39] 39. Russolo, *The Art of Noises*, 23.

[40] 40. Russolo, *The Art of Noises*, 24.

[41] 41. Russolo, *The Art of Noises*, 24.

[42] 42. Russolo, *The Art of Noises*, 24.

[43] 43. Pratella, "Futurist Music: Technical Manifesto," 83.

[44] 44. Brown Introduction to *The Art of Noises,* 19.

Although Russolo states that "if we overlook the exceptional movements of earth's crust, hurricanes, storms, avalanches, and waterfalls, nature is silent."[45] This statement is somewhat contradictory, given that those sounds are still a part of nature. Here, it seems that Russolo is equating noises to grandiose and destructive events, much like the explosive sounds heard in war.

Comparing the music of Russolo and Pratella (all made with acoustic instruments), we see a difference in their view of Futurist music. Pratella wrote the piece "La Guerra: La Battaglia"; the title itself alludes to the Futurist fetishization of war and violence. The piece centers on one piano playing dissonant chords, invoking feelings of motion and dynamism. There are several rhythmic ostinati in short sections of the piece, which, despite being irregular, still create a sense of unity because of their motion and speed. The piece does not incorporate spatiality, but creates a two dimensional sound for the piano, mostly utilizing rhythmic variations and dissonances. Pratella's own piece does not utilize his idea of creating a sound collage with noises, but instead resemble a more traditional idea of music: it is a piece for an acoustic instrument that does not utilize noise. Although Pratella's music could be considered dissonant for the time, he is not incorporating his ideas of enharmony that he wrote about in his technical manifesto. The chords he uses, while being dissonant, are not what the Futurist would call "noise-sound."

Russolo's 1914 piece "Risveglio di una Città,"[46] (Awakening of a City), creates a sound collage using the *intonarumori* (Musica Futurista: The Art of Noises). Russolo developed a score with a different system of notation for the intonarumori, where

---

[45]45. Russolo, *The Art of Noises*, 23.

[46]46*. An Anthology of Noise & Electronic Music*. Sub Rosa, 2005, CD.

"traditional notes such as crotchets and semi-quavers would be replaced by a number system, and the continuity of notes indicated by a solid line."[47] It was performed in the Teatro dal Verme, with two other pieces for the *intonarumori*, in 1914.[48] Marinetti described the crowd's reaction to the *intronarumori* as analogous to "showing the first steam engine to a herd of cows," expressing his frustration that the audience did not appreciate its ingenuity.[49] The piece begins with percussive noises meshed together with rumbles and scrapes. The piece is reminiscent of the construction of a city, using sounds one could have heard during the industrial revolution. Between segments of the piece, there are silences. Around 1:30 there is a crescendo in the piece, where the scrapes become louder, followed by a diminuendo. The sounds appear to be disjointed, but they actually create interest in the listener's ear because of their spontaneity. This is consistent with Russolo's theory in *The Art of Noises* where he argued that "noise, therefore, is familiar to our ear, and has the power of immediately recalling life itself."[50]

Marinetti wrote what could be considered Futurist "noise-sound" pieces in 1933, creating "five short experimental radio compositions".  The sound piece, which can be described  as "abstract and programmatic," was not actually realized until 1978 in a recording by composer Daniele Lombardi; before that, only the scores existed.[51] In "An Acoustical Landscape," the first composition, sounds of water, a fire, and a bird can be

---

[47] 47. Caroline Tisdall and Angelo Bozzola, *Futurism*,(London: Thames and Hudson, 1977), 116.

[48] 48. Tisdall and Bozzola, *Futurism*, 118.

[49] 49. Tisdall and Bozzola, *Futurism*, 118.

[50] 50. Russolo, *The Art of Noises*, 27.

[51] 51. Buelens, Hendrix, and Jansen, *The History of Futurism,* 283*.*

heard.[52] The cracklings last for one second each in between the other sounds, which creates rhythmic continuity. The segment ends abruptly with the chirping of a blackbird. The sounds together interrupt each other, which are "at the same time connectors and modulators of the degree of intensity of the lapping [of water]."[53] In the second composition "Drama of Distances," segments of music and sounds play from across the world.[54] The segment features marching music in Rome, a boxing match in New York, and street noises in Milan.[55] The piece is a commentary about the transmission of sounds through the radio, which "immensifies space" artificially.[56] In the third piece, "Silences speak among themselves," sounds of silences alternate with the pitches of several instruments, the sound of a baby, and the sounds of a young girl.[57] The piece is meant to play with the listener's expectations, making them question whether the silence is interrupting the sounds or vice versa.[58] The fourth segment, "Battle of Rhythms," "intensifies the exchange between interruptions and intervals, silences and sounds," and mixes together silence and sounds more aggressively than in the previous piece.[59] Marinetti continues the theme of playing with the listener's expectations of what music, noise, sound, and interruptions are; the juxtaposition of noise and silence draws attention to the

[52] 52. Buelens, Hendrix, and Jansen, *The History of Futurism,* 283.

[53] 53. Buelens, Hendrix, and Jansen, *The History of Futurism,* 288.

[54] 54. Buelens, Hendrix, and Jansen, *The History of Futurism,* 288.

[55] 55. Buelens, Hendrix, and Jansen, *The History of Futurism,* 288.

[56] 56. Buelens, Hendrix, and Jansen, *The History of Futurism,* 288.

[57] 57. Buelens, Hendrix, and Jansen, *The History of Futurism,* 289.

[58] 58. Buelens, Hendrix, and Jansen, *The History of Futurism,* 289.

[59] 59. Buelens, Hendrix, and Jansen, *The History of Futurism,* 289.

disparity. The final piece, "Building a Silence," commences after "a minute long silence" from the previous segment; here, building a silence becomes similar to building a wall, while still utilizing sounds to create these silences.[60]

## Intonarumori

Russolo's core argument in *The Art of Noises* is that "Futurist composers should continue to enlarge and enrich the field of sound."[61] He claimed that "musical sound is too limited in its variety of timbres"[62] and we must expand on it with noise, given its "surprising variety."[63] Russolo sought to harness the power of noise to create music to "give pitches to these diverse noises" and "[regulate] them harmonically and rhythmically."[64] He ends the manifesto with an exciting vision for music, where a city's machines "can one day be given pitches, so that every workshop will become an intoxication orchestra of noises."[65]

To realize his vision, Russolo created a series of noise instruments, the *intonarumori* (noise intoners). Russolo divides noises into six families:

1. Roars, Thunderings, Explosions, Hissing roars, Bangs, Booms
2. Whistling, Hissing, Puffing
3. Whispers, Murmurs, Mumbling, Muttering, Gurgling
4. Screeching, Creaking, Rustling, Buzzing, Crackling, Scraping
5. Noises obtained by beating on metals, woods, skins, stones, pottery, etc.
6. Voices of animals and people, Shouts, Screams, Shrieks, Wails, Hoots, Howls, Death rattles, Sobs[66]

---

[60] 60. Buelens, Hendrix, and Jansen, *The History of Futurism,* 290*.*

[61] 61. Russolo, *The Art of Noises*, 28.

[62] 62. Russolo, *The Art of Noises*, 24.

[63] 63. Russolo, *The Art of Noises*, 25.

[64] 64. Russolo, *The Art of Noises*, 27.

[65] 65. Russolo, *The Art of Noises*, 29.

[66] 66. Russolo, *The Art of Noises*, 28.

With this foundation, Russolo created twelve noise intoners:

> 1) The howler: a noise somewhere between that of a traditional string instrument and that of a siren
>
> 2) The roarer: a rumbling noise in the low-pitched instruments; not clearly described in the higher instruments
>
> 3) The crackler: a metallic crackling noise in the high-pitched instruments; a strident metallic clashing in the lower ones
>
> 4) The rubber: a metallic scraping or rubbing sound: less forceful than the noise of the preceding instruments
>
> 5) The hummer: a noise resembling the sound of an electric motor or the dynamos of electric power plants
>
> 6) The gurgler: a noise like that of water running through the raingutters of a house
>
> 7) The hisser: a hissing or roaring noise like that produced by heavy rain
>
> 8) The whistler: a noise like the howling or whistling of the wind
>
> 9) The burster (1): a noise like that of an early automobile engine
>
> 10) The burster (2): a noise like that of dishes or pottery falling and shattering
>
> 11) The croaker: a noise like the croaking of frogs
>
> 12) The rustler: a noise resembling the rustling of leaves or of silk[67]

The exact specifications of each instrument are unknown, but based on diagrams and speculation, we have ideas about how some of the instrument might work. The basic construction of several of the instruments involve variations on indented metal rods rubbed against strings or a metal disk turning a wire connected to a drumstick.[68]

---

[67] 67. Brown, Introduction to *The Art of Noises,* 12.

[68] 68. Brown, Introduction to *The Art of Noises,* 12.
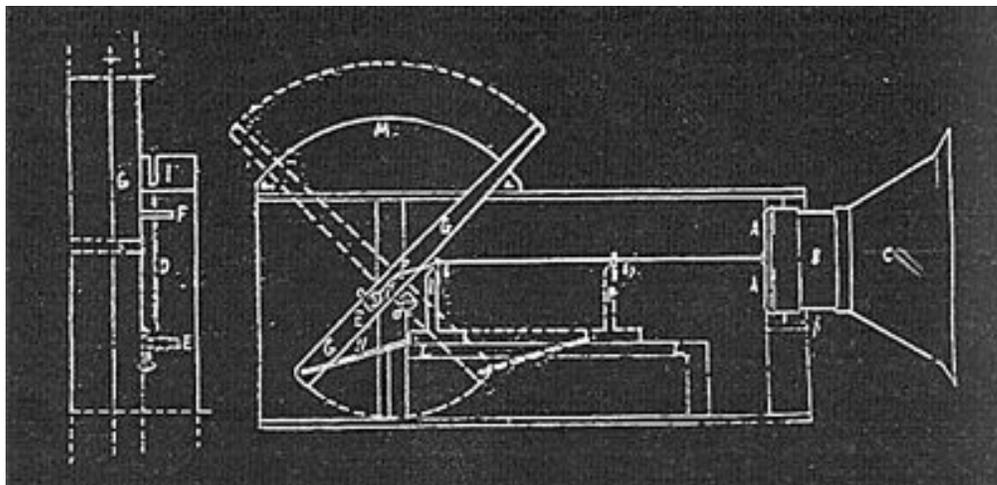
Fig. 1- Drawing of an *intonarumori*[69]

The howler, roarer, crackler, and rubber are all constructed similarly. The howler is made of a wood disk with evenly roughened rims, the roarer has a wood disk with indentations, the crackler has a metal disk with sharp edges, while the rubber has a metal disk with shallow indentations.[70] Regarding the hummer, there is photo evidence to show how this instrument works; a small steel ball vibrated against a drum skin with an electric motor.[71] The gurgler also has a small steel ball vibrating but against a wire instead of a drum skin; the hisser works the same as a gurgler but it controlled with a level.[72] For the whistler, three organ pipes of different lengths (tuned to the tonic, major third, and fifth) are joined to a wind pipe with a drum skin, which is connected to a metal roller that puts

---

[69]69. Valerio Saggini, "Intonarumori" last modified February 21, 2004. http://www.thereminvox.com/article/articleview/116.html

[70]70. Brown Introduction to *The Art of Noises,* 13.

[71]71. Brown Introduction to *The Art of Noises,* 13.

[72]72. Brown Introduction to *The Art of Noises,* 13.

pressure on the drum skin.[73] We know that the burster is also built with drum skins; aside from that, the construction of the burster, croaker, and rustlers are unknown.[74] Russolo's ultimate goal was to combine the noise instruments, creating a *rumoraromnio* (noise harmonium); by 1924, the first version of the instrument was completed.[75] The first and second versions of the noise harmonium had keys, but did not produce all twelve timbres of the original set of *intonarumori*.[76] The third version, built in 1927, did include all twelve timbres of the *intonarumori* but worked with levers instead of keys; the fourth and final version also had levers.[77]

Two months after the creation of the *intonarumori*, Marinetti hosted a performance of the *intonarumori* in his home.[78] There, he performed the two pieces *Meeting of Automobiles and Airplanes* and *Awakening of a City*.[79] In 1921, he performed concerts in Paris at the Théâtre des Champe Elysées with an orchestra, though Russolo himself was not a fan of the produced effect.[80] Russolo preferred improvisation as the more appropriate method to create music with his instruments.[81] Today, none of these instruments remain.[82]

---

[73] 73. Brown, Introduction to *The Art of Noises,* 14.

[74] 74. Brown, Introduction to *The Art of Noises,* 14.

[75] 75. Brown, Introduction to *The Art of Noises,* 7.

[76] 76. Brown Introduction to *The Art of Noises,* 15.

[77] 77. Brown, Introduction to *The Art of Noises,* 15.

[78] 78. Brown, Introduction to *The Art of Noises,* 4.

[79] 79. Brown, Introduction to *The Art of Noises,* 4.

[80] 80. Brown, Introduction to *The Art of Noises,* 4.

[81] 81. Brown, Introduction to *The Art of Noises,* 18.

[82] 82. Brown, Introduction to *The Art of Noises,* 10.

# Noise: Variations on a Sound

*"Sound is all our dreams of music. Noise is music's dreams of us."*

-Morton Feldman[83]

The Futurist held noise in high regard because, for the Futurists, noise was a means of subversion,[84] a product of war and the machine. Russolo devoted an entire book to *The Art of Noises,* including three chapters describing noises in life and nature, noises in war, and how to notate noise. Nowhere in the book, however, is there a straightforward and singular definition of what noise is; only examples and qualities of it are provided Therefore, we are faced with an important question: for the Futurists, what is "noise"?

Noise can be several things: interference, sounds, unpleasantness. According to the Merriam-Webster online dictionary, noise can be defined as a "loud, confused, or senseless shouting or outcry - the *noise* of the rioters."[85] The example, "the *noise* of the rioters," highlights the subversion that, for Jacques Attali in *Noise: The Political Economy of Music* (1977), noise represents - noise is related to power, violence and war. This concept is also alluded to in Douglas Kahn's argument in *Noise,Water,Meat* (originally published in 1999) that "...in the history of avant-garde noise, war is not the continuation of politics through

---

[83] 83. Morton Feldman, "Sound, Noise, Varèse, Boulez," in *Audio Culture.: Readings in Modern Music*, ed. by Christoph Cox and Daniel Warner, (Continuum, 2004), 15 - 16.

[84] 84. Jacques Attali, *Noise: The Political Economy of Music*, trans. by Brian Massumi (University of Minnesota Press, 2014), 122. Attali elaborates on this point, saying "Today, every noise evokes an image of subversion. It is repressed, monitored...it is possible to judge the strength of a political power by its legislation on noise and the effectiveness of its control over it."

[85] 85*. Merriam-Webster Dictionary, "*Noise." accessed April 26, 2018.
https://www.merriam-webster.com/dictionary/noise

other means; war is the major political source that artistic nosies echoes."[86] At the

beginning of "The Art of Noises Futurist Manifesto", Russolo claims that "in the 19th

Century, with the invention of machines, Noise was born."[87] Attali makes an interesting

connection to noise and the machine, stating that "since noise is a source of power, power

has always listened to it with fascination."[88] Attali goes on to say that "it is necessary to ban

subversive noise because it betokens demand for cultural autonomy."[89] Noise is what gives

machines and subversion their power, since "a network can be destroyed by noises that

attack and transform it."[90]

     In *Noise: the Political Economy of Music*, Attali defines noise in relation to music and

its role in society. Attali describes music in terms of noise, stating that "it is thus necessary

to imagine radically new theoretical forms, in order to speak to new realities. Music, the

organization of noise, is one such form."[91] There is a significance in calling music an

"organization of noise" rather than an "organization of sounds," implying that noise is not

an inherently separate entity from music. He goes one step further in asserting that music

is noise, arguing that "the only thing that primitive polyphony, classical counterpoint, tonal

harmony, twelve-tone serial music, and electronic music have in common is the principle of

---

[86] 86. Douglas Kahn, *Noise, Water, Meat : History of Voice, Sound, and Aurality in the Arts.* (Cambridge: MIT Press, 2015), 24.

[87] 87. Russolo, *The Art of Noises*, 23.

[88] 88. Attali, *Noise: The Political Economy of Music*, 6.

[89] 89. Attali, *Noise: The Political Economy of Music*, 7.

[90] 90. Attali, *Noise: The Political Economy of Music*, 28.

[91] 91. Attali, *Noise: The Political Economy of Music*, 4.

giving form to noise in accordance with changing syntactic structures."[92] Throughout his second chapter, *Sacrificing*, Attali describes the relationship between noise and music in violent terms. Noise is a "weapon of death" and "music responds to the terror noise" with its need to subdue the disorder in the dissonance.[93] He argues that music is responding to the disorder that it creates itself; music creates dissonances in order to resolve them, creating a "game of power."[94]

The Futurists were fixated on war as a means of producing noise and violence. Attali describes noise as the"[rumblings] of revolution. Sounds of competing powers. Clashing noises, of which the musician is the mysterious, strange and ambiguous forerunner - after having been long imprisoned, a captive of power."[95] Furthering the links between noise, violence, and the machine, Kahn states that "noise in the avant-garde was linked to the sounds of military combat, the specter of incursion of technology and industrialism."[96]  In Kahn's second chapter of *Noise, Water, Meat,* titled "Noises of the Avant-Garde," he devotes several paragraphs to discussing noise and war among the Futurists. He emphasized the importance of war in the early avant-garde scene; war was a "rhetorical device" to represent the inescapable role of noise within the world; because war provided novel noises and this "required new artistic means for their expression"; and, quite simply,

---

[92] 92. Attali, *Noise: The Political Economy of Music*, 9-10.

[93] 93. Attali, *Noise: The Political Economy of Music*, 27-28.

[94] 94. Attali, *Noise: The Political Economy of Music*, 28.

[95] 95. Attali, *Noise: The Political Economy of Music*, 12.

[96] 96. Kahn, *Noise, Water, Meat,* 22*.*

Russolo valued war.[97] The Futurists wanted Italy to intervene in the first World War and began protesting in favor of war, in general, demonstrating outside of the Teatro dal Verme and burning an Austrian flag.[98] Russolo says he "left for the front together with [his] futurist friends, Marinetti, Boccioni, Piatti, Sant'Elia, and Sironi. And I was lucky enough to fight in the midst of the marvelous and grand tragic symphony of modern war."[99] In the chapter "The Noises of War" in *The Art of Noises*, Russolo describes the noises of artillery, the "whistling of the shell," shrapnel, grenades, and machine guns with great enthusiasm. He states the importance of the ear in war, which can be more reliable than the eye.[100] Russolo describes how "from noise, the different calibers of grenades and shrapnels can be known even before they explode. Noises enables us to discern a marching patrol in the deepest darkness, even judging the number of men that compose it."[101]  Kahn makes an interesting observation concerning this section of *The Art of Noises*, where Russolo does not address sounds or noises created by injured humans or animals.[102] For Russolo and the Futurists, this could mean doing away with the human element of noise, letting it become something more powerful represented with the machine. Alternatively, avoiding the discussion of death in war could have been done to mitigate the negative impact of war, focusing only on its grandiose vision of noise.

The second definition of noise in the Merriam Webster dictionary is more comprehensive. The first subsection states that noise "a : SOUND; *especially* : one that lacks

---

[97] 97. Kahn, *Noise, Water, Meat,* 59*.*

[98] 98. Kahn, *Noise, Water, Meat,* 62*.*

[99] 99. Kahn, *Noise, Water, Meat,* 62*.*

[100] 100. Russolo, *The Art of Noises*, 49.

[101] 101. Russolo, *The Art of Noises*, 50.

[102] 102. Kahn, *Noise, Water, Meat,* 63*.*

agreeable musical quality or is noticeably unpleasant - traffic *noise,* engine *noises.*"[103] In

these definitions, noise is put in terms of its negative qualities. In the second and last

subsections, noise is defined as "b : any sound that is undesired or interferes with one's

hearing of something - I couldn't hear him over all the *noise*," and "e : irrelevant or

meaningless data or output occurring along with desired information - The initial data

includes a lot of *noise* that needs weeded out," respectively; this again relates noise to

something negative and unwanted.[104] These three definitions are ones that Russolo fought

against in *The Art of Noises* in the chapter titled "The Noises of Nature and Life (Timbres

and Rhythms)." Russolo refutes a negative definition of noise in saying "...I will be satisfied

if I succeed in convincing you that noise is not always as disagreeable and annoying as you

believe and say, and that for him who *understands* it, noise represents instead and

inexhaustible source of sensations, from one moment to the next exquisite and profound,

grandiose and exaltant."[105]  Kahn makes a similar point in *Noise,Water,Meat*: "we know they

are noises in the first place because they exist where they shouldn't or they don't make

sense when they should."[106] The third subsection in the Merriam-Webster dictionary

defines noise in terms of information theory where it is part of a system, "c : an unwanted

signal or a disturbance (such as static or a variation of voltage) in an  electronic device or

---

[103]103. *Merriam-Webster Dictionary, "*Noise." accessed April 26, 2018.
https://www.merriam-webster.com/dictionary/noise

[104]104. *Merriam-Webster Dictionary, "*Noise." accessed April 26, 2018.
https://www.merriam-webster.com/dictionary/noise

[105]105. Russolo, *The Art of Noises*, 41.

[106]106. Kahn, *Noise, Water, Meat,* 22.

instrument (such as radio or television); *broadly* : a disturbance interfering with the operation of a usually mechanical device or system."[107]

If we think of music as a communication system, one can analyze what noise is within that system. We can use the Shannon-Weaver model, developed in 1948 to model communication[108], to discuss music as a communication system. Shannon gives a model of a communication system in *The Mathematical Theory of Communication* in the following diagram:
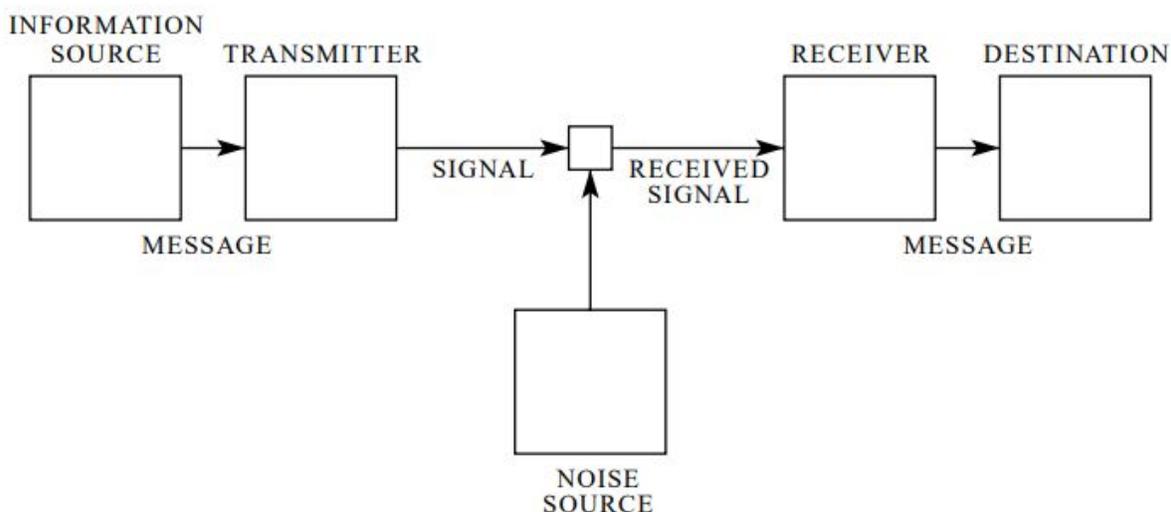


Fig. 1 - The Shannon-Weaver model of communication.[109]

From left to right, the first part of the diagram depicts an *information source*, which Shannon defines as something "which produces a message or sequence of messages to be

---

[107]107. *Merriam-Webster Dictionary, "*Noise." accessed April 26, 2018. https://www.merriam-webster.com/dictionary/noise

[108]108. "Shannon and Weaver Model of Communication" Accessed April 26, 2018. https://www.businesstopia.net/communication/shannon-and-weaver-model-communication

[109]109. Claude Elwood Shannon and Warren Weaver, *The Mathematical Theory of Communication*,(University of Illinois Press, 1999),34.

communicated to the receiving terminal."[110] In a musical example, for this analysis,

consider a violinist reading a Western music score. The mind of the composer would be the

information source; it is their perception and interpretation of what they want the music to

represent before it gets written on sheet music. The message, in this case, is the sheet

music the composer produces to be interpreted by the violinist. The next step is the

*transmitter*, "which operates on the message in some way to produce a signal suitable for

transmission over the channel."[111] In our example, the transmitter is the instrument being

played, the violin. When the musician plays the violin according to the score, the message

becomes a signal. The *channel,* as Shannon describes it, is "the medium used to transmit the

signal from the transmitter to receiver."[112] Here, the channel is the air through which the

sound produced by the violin is propagating. Between the signal being transmitted and

being received, the *noise source* is introduced and "all of these changes in the transmitted

signal are called noise."[113] Within this system, we must consider the Signal to Noise ratio[114]

to determine the usability of a signal. Examples of noise introduced into the system in this

example include any external sound sources that disrupt the dissemination of the violin's

---

[110] 110. Shannon and Weaver, *The Mathematical Theory of Communication*, 33

[111] 111. Shannon and Weaver, *The Mathematical Theory of Communication*, 33.

[112] 112. Shannon and Weaver, *The Mathematical Theory of Communication*, 34.

[113] 113. Shannon and Weaver, *The Mathematical Theory of Communication*, 8.

[114] 114. Daniel Chandler and Rod Munday. "signal-to-noise ratio," *A Dictionary of Media and Communication,* (Oxford University Press. Oxford Reference, 2016), <http://www.oxfordreference.com.ezproxy.wellesley.edu/view/10.1093/acref/9780191800986.001.0001/acref-9780191800986-e-2483>. Signal-to-noise ratio, or SNR is defined by the Oxford's A Dictionary of Media and Communication as "A measure of the capacity of a recording or transmission medium to carry a usable signal which exists below a threshold where it starts to distort and above a threshold where it becomes indistinguishable from background noise."

sound, issues within the message being used (i.e, any misprints with the score), or

problems with the actual transmitter (an out of tune violin or a defective bow). From there,

the receiver is our ears, which turns the variations in pressure in the air created by the

violin into a message our brain can process. Finally, that information reaches its

destination, presumably our brain, which interprets the signal back into a thought.

Weaver describes the three levels of communication problems, all of which

contribute to the noise in the communication path:

> Level A. How accurately can the symbols of communication be transmitted? (The technical problem.)
> Level B. How precisely do the transmitted symbols convey the desired meaning? (The semantic problem.)
> Level C. How effectively does the received meaning affect conduct in the desired way? (The effectiveness problem)[115]

We will focus on examining the problem posed in Level B. In the first part of the music

communication system we have created, a semantic problem is encountered at the early

stage of transforming the information source into a message. The notation system of

Western classical music has already restrained us, predetermining the type of musical

messages we can create. We are given a finite number of staves with only one way to notate

specific pitches. The lowest possible unit of pitch we are allowed to write on the staff is the

semitone; we are unable to notate more precise microtones that can be recreated on the

violin. Therefore, if a composer in wanted to create a score utilizing microtones, for

instance, they would have to find a different way of transmitting the message.

Expanding beyond the Western classical notation in music allows us to consider a

larger set of symbols to convey a wider range of music and a way to notate noise. In our

---

[115]115. Shannon and Weaver, *The Mathematical Theory of Communication*, 4.

analysis of the music communication system, we assumed the message was a discrete

system. But, of course, there are other types of messages (scores in this case) within music

to analyze. As opposed to a discrete system in Western classical music, where there are

distinct notes to be played, one can use graphic notational systems to create a score, which

include continuous systems.

We will consider two examples of music notation systems that differ from Western

classical music. First, we have the score for "Projection 1: for solo cello" (1950) by Morton

Feldman:
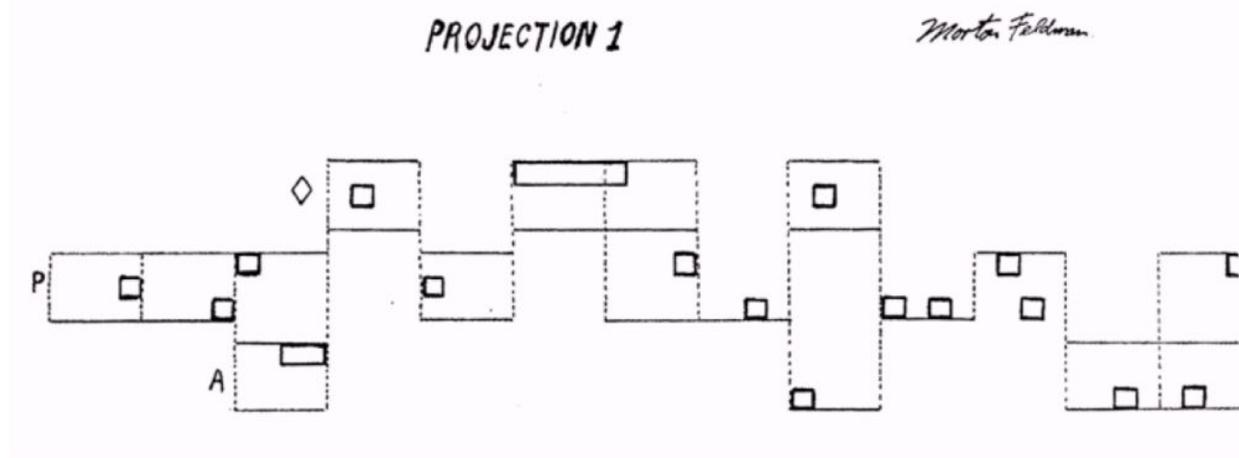


Fig. 2 - Score for Morton Feldman's *Projection 1: for solo cello*[116]

Here, Feldman gives up some control as the composer, allowing the player greater

freedom in choosing what to play. This score divides pitches into three categories: the

boxes toward the bottom indicate low pitches, the middle boxes indicate a middle range,

---

[116]116. Morton Feldman, "Projection 1: for solo cello," (Edition Peters P6945, 1950),
http://davehall.io/wp-content/uploads/2016/05/Morton-Feldman-Projection-50-e1462486131973.png
Accessed April 2018.

and the boxes near the top of score indicate high pitches.[117] Any pitch chosen by the player

can be played within these constraints.[118] The music is precise in some areas but offers

room for interpretation in terms of pitch.[119] Feldman does specify the timbre, since it is a

piece for solo cello, and rhythm, with its placement of where the sounds should occur.[120]

---

[117]117. Ryan Vigil, "Compositional Parameters: "Projection 4" and an Analytical Methodology for Morton Feldman's Graphic Works," (*Perspectives of New Music* 47, no. 1,2009) http://www.jstor.org.ezproxy.wellesley.edu/stable/25652408, 233.

[118]118. Vigil, "Compositional Parameters: "Projection 4," 233.

[119]119. Vigil, "Compositional Parameters: "Projection 4," 233.

[120]120. Vigil, "Compositional Parameters: "Projection 4," 233.

Next, we have the score for "Radio Music" (1956) by John Cage:



Fig. 3 - Score for John Cage's *Radio Music*[121]

At the top of the score, there are instructions for its interpretation. This piece is scored for

8 or less radios. Each radio is tuned to frequencies that Cage specifies in the score, one by

one, for a period of time, with pauses in between sections or at the end of the piece,

---

[121]121. John Cage, *Radio Music,*(New York. Peters Edition EP 6783, 1956), accessed April 2018, http://silakka.fi/esa/cage1.jpg

indicated by blank lines. Cage allows the piece to be controlled by chance; whatever happens to be on the radio, whether that be music, a talk show, or static, is a viable part of the composition.

What both these scores express is chance. This is similar to the fourth subsection of the Merriam-Webster definition of noise which defines noise as "d : electromagnetic radiation (such as light or radio waves) that is composed of several frequencies (see FREQUENCY 3b) and that involves random changes in frequency or amplitude (see AMPLITUDE 1b)."[122] This definition suggests that it is the use of randomness and indeterminacy that gives noise and sound meaning. In the introduction to *The Theory of Mathematical Communication*, Warren Weaver discusses uncertainty in relation to a communication system and the noise being produced within the system. He says that "to be sure, this word information in communication theory relates not so much to what you do say, as to what you could say.  That is, information is a measure of one's freedom of choice when one selects a message."[123] Weaver goes on to explain the issues of noise being introduced into a system, where "the received message contains certain distortions, certain errors, and certain extraneous material…" and how "some of the information is spurious and undesirable and has been introduced via the noise."[124] Weaver acknowledges the functions of probability, indeterminacy, and chance in noise and the communication system.

---

[122]122. *Merriam-Webster Dictionary, "*Noise." accessed April 26, 2018.
https://www.merriam-webster.com/dictionary/noise

[123]123. Shannon and Weaver, *The Mathematical Theory of Communication*, 9.

[124]124. Shannon and Weaver, *The Mathematical Theory of Communication*, 19.

The Shannon-Weaver model assumes that noise is what interferes with the signal. But, as Kahn argues, "the interesting problem arises when *noise* itself is being communicated, since it no longer remains inextricably locked into empiricism but is transformed into an abstraction of another noise."[125] In both Feldman's score and Cage's score, the chance elements introduced into their music (something we could think of as noise) become the signal. Essentially, one can argue that what noise is considered to be depends on the way one chooses to communicate a message. As Attali writes:

> A noise is a resonance that interferes with the audition of a messa in the process of emission. A resonance is a set of simultaneous, pure sounds of determined frequence and differing intensities. Noise, then, does not exist in itself, but only in relation to the system within which it is inscribed: emitter, transmitter, receiver: noise is the term for a signal that interferes with the reception of a message, even if the interfering signal itself has a meaning for the receiver.[126]

If we chose to communicate what can be considered noise in one system, it becomes the signal in that different system, where the noise obtains its own meaning. Attali extends this point, stating that "what noise is to the old order is harmony to the new: Monteverdi and Bach created noise for the polyphonic order. Webern for the tonal order. Lamont [sic] Young for the serial order."[127] To figure out what the "noise" is in these scores, we must instead determine what is interfering with their signals.

Russolo describes ways of notating "noise" in the chapter "Enharmonic Notation" within *The Art of Noises.* He makes the argument that because the *intonarumori* have conquered the enharmonic system, we must make "some modifications in the present method in musical notation...this method as it exists today considers only the subdivision

---

[125] 125. Kahn, *Noise, Water, Meat,* 26*.*

[126] 126. Attali, *Noise: The Political Economy of Music*, 27.

[127] 127. Attali, *Noise: The Political Economy of Music*, 35.

represented by the semitone, while the noise instruments are able to realize any fraction of a tone."[128] Russolo makes reference to the distinction between discrete and continuous systems (where discrete systems are the standard-practice notation and continuous systems are graphic musical notation) within music, stating that "*Dynamic continuity*" is what separates the enharmonic system "from the music of diatonic-chromatic system, which be called rather, *Intermittent dynamicism,* or more exactly, *Fragmentary dynamicism.*"[129] In the chapter, he provides an example of his graphical notation in the score for *Awakening of a city*:



Fig. 4 - Russolo's graphic score for *Awakening of a City*[130]

---

[128]128. Russolo, *The Art of Noises*, 67.

[129]129. Russolo, *The Art of Noises*, 68.

[130]130. Russolo, *The Art of Noises*, 72-73.

Russolo explains the strengths of his enharmonic notation. For expressing exact pitches, "...we relate exactly the value of the dot (fixed or static principle) and the value of the line (dynamic principle) to express the values of the diatonic system in relation to the enharmonic system, and to represent them in a logical and perfect system."[131] The rising and falling lines on the staff convey the pitch of the sound each noise intoner is creating.[132] Russolo described his system as having a better visual representation of time than standard-practice notation because the length of the line corresponds to the time the sound should be played, unlike our common-practice notation where whole, half, and eighth notes are all the same length.[133] Also, rather than having a symbol to represent rests, an empty staff indicates silence.[134]

John Cage saw noise as an opportunity to expand music, much like Russolo. In his essay *The Future of Music: Credo* (1937), Cage describes our fixation with noise: "when we ignore it, it disturbs us. When we listen to it, we find it fascinating."[135] Cage envisions a future wherein we are past the use of dissonances and consonances, instead focusing on "noise and so-called musical sounds".[136] Cage argues that humans "want to capture and control these sounds" to harness them as musical instruments.[137] As described in my next

---

[131]131. Russolo, *The Art of Noises*, 68.

[132]132. Russolo, *The Art of Noises*, 69.

[133]133. Russolo, *The Art of Noises*, 69.

[134]134. Russolo, *The Art of Noises*, 69.

[135]135. John Cage, "The Future of Music: Credo." In *Audio Culture.: Readings in Modern Music*, ed. by Christoph Cox and Daniel Warner, (Continuum, 2004), 25.

[136]136. Cage, "The Future of Music: Credo," 26.

[137]137. Cage, "The Future of Music: Credo," 26.

chapter, with modern technology, Cage's vision of the future of music can be combined with

Russolo's vision of new noise making instruments to yield interesting results.

# From Noise Intoners to Noise Taction

"*Where the sea meets the land there is a border.*

*We live at the border where bits meet atoms...*"

-Hiroshi Ishii[138]

Futurism's affinity for the machine comes as no surprise, given that one of Futurism's main objectives was the complete elimination of the past. Although they lived in a pre-digital era, I have no doubt Futurism would have embraced the world of technology as it is now, where things are constantly being updated and becoming obsolete; in this day in age, the past becomes the past much sooner. It is, therefore, quite apt to make a recreation of the *intonarumori* using digital technology.

For this project, I have created an application for the MultiTaction, a tabletop touch interface, to make a digital *intonarumori* that utilizes touch, dubbed the *tattorumori* - Noise Taction. This instrument acts as a digital audio interface for the user to mix different predetermined sound samples in order to create "noise-sound" pieces and improvisations. The reasoning behind using the tabletop interface, rather than a normal audio interface or a different program, is to emphasize the feeling of playing an actual, tactile instrument as opposed to just a digital audio interface. This will make the music making process more engaging. Additionally, the tabletop interfaces are part of the field of Tangible User

---

[138]138. Hiroshi Ishii and Brygg Ullmer. *Tangible bits: Towards seamless interfaces between people, bits and atoms.* Proceedings of the CHI 97 Conference on Human Factors in Computing Systems. (New York: ACM, 1997).

Interfaces. While these type of technologies are not yet ubiquitous, they symbolize the spirit of Futurism in always looking forward toward a future that embraces the machine.

## Tangible User Interfaces and Music

The field of Tangible User Interfaces (TUI) investigates how to bridge the gap between the physical and digital world by giving us physical interfaces to interact with digital information. This approach to interfaces allows us to use incorporate all of our senses into the computing experience. TUIs incorporate augmented reality, virtual reality, physical tokens (physical objects that are marked in such a way that a multi-touch surface can recognize it), ubiquitous computing, mobile interactions, tabletop interfaces, and multi-touch interfaces, among other things, to create a unique user experience. For this thesis project, I will focus on examining tabletop and multi-touch interfaces for use in musical performances.

In the area of music and performances, TUIs provide several advantages over traditional musical interfaces. TUIs offer us a greater ability to collaborate with other users, offering "real-time" interaction with data, and supporting "complex, skilled, expressive, and explorative interaction."[139] There are several categories of TUIs for music performances: *instruments, squencers, sound toy,* and *controllers.*[140] *Instruments* are suited for expert users, allowing for full control of the audio process by the users; in contrast, *sound toy*s are geared toward novice users, limiting their control in producing sound. *Sequencers* allow users to "mix and play audio samples," while controllers allow for controlling a synthesizer

---

[139]139. Orit Shaer and Eva Hornecker, *Tangible User Interfaces: Past, Present, and Future Directions*, (NOW, 2010), 39.

[140]140. Shaer and Hornecker, *Tangible User Interfaces,* 40.

remotely.[141] A well known example of a TUI for musical performance is reacTable, an "electronic instrument based on a multi-touch table" that was created in 2003 by Sergi Jordà, Martin Kaltenbrunner, Günter Geiger, and Marcos Alonso.[142] It utilizes visual programming as well as physical tokens(called pucks) that perform certain functions on its surface; for instance, the pucks can be used for "generating sound, filtering audio, or controlling sound parameters."[143] On this instrument, the player controls physical objects that act as synthesis modules to create sounds.[144]

Direct-touch table tops have a unique set of advantages and usability challenges. The potential benefits of direct touch tabletops include large work areas, collaborative spaces near other people, and taking natural hand gestures and content manipulation as input.[145] The five parameters to consider for the usability of these surfaces are the orientation of the content, reach of content on the surface for the user, occlusion of the content on the surface, and group interactions.[146] For orientation of the contents, we must

---

[141]141. Shaer and Hornecker, *Tangible User Interfaces,* 40.

[142]142. *The Grove Dictionary of Musical Instruments*, 2nd ed., s.v. "ReacTable," by Laurence Libin accessed April 26, 2018 http://www.oxfordreference.com.ezproxy.wellesley.edu/view/10.1093/acref/9780199743391.001.0001/acref-9780199743391-e-6262.

[143]143. Shaer and Hornecker, *Tangible User Interfaces,* 40.

[144]144. *The Grove Dictionary of Musical Instruments*, 2nd ed., s.v. "ReacTable," by Laurence Libin accessed April 26, 2018 http://www.oxfordreference.com.ezproxy.wellesley.edu/view/10.1093/acref/9780199743391.001.0001/acref-9780199743391-e-6262.

[145]145. C. Shen, K. Ryall, C. Forlines, A. Esenther, F.d. Vernier, K. Everitt, M. Wu, D. Wigdor, M.r. Morris, M. Hancock, and E. Tse. "Informing the Design of Direct-Touch Tabletops."( *IEEE Computer Graphics and Applications*26, no. 5, 2006), 36.

[146]146. Shen, Ryall, Forlines, Esenther, Vernier, Everitt, Wu, Wigdor, Morris, Hancock, and Tse."Informing the Design of Direct-Touch Tabletops," 36-37,39,41.

consider what direction the content will be on the outside edge, how the contents will be moved to be reoriented, and whether the contents can be reoriented together.[147] Designers must consider how users will reach each region in large workspaces, where to place commands, where to display information most efficiently, and whether the content will freely move and rotate in order to facilitate reach.[148] With multiple elements on the direct touch tabletops, occlusion may become an issue, where users hands may obscure part of the table.[149] While traditional visual feedback methods (highlighting or drop shadows, for instance) will not be effective in addressing the occlusion issue, designers can instead place visual feedback on the screen or give users the ability to enlarge selected areas to prevent occlusion.[150] Since these direct table top surfaces offer possibilities for collaboration than traditional interfaces, designers must construct graphical user interface (GUI) elements that address multiple users accessing items, for example menus and toolbars, that are traditionally single user.[151]

## MultiTaction Surface and Implementation

---

[147]147. Shen, Ryall, Forlines, Esenther, Vernier, Everitt, Wu, Wigdor, Morris, Hancock, and Tse."Informing the Design of Direct-Touch Tabletops," 36,37.

[148]148. Shen, Ryall, Forlines, Esenther, Vernier, Everitt, Wu, Wigdor, Morris, Hancock, and Tse."Informing the Design of Direct-Touch Tabletops," 37-39.

[149]149.  Shen, Ryall, Forlines, Esenther, Vernier, Everitt, Wu, Wigdor, Morris, Hancock, and Tse."Informing the Design of Direct-Touch Tabletops," 39.

[150]150. Shen, Ryall, Forlines, Esenther, Vernier, Everitt, Wu, Wigdor, Morris, Hancock, and Tse."Informing the Design of Direct-Touch Tabletops," 39.

[151]151. Shen, Ryall, Forlines, Esenther, Vernier, Everitt, Wu, Wigdor, Morris, Hancock, and Tse."Informing the Design of Direct-Touch Tabletops," 41.

The MultiTaction used in this project is a multi-touch tabletop interface that allows for collaboration between several users by recognizing multiple touch points[152]. The MultiTaction surface also has the ability to identify tagged objects. Using the Cornerstone 2 SDK application, MultiTaction applications can be developed using JavaScript or C++. This project was created using JavaScript.

*GUI*

The layout for this application consists of six modules made of several components. Each module contains a button to play sound samples, arrows to scroll through all the possible sound samples, a slider for pitch transposition, a slider for gain, a checkbox to set looping for each module, and radio buttons to change the channel output of each sound. There is also one master control module that is capable of stopping all the samples being played and contains a slider for universal gain. All of the components of the module are fixed in place, which allows all the components to stay in their corresponding modules;

---

[152]152. "What is Cornerstone SDK?" accessed April 26, 2018
https://cornerstone.multitouch.fi/generated-content/developer-guide/.
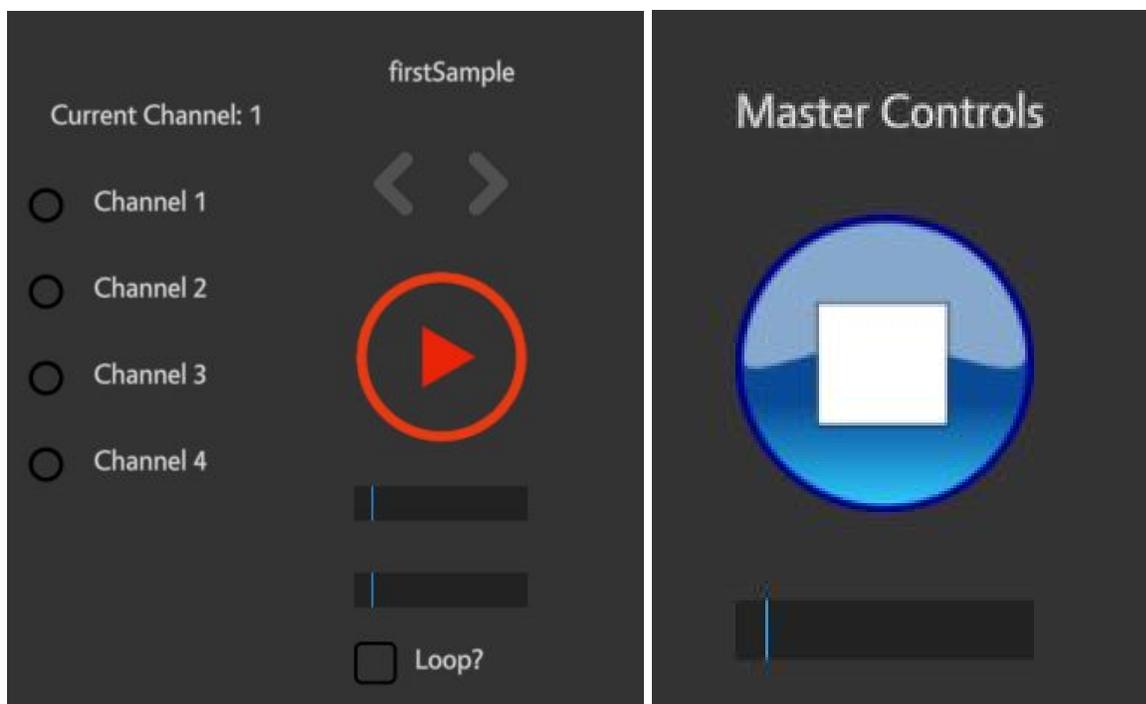
Fig. 1 - Screenshot of Module on the MultiTaction surface. The layout of one of six fixed module is shown.

while this design decision restricts the reach of the user, organization is improved for the layout of each module. There is some ambiguity with the lack of labels in the pitch and gain sliders; this choice was intentional to encourage experimentation with the application, as they will receive immediate aural feedback when interacting with the siders. The use of several modules offers greater opportunity for collaboration, where more than one player can add additional sounds to the overall piece. Because all sound modules do not need to be used at once, one player could still control the interface by themselves. The sound samples selected for the instrument are based on Russolo's description of the sounds produced by each of the different *intonarumori.*

*Code Structure*

The code was made in JavaScript using the MultiWidgets and Resonant classes

(which define the functions to make widgets and sound for the MultiTaction surface) to

make the components and sound functionality, respectively, for the application.

## Components

Each component is placed in locations based on the coordinates of the MultiTaction,

beginning at (0,0) on the top left edge of the screen and ending at the length and width of

the screen in pixels. There are several functions for creating each individual class of

components, including the functions to add arrows, text, checkboxes, sliders, and channel

buttons.

All of the functions to add components have the same basic layout, with differences

in functionality. Each component function has two parameters to determine its location on

the screen, two parameters for determining the size of the widget, and a parameter to

assign it to a particular module. Some functions contain locations of images for the

component as well as other identifying parameters. For instance, in the function `addBttn`

(the code used to add a button component), we have the parameters:

```
function addBttn(x,y,sizeX,sizeY,image,moduleNum) {
 ...
}
```

Here is an example of instantiating a button widget:

```
addBttn(200,150,100,100,"images/play.png","1");
```

From there, we create a `JavaScriptWidget` that will be overlayed on top of an

`ImageWidget`. The `ImageWidget` gives the appearance of the button component, while

the `JavaScriptWidget` contains the functionality of the button. There is a similar

structure for all of the components with images.

```
var w = new MultiWidgets.JavaScriptWidget();
w.setLocation(x, y);
w.setWidth(sizeX);
w.setHeight(sizeY);
w.setBackgroundColor(0, 0, 0, 0);
w.raiseToTop();
w.img = new MultiWidgets.ImageWidget();

if (w.img.load(image)) {
    w.img.addOperator(new MultiWidgets.StayInsideParentOperator());
w.img.setLocation(x,y);
w.img.setWidth(sizeX);
    w.img.setHeight(sizeY);
    w.addChild(w.img);
w.setFixed();
w.img.setFixed();
w.img.lowerToBottom();
w.img.name = "play";
}
```

We raise the `JavaScriptWidget` to the top layer in order for users interact with it and

lower the `ImageWidget` to the bottom layer for display purposes only.

Each component also has a function that is called when the object is tapped once (or,

in the case of the sliders, when the interaction with the component ends).

```
w.onSingleTap(function(){
        …
}
```

The code contained within `onSingleTap` varies with each component. For the arrows, it

changes the text that is displayed which corresponds to the current sample. For the play

buttons, it will call a function to play the sounds. For the sliders, it will set either the pitch

or gain to the value on the slider. For the channel radio buttons, it will change which

channel the sound it going to. Finally, we add the widgets to the application and return the

widget to initialize the variable.

## Sound

For the sound within the application, we use the Resonant class. Two global

variables are instantiated to access the DSP network within the app:

```
var dsp = $.app.dspNetwork();
var player = dsp.javascriptSamplePlayer();
```

Global variables designating each individual sound file are declared at the beginning of the

file:

```
var firstSampleMod1;
var firstSampleMod2;
```

From there, the `player` variable will control which sound samples are played. The

`playSample` function is called when the button is pressed. In the `playSample` function, we

check where it was called from using the `moduleNum` and `sampleToPlay` parameters that

were passed into it. Then we initialize the appropriate variable, set the sample looping,

pitch, and gain values based on the current value of their corresponding sliders and

checkboxes.

```
function playSample(moduleNum,sampleToPlay){
      //check which module playSample was called from
      if(moduleNum == 1){
            //check which sample is to be played
            if (sampleToPlay == "firstSample"){
                  //initialize the var firstSampleMod1
                  firstSampleMod1 = player.playSample("firstSample.wav", 1.0, 1.0,
1, 1);

                  //set the sample looping,relative pitches and gain.
                  player.setSampleRelativePitch(firstSampleMod1,pitchSlider1.curren
                  tValue());
                  player.setSampleLooping(firstSampleMod1,loopPressed1);
                  player.setSampleGain(firstSampleMod1,gainSlider1.currentValue());
            }
      }
      ...
}
```

A similar process is done in the `stopSample` function to check which sample should be stopped, which then calles `player.stopSample()` on the specified sample.

The entire code base and additional documentation can be found at

https://github.com/dtosca/MTProject.

*Max MSP for additional DSP*

Because of the limited options for digital signal processing within the Resonant class using JavaScript, I have created a patch using the visual programming language Max MSP to simulate additional possibilities for DSP with the sound samples. Within presentation mode (where certain components are obscured from the user), the Max patch has a similar layout to the MultiTaction GUI, with a similar theme of encouraging the user to explore the instrument by maintaining the ambiguity of the sliders.
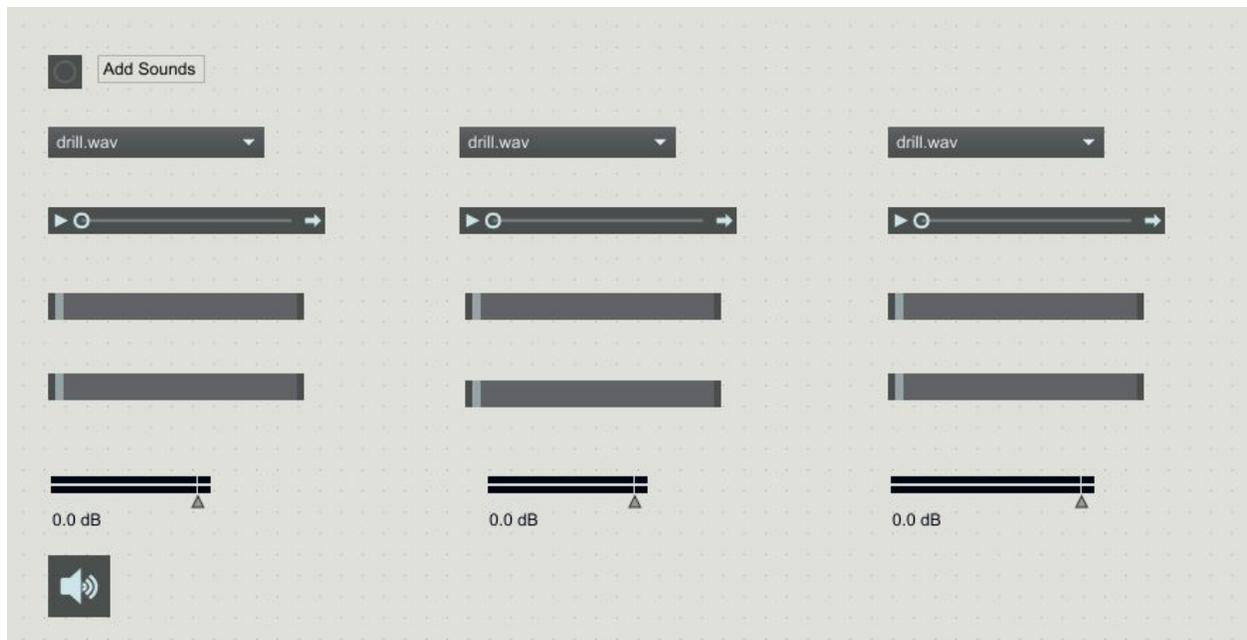


Fig. 2 - The Max patch version of the instrument in presentation mode. It has two sliders for pitch and speed, one slider for gain, and a drop box to choose which samples to play.

Looking at the full patch, we see that the sound files are prepopulated into the menu bar

and are then run through the `sfplay` object. From there, the sound samples can be played

by the user using the `playbar` object and the gain can be altered with the `live.gain`

object below it. The speed and pitch are controlled by the two sliders. All of the sounds

from all three modules are output through the `dac` object.
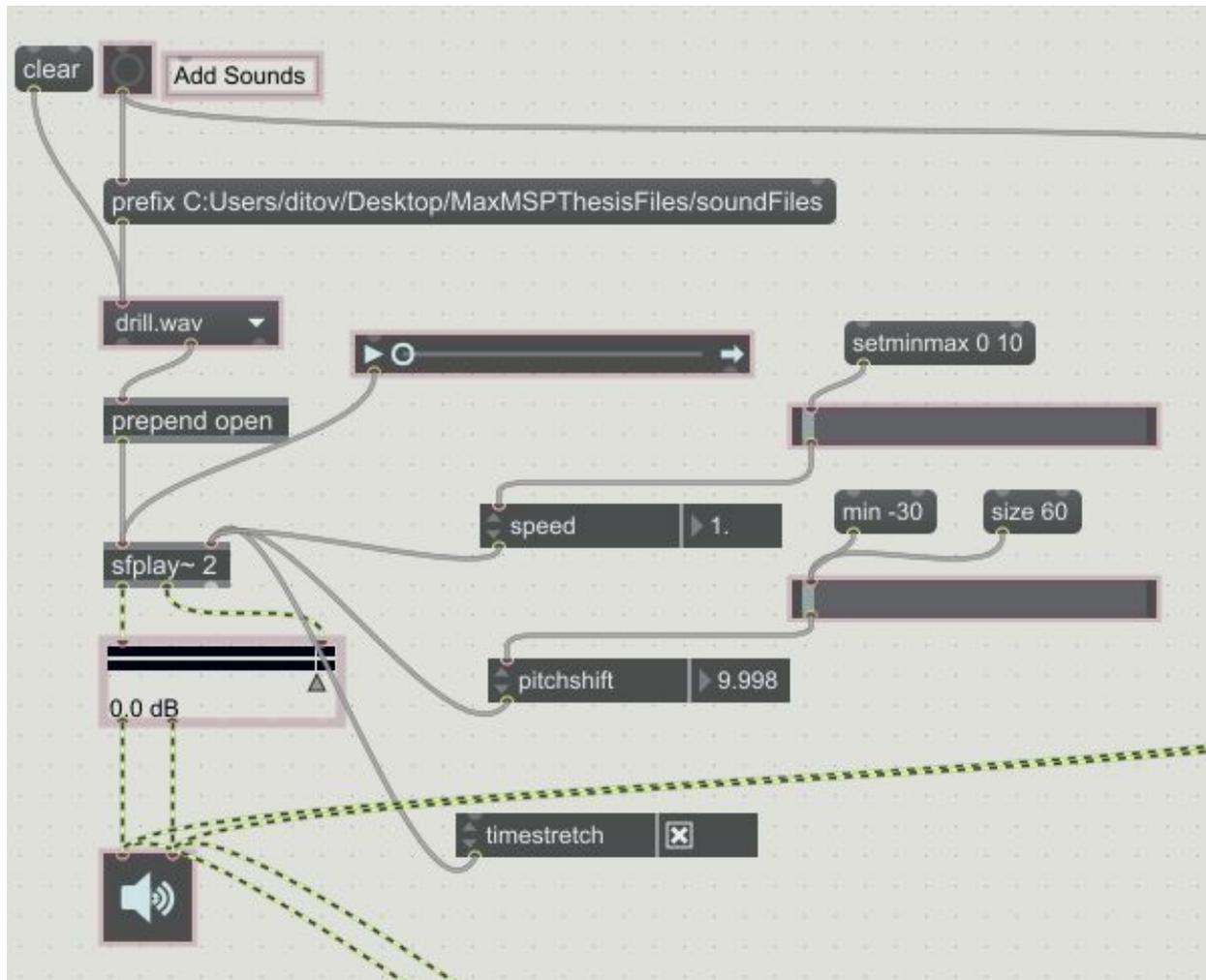


Fig. 3 - The complete Max patch. Sounds are loaded onto the menu bar, which are sent to `sfplay~` and the sound is modified with both the sliders and the `live.gain` object.

Futurism's Impact on my work

With Russolo's utilization of noise and the creation of the *intonarumori*, we see the beginnings of the musical world opening its doors to all sounds, rather than prioritizing so-called "musical" sounds. The kinds of sounds I chose to make in this instrument follow the same spirit of not prioritizing "musical" sounds, but rather using more "noisy" sounds. Examples of the sound samples chosen include the sound of a drill, tapping of metal, dissonant pianos, scratches, clicks, and running water. All these sounds are "noises," disturbances in our lives, things that the average person would never call "music." I acquired these sounds by going through the objects in my life that seemed loud and disturbing - the scratch and squeaks of a door, the booming sound of a hot chocolate machine, and the beautiful cacophony of the subway.

I hope people will embrace improvisation and dispel any preconceived notions of what music should sound like when playing my instrument. Users should be able to feel like they are wielding a musical instrument without the need for musical training. I want users to play with the disturbing sounds, transforming them into rhythms and unheard timbres. Users of the instrument will be freed from musical conventions of the past, exploring a new sound world that may have been unavailable to them before. My instrument seeks to do more than emancipate dissonances; rather, it wants to follow in Futurim's footsteps of eliminating the distinction between consonances and dissonances, instead thinking of music as the organization of noises and sounds.

While I admire the aesthetic of the Futurist's in regard to music, they are not without their problematic views that I must reconcile with. Their constant glamorization of war, violence, misogyny, and erasure of the past poses questions for me to consider in my

own work. I hate war, I am appalled by the violence perpetrated against women and people

of color, and I do love the past in terms of my own roots and culture. I am, however,

enamoured with noise, found sounds, and love the subversion of the Futurist's going

against tradition. Ultimately, there is no way for me, a women in academia, to fully embrace

Futurism as articulated by the Italian Futurists of the early 20th century. What I do instead

in my work is try to reclaim this aesthetic and give a new, more inclusive meaning to it. In

order for the spirit of Futurism to live on in the 21st century and beyond, we must discard

their antiquated notions of gender, their toxic masculinity, and challenge their love of war.

Most importantly, we must remember the past, with all the pain and violence associated

with it. In this Post-Futurist era, I am destroying Futurism in order to preserve it.

# Conclusion

In this thesis project, I examined the relationship Futurism has to music, discussed the importance of noise to Futurism and music, and descrived the implementation of my reimagining of the *intonarumori* as a modern noise-taction audio interface. The principles of Futurism sought to expand what music could be, incorporating sounds into the musical world. This idea opened the possibility of using noise in music, creating a way to make noise with the *intonarumori* instruments. In my recreation of the instrument, I used the touch table top surface, the MultiTaction, to make the *intonarumori* feel more tactile, similar to an acoustic instrument.

Prior to beginning my investigations on noise and Futurism, I did not fully understand the implications Futurism and noise had on modern sound art. Russolo's ideas are the precursor to experimental and digital music. This world of music and noise as described by the Futurists was a tactic of subversion, a response to the chains of that past that limited our creative abilities; Futurism sought to free us from these traps. For me, the *intonarumori* is the ultimate symbol of Futurism - a powerful, noisy instrument that give new meaning to what music is. Because of what the *intonarumori* symbolized, recreating the *intonarumori* in a modern context made sense. Futurism wants to embrace technology and, therefore, it would be a disservice to Futurism to leave the *intonarumori* as a diagram, a relic of the past without revitalizing it.

Bibliography

*An Anthology of Noise & Electronic Music*. Sub Rosa, 2005, CD.

Apollonio, Umbro. *Futurist Manifestos*. New York: Viking Press, 1973.

Attali, Jacques, Fredric Jameson, and Brian Massumi. *Noise: The Political Economy of Music*. University of Minnesota Press, 2014.

Barthes, Roland, and Stephen Heath. *Image, Music, Text*. Fontana Press, HarperCollinsPublishers, 2010.

Blum, Cinzia. "Rhetorical Strategies and Gender in Marinetti's Futurist Manifesto." *Italica* 67, no. 2 (1990): 196. doi:10.2307/478592.

Brown, Barclay. Introduction to *The Art of Noises,* 1 - 22. By Luigi Russolo. trans. Barclay Brown. Pendragon Press, 1986.

Buelens, Geert, Harald Arno Hendrix, and Michelangela Monica Jansen. *The History of Futurism: The Precursors, Protagonists, and Legacies*. Lexington Books, 2012.

Cage, John. *Radio Music.* New York. Peters Edition EP 6783, 1956. http://silakka.fi/esa/cage1.jpg Accessed April 2018.

Cage, John. "The Future of Music: Credo." In *Audio Culture.: Readings in Modern Music*, edited by Christoph Cox and Daniel Warner, 25 - 28. Continuum, 2004.

Chandler, Daniel, and Rod Munday. "signal-to-noise ratio." *A Dictionary of Media and Communication.* : Oxford University Press. Oxford Reference. 2016.<http://www.oxfordreference.com.ezproxy.wellesley.edu/view/10.1093/acref/9780 191800986.001.0001/acref-9780191800986-e-2483>.

Clough, Rosa Trillo. *Futurism: The Story of a Modern Art Movement: A New Appraisal*. Greenwood Press, 1969.

Cox, Christoph, and Daniel Warner. *Audio Culture.: Readings in Modern Music*. Continuum, 2004.

Feldman, Morton. "Projection 1: for solo cello" Edition Peters P6945, 1950.
http://davehall.io/wp-content/uploads/2016/05/Morton-Feldman-Projection-50-e14624
86131973.png Accessed April 2018.

Feldman, Morton. "Sound, Noise, Varèse, Boulez." in *Audio Culture.: Readings in Modern Music*, edited by Christoph Cox and Daniel Warner, 15 - 16. Continuum, 2004.

Ishii, H., & Ullmer, B. *Tangible bits: Towards seamless interfaces between people, bits and atoms.* Proceedings of the CHI 97 Conference on Human Factors in Computing Systems. New York, ACM. 1997.

Kahn, Douglas. *Noise, Water, Meat : History of Voice, Sound, and Aurality in the Arts.* Cambridge: MIT Press, 2015. Accessed April 26, 2018. ProQuest Ebook Central.

Marinetti, F.T. "The Founding and Manifesto of Futurism, 1909." in *Futurist Manifestos,* edited by Umbro Apollonio, 19 - 24. New York: Viking Press, 1973.

"Noise." *Merriam-Webster Dictionary.*
https://www.merriam-webster.com/dictionary/noise Accessed 22 Apr. 2018

Pratella, Francesco Ballila. "Manifesto of Futurist Musicians." in *Futurism: An Anthology,* edited by Lawrence Rainey, Christine Poggi, and Laura Wittman, 75 - 80. Yale University Press, 2009.

Pratella, Francesco Ballila. "Futurist Music: Technical Manifesto." in *Futurism: An Anthology,* edited by Lawrence Rainey, Christine Poggi, and Laura Wittman, 80 - 84. Yale University Press, 2009

"Pratella, Francesco Balilla (1 Feb. 1880, Lugo di Romagna - 17 May 1955, Ravenna)." *The Harvard Biographical Dictionary of Music*, edited by Don Michael Randel, Harvard University Press, 1st edition, 2003. *Credo Reference*, http://0-search.credoreference.com.luna.wellesley.edu/content/entry/harvbiodictmusic/pratella_francesco_balilla_1_feb_1880_lugo_di_romagna_17_may_1955_ravenna/0?institutionId=774. Accessed 24 Mar 2018.

Rainey, Lawrence S. *Futurism: An Anthology*. Yale University Press, 2009.

"ReacTable." In *The Grove Dictionary of Musical Instruments*. : Oxford University Press, 2014.

http://www.oxfordreference.com.ezproxy.wellesley.edu/view/10.1093/acref/978019974 3391.001.0001/acref-9780199743391-e-6262.

Russolo, Luigi. *The Art of Noises*. Translated by Barclay Brown.  Pendragon Press, 1986.

Saggini, Valerio. "Intonarumori" las modified February 21, 2004. http://www.thereminvox.com/article/articleview/116.html

Shaer, Orit, and Eva Hornecker. *Tangible User Interfaces: Past, Present, and Future Directions*. NOW, 2010.

"Shannon and Weaver Model of Communication" Accessed April 26, 2018. https://www.businesstopia.net/communication/shannon-and-weaver-model-communication

Shannon, Claude Elwood, and Warren Weaver. *The Mathematical Theory of Communication*. University of Illinois Press, 1999.

Shen, C., K. Ryall, C. Forlines, A. Esenther, F.d. Vernier, K. Everitt, M. Wu, D. Wigdor, M.r. Morris, M. Hancock, and E. Tse. "Informing the Design of Direct-Touch Tabletops." *IEEE Computer Graphics and Applications*26, no. 5 (2006): 36-46. doi:10.1109/mcg.2006.109.

Strunk, W. Oliver, Leo Treitler, Thomas J. Mathiesen, James W. McKinnon, Gary Tomlinson, Margaret Murata, Wye Jamison. Allanbrook, Ruth A. Solie, and Robert P. Morgan. *Source Readings in Music History*. Norton, 1998.

Tisdall, Caroline, and Angelo Bozzola. *Futurism*. London: Thames and Hudson, 1977.

Vigil, Ryan. "Compositional Parameters: "Projection 4" and an Analytical Methodology for Morton Feldman's Graphic Works." *Perspectives of New Music* 47, no. 1 (2009): 233-67. http://www.jstor.org.ezproxy.wellesley.edu/stable/25652408.

"What is Cornerstone SDK?" accessed April 26, 2018 https://cornerstone.multitouch.fi/generated-content/developer-guide/.

# Acknowledgements

First and foremost, thank you to Professor Jenny Johnson, my thesis advisor, for all her support throughout this project, all my other music projects, and for guiding me through the world of 20th century music; I am truly honored to be her advisee. Thank you to Orit Shaer, my Computer Science advisor, for showing me the world of Human Computer Interaction, lending me the MultiTaction surface, and allowing me to explore my creativity in CS. Thank you to Lauren Westendorf for her MultiTaction advice and expertise. Thank you to the room that envelopes the Wellesley HCI lab for the hours I have spent there. Thank you to MultiTaction Support for answering all my emails. Thank you to those who awarded me the Jerome A. Schiff Fellowship for funding my thesis. Thank you to my friends who supported me during this year, including Caroline Frias, Michael Perez, Kasey Shen, Sabrina Leung, Tyanna Crump, and Jen Otiono. Thank you to my partner Trenton Couture for supporting me and reading this thesis. Thank you to my mom, dad, aunt, and cousin for their support. And thank you to my Abuela Cuca for all her love and support throughout her life. I couldn't have done this without all of you.