Portfolio of compositions: a personal approach to noise timbres.

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Abstract

I am fascinated by noise. Whether through extended instrumental techniques, or through electronic means, or even a combination of the two, noise timbres are what interest me and satisfy me. I agree with Alice Kemp (GERMSEED) when she states: ''Noise is a living entity, pure expression, force, simple and complex. It is a system of diametrical differences—it can be a cycle of giving and receiving, an exchange of power.''[1] In this way, noise can be the foundation for invention that can create tension and energy similar to consonance and dissonance. I find that noise has a very direct impact on emotions. I want to explore the rich variety of noise sounds that traditional music making seeks to minimize and ignore.

This fundamental notion gives rise to the following research questions. What do we mean by 'noise'? What are the musical possibilities of using it? What range of different types of noise is available to me? How can these be generated both through instruments and electronics? How best can I notate these sounds and techniques?

I have investigated these questions through the composition of a portfolio of five pieces for instruments, instruments and electronics, and electronics alone. These are:

1. *Toward The Sun Lives,* for electronic violin and tape/ live electronics.
2. *Twist Roll,* for saxophone, percussion, and tape.
3. *Brick Block,* for 2 violins, 2 cellos, and 2 double basses.
4. *Breathe,* for trombone solo.
5. *Foam No.1*, an electroacoustic, fixed media piece.

After a discussion of the underlying topic of the musical possibilities of noise, I take each piece in turn and indicate how it has addressed the above questions.

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[1] Alice Kemp (Germseed), *NOISE IN AND AS MUSIC*, Aaron Cassidy and Aaron Einbond. University of Huddersfield press, 2013, p.31.

Portfolio contents

1. *Toward The Sun Lives*, recording/ performing by Martin Suckling.
2. *Twist Roll*, recording by Ko-Han, Shao, performing by saxophone Ming-Yu, Ho, percussion Sheng-Hao, Hsieh.
3. *Brick Block*, demonstrator Rui-Yun, Yan.
4. *Breathe*, performing by Zheng-Xiang, Jian.
5. *Foam No. 1*.

Author's Declaration

I declare that this thesis is a presentation of original work, and I am the sole author. This work has not previously been presented for an award at this, or any other, University. All sources are acknowledged as References.

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Introduction: Why noise?

I am fascinated by noise. Whether through extended instrumental techniques, or through electronic means, or even a combination of the two, noise timbres are what interest me and satisfy me. I agree with Alice Kemp when she states: "Noise is a living entity, pure expression, force, simple and complex. It is a system of diametrical differences—it can be a cycle of giving and receiving, an exchange of power."[2] In this way, noise can be the foundation for invention that can create tension and energy similar to consonance and dissonance. I find that noise has a very direct impact on emotions. I want to explore the rich variety of noise sounds that traditional music making seeks to minimize and ignore.

This fundamental notion gives rise to the following research questions. What do we mean by 'noise'? What are the musical possibilities of using it? What range of different types of noise is available to me? How can these be generated both through instruments and electronics? How best can I notate these sounds and techniques? These can be grouped into three main topic areas: (1) creating a musical language through noise, (2) exploring instrumental extremes to create noise-based elements and (3) the challenge of notating noise-based musics.

In this portfolio of compositions and commentary I seek to explore these questions and demonstrate their impact on my creative practice.

Section 1: Noise Music in Theory

1.1 What is noise?

People have different views about the definition of noise. In the broadest sense of the word, an unpleasant sound is noise. For example: "a sound, especially one that is loud or unpleasant or that causes disturbance;"[3] or "the auditory experience of sound that lacks musical quality; sound that is a disagreeable auditory experience."[4] However, these are subjective feelings. After all, everyone has different aesthetics. Some people like tonal music and some people are attracted to non-tonal music. For example, some people like the sound of fingernails rubbing against a blackboard, while others cannot stand it at all. We can use common sense to make a basic judgment as to what sounds can be classified as noise, but there is no way to list the necessary conditions accurately and objectively for noise. Throughout the history of music, almost all innovations have been referred to as noise by the people of the time. For example, the premiere of Stravinsky's *Le Sacre du Printemps* famously resulted in a riot between those who thought it was mere noise and those who felt the composer should be respected and listened to. It was a shocking and unacceptable innovation for many in the Parisian upper classes at the time, but it quickly became an important document in the history of 20th century classical music. This description may be an oft-repeated distortion of historical facts that suits popular understanding, but nevertheless it serves to underline the power of the idea of noise and that people's acceptance of noise has to do with the environment or the zeitgeist. Music acceptable in a club would be noise in a church, for example. People are often unable to accept things that conflict with their own consciousness, and so with sound, so perhaps anything outside of their own range of familiar, acceptable sounds is noise. Noise, whether successful or unsuccessful, is therefore inextricably linked with innovation. Any innovation will necessarily be considered 'noise' because it involves a movement outside the currently accepted norms.

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[2] Alice Kemp (Germseed), *NOISE IN AND AS MUSIC*, Aaron Cassidy and Aaron Einbond. University of Huddersfield press, 2013, p.31.
[3] Lexico Dictionaries | English. 'NOISE | Meaning & Definition for UK English | Lexico.Com'. Accessed 18 October 2021. https://www.lexico.com/definition/noise.
[4] "noise, n." online, Music dictionary. http://musicaldictionary.com./ (Accessed 20 October 2021.)

Instead of these subjective ideas, we could consider the acoustics of noise. 'If we define sound as anything we can hear, then noise is the kind of sound that is disorderly. The orderly kind of sound is called tone. All sound is either the one or the other or a mixture of the two.'[6] Noise by this definition is a jumbled mess of sounds that demonstrates why people may think of the sound of cars and traffic when they think of noise. Children screaming, loud chatter in the library and the sound of moving furniture in the middle of the night can also be well categorized as unpredictable and highly unstable. If there is only a dichotomy between 'orderly' tones and 'disorderly' noise, then a mixture of the two is music. In other words, the timbre of 'normal' music is a mixture of ordered and disordered components, such as breathing or bowed string noise. Composers can make music by using different compositional techniques, using ordered tones, and filtered disordered noise. Such disordered noise is simply one of the materials of music.

Nevertheless, some definitions would seem to exclude such disorders from the world of music. 'Music is ordered sound. Noise is disordered sound. Music and noise are both mixtures of sound waves of different frequencies.'[7] However, this ignores the fact that music can be made up of a great many sonic materials, some of which may be ordered, and others may be disordered. When the noise-timbres are organized by way of a musical situation, they takes on a structured appearance. This shows the opposition of 'music' and 'noise' to be unsustainable: music can be made from noise materials.

Considered more expansively, the term 'noise' has three main usages: '(1) sounds at potentially deafening levels, (2) unwanted sounds, and (3) statistical processes where events are random and uncorrelated, and which give rise to sounds where the waveform follows such a statistical.[8]' These usages are often confused in daily use. A good example is in the recent history of twentieth century Western music. To quote Hainge: 'From Schoenberg to Stravinsky to Russolo to Cage to Hendrix to Merzbow, atonality, dissonance, explosions, coughs, splutters, feedback, distortion, glitch, and various shades of noise have done their best to (dis)colour music and to make of it what we had thought it was not'.[9] This refers mostly to noise in the third sense, but the second sense (unwantedness) is also invoked.'[10] This entanglement of definitions is a particular challenge for composers who wish to employ noise-timbres as a core aspect of their music as the negative connotations of noise as unwanted sounds may be impossible to escape.

It was fascinating to notice the divergence of opinions under similar hearing settings during the recent annoyance tests on motor horns at the National Physical Laboratory, in which about two or three hundred observers were involved. There was, it is true, a great deal of agreement in most of the situations, but some observers would as blithely classify a specific horn's loudness as extremely disagreeable as others would just as cheerfully classify it as bearable or agreeable. The investigations actually backed up the idea that evaluating noise is a question of taste, and the British Standard Glossary supports this notion by defining noise as "sound undesirable by the recipient."[11] "Noise, like speech, is also an uneven social negotiation."[12] Justin Patch observes that it requires an auditor, a discourse, and an aesthetic in addition to a producer (although that could be generated in the natural world). His claim for noise is that it is a product of social interaction and is inherently opposed to other acoustic phenomena, such as music, silence, or the same

[6] Levarie, Siegmund. "Noise." Critical Inquiry 4, no. 1 (1977): 21–31. http://www.jstor.org/stable/1343040.

[7] Glenn Elert. *The Physics Hypertextbook Opus in profectus*, 2021. Waves and optics-2-8 Music and Noise.

[8] Keizer, G. *The unwanted sound of everything we want: A book about noise.* 2010. New York: Public Affairs.

[9] Hainge, G. *Noise matters: Towards an ontology of noise.* 2013. Bloomsbury: New York, London.

[10] Mark Reybrouck, Piotr Podlipniak and David Welch. Music and Noise: Same or Different? What Our Body Tells Us. Front. Psychol., 25 June 2019 | https://doi.org/10.3389/fpsyg.2019.01153 (Accessed 22 October 2021)

[11] Kaye, G. W. C. "*NOISE AND ITS ABATEMENT.*" Journal of the Royal Society of Arts 85, no. 4431 (1937): 1054–67. http://www.jstor.org/stable/41361125.

[12] Patch, Justin. "THE ART OF NOISE: Hearing, Feeling and Experiencing the Sound of Democracy." *Soundings: An Interdisciplinary Journal* 92, no. 3/4 (2009): 303–29. http://www.jstor.org/stable/41179250.

sound at a manageable volume. Although this perspective recognises the socially-contingent aspect of 'noise' as a concept, Patch's insistence that it is 'inherently opposed' to music is at odds with many composers.

'Noise is sound, sound is music, noise is music. The vibration of the air.'[13] This definition emphasises that noise is simply a kind of a sound. If we can organize the sound, and all the noise is part of the sound, then we can reorganize the sound with the noise and design it as music. According to this logic of noise as part of sound, music is a composition. It is made up of material such as pitch, sound quality, volume. So, if we can organize sound, then even if it is noise-sound, we can still make music. The OED definition of noise indicates that it is a fundamental part of certain types of music: 'Any of various kinds of music characterized by use of dissonance or inharmonious noise, esp. loud distorted guitar, amplifier noise, feedback, etc.'[14]

One of the key figures of noise within modern classical music is the German composer, Helmut Lachenmann. *Musique concrète instrumentale* is the label he gave to his approach, explicitly connecting it to the work of Pierre Schaeffer and others in recorded music. Lachenmann's focus on extended techniques gives rise to a vast array of noise-timbres in his music, but it is interesting that he states that this is music 'in which the sound events are chosen and organized so that the manner in which they are generated is at least as important as the resultant acoustic qualities themselves.'[15] The noise aspect is in this way a byproduct of the main focus of his music: 'listening, you hear the conditions under which a sound- or noise-action is carried out, you hear what materials and energies are involved and what resistance is encountered.'[16] Nevertheless, deploying a musical language that encompasses the full audio spectrum made available through creative playing methods, Lachenmann has developed fresh musical expressions by way of noise. He has challenged previous beliefs about the purpose and expectations of music by using instruments and voices in unorthodox ways.[17]

In my opinion, what is 'noise'? I think that noise is the definition of the sounds that are ignored or minimized by the majority of approaches in the Western Art Music tradition. In the European Classical tradition, there is a focus on form, pitch and harmony. I wish to build on this tradition with a greater focus on noise, or new sounds. There is a great deal of variety and potential in these sounds in spite of them being ignored by traditional music, as Maja Ratkje notes: ''At its best it is multi-dimensional, it is both dark and light, and in its own way sparingly beautiful."[21] A kind of musical expression is the re-selection or organisation of sound into new products. These qualities, such as timbre, loudness, etc., do not make sounds for their own purpose, but rather depict or represent particular situations, according to this definition of "sound occurrences selected and organised."[22] This is the type of noise that many contemporary composers aspire to, including me. In a broad sense, it is a sound that may make you uncomfortable; In a narrow sense, it refers to the use of the extended playing techniques of musical instruments and computers to change the original sound. As I am interested in sounds that are ignored and/or avoided by the mainstream repertoire of Western Art Music, by

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[13] Antoine Chessex, *NOISE IN AND AS MUSIC*, Aaron Cassidy and Aaron Einbond. University of Huddersfield Press, 2013, p.9.

[14] "noise, n.". OED Online. September 2021. Oxford University Press. https://www-oed-com.libproxy.york.ac.uk/view/Entry/127655?rskey=lbxu4y&result=1 (accessed October 18, 2021).

[15] "Musique Concrète Instrumentale - Programs – Slought". 2022. Slought.Org. https://slought.org/resources/musique_concrete_instrumentale.

[16] *Ibid.*

[17] Nesssoftware.com. 2022. Musique concrète, musique concrète instrumentale. Available at: http://www.nesssoftware.com/home/asn/homepage/teaching/explectureNotes/110208musiqueConcrete/musiqueConcrete.html.

[21] Maja Solveig Kjelstrup Ratkje, *NOISE IN AND AS MUSIC*, Aaron Cassidy and Aaron Einbond. University of Huddersfield Press, 2013, p.55.

[22] Sarrazin, Natalie. 2022. "Chapter 2: Music: Fundamentals And Educational Roots In The U.S.". *Milnepublishing.Geneseo.Edu.* https://milnepublishing.geneseo.edu/music-and-the-child/chapter/chapter-2/.

definition from the instrumentalist's perspective I will be using extended techniques.) Through instrumental extended techniques, electronic music, and both, I will work with noise timbres to make music.

1.2 Some approaches to noise in contemporary classical music

In order to gain a deeper understanding of noise music, I have tried to find some composers for whom the common denominator is that for them 'noise' is a major part of their sound world. Starting from their works, there are several questions here. The first is to explore how the composer uses noise in this work. The second is how does it create tension and release in the piece, how do these highs and lows of musical tension form. Then how does the composer make use of convincing structures to create musicality. Finally, have any composers written anything about their use of noise? And if so, what would be the definition or elaboration?

There are two reasons why I chose the compositions discussed in this section. Firstly, because of the instrumental forces used and secondly, because they were composers I was already interested in. In the former case, when I chose instruments to write for myself, I wanted to explore the possibilities of these instruments to create noise and sought existing music that used the instruments in this way. In the latter case, I was often attracted by the sound of that composer's work in general and wanted to know how the composer achieved these effects and whether there were any other breakthroughs.

Sivunittinni, Tanya Tagaq, 2015
Vocal demo

'Tanya Tagaq's work is political, often tackling themes of environmentalism and Indigenous rights. The Inuk throat singer uses live performance and audiovisual media to engage themes of climate change and give voice to environmental violence.'[23] Her work has diversified the discourse of environmentalism to include the voices and environmental trauma experienced by people who are marginalized, with a particular focus on the voices and perspectives of indigenous North Americans.

Although *Sivunittinni* is a piece for string quartet, it is in fact a transcription (by Jacob Garchik) of Tagaq's singing. Based in the Inuk throat singing tradition, Tagaq's vocalisations incorporate a wide range of 'noise' sounds, as can be heard in the vocal demo she made as part of *Sivunittinni's* compositional process.[24] As a consequence, noise timbres are a fundamental part of the resulting quartet piece. All the materials are muffled sounds, high and low gasps, male and female voices, grunts, gargles, shouts, high and low resonances, hysterical sounds, rhythms, and brief moments of harmony..

I think the noise in this piece has undergone two transformations. The first is a shift from textual description to traditional Inuk throat singing; the second is an adaptation from the vocal version to a string quartet. In the following paragraphs I will give examples of how composers have used different approaches to achieve the same effect when confronted with the same descriptive text of sound, even though these are two different instruments. Different cultural traditions allow and exclude different types of timbre, so that in effect different sounds are classified as noise.

The Inuk tradition therefore provides a model of how noise timbres can be used in string quartet writing. In the vocal version the composer creates noise music in a way that uses the singing style of the Inuk throat, which is matched in the string version by the use of extended string techniques to imitate the vocal sound,

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[23] Kate Galloway, *The aurality of pipeline politics and listening for nacreous clouds: voicing Indigenous ecological knowledge in Tanya Tagaq's Animism and Retribution*, Popular Music 39(1):121-144, February 2020. DOI:10.1017/S026114301900059X

[24] Tanya Tagaq, *Tanya Tagaq - Sivunittinni (Vocal Demo)*, accessed 15 December 2021, https://soundcloud.com/kronosquartet/tanya-tagaq-sivunittinni-voice.

and even better noise effects, such as tension in pitch between instruments. The former refers to the vocal version, while the latter refers to the string version.

The first is that one hears a series of muffled sounds that are passages of varying density and speed, each with its own mumbling rhythm; the contrasting noise sounds like the guttural sound of strings and limits the notes to E-flat and F. The tension allows the noise to be heard. Extreme high- or low-pitched hissing sounds; there is a heavy pressure on the strings, from the original division to tutti, creating a strong contrasting musical tension. The resonant sound of the low frequencies has the same effect as the short, clean staccato of the strings in the bass. Finally, an almost hysterical sound is used, each sound is parabolic and gradually intensifies to the end; and the strings end up using all the extended technique materials, such as heavy string pressing, ricochet and rubbing on the fretboard, coming together to end the piece at high energy and high volume.

Dead Wasps in the Jam-jar (ii), Clara Iannotta, 2016 (for string orchestra, objects, and sine waves)

Clara Iannotta's hallmark is meticulous and imaginative work in equal measure to shapes of quiet and very quiet sounds. Her music opens space for artistic fantasies while realizing them with a unique musical sensitivity: visibility and variety, lightness, and a sense of precision. When we are in a quiet environment, any sound is amplified, whether it is sharp and harsh or not, and in such a space people can pick up messages that are more unfriendly or uncomfortable than usual.

J. S. Bach's Partita BWV 1002 for solo violin, which Clara Iannotta has extended and rebuilt for string orchestra, lies beneath the surface of this composition. Despite the fact that her noise-based music lacks tonal patterns of tension and release, she chooses to arrange her composition using Bach's Partita as a skeleton or frame. As a result, this is one method a composer can approach the problem of structuring a noise-based composition. For example, the string instruments are muted and prepared, supplemented by whistles, lion's roar, cymbals, and other objects with which the composer creates a sound space that is both creatively equipped and extremely realistic.

In *Dead Wasp in a Jam Jar (ii)*, Clara Iannotta brings to life another central aspect of her musical poetry: she brings the visual dimension of music into her own domain. This piece represents an experimental process that does not settle for the ordinary, rehearsed use of objects, sounds and instruments. Clara Iannotta's music produces a really authentic and creatively prepared soundscape a special ear for music to recognize them. A musical awareness that is clear and numerous, light and precise.

From the CD liner note, Clara Iannotta mentioned some of the questions she asked herself: how could you scream quietly? How did instruments transcend the standard world of sound?[25] When generating noise, I often wonder how an instrument may go beyond the world's established sound standards. I believe it is critical to listen to the music repeatedly and to repeat the looped portions. It assists people in being more immersed in the music and in attempting to get closer to the sound you envision in your head. Without a doubt, this process will manifest itself in the music.

II. Streichquartett "Reigen seliger Geister", Helmut Lachenmann, 1989

Some people believe that noise is the definition of the sounds ignored or minimized by traditional music. I think part of what happens in this piece, what we see is not what we would normally expect to see, but all the sort of material that goes into the making of it that you would normally ignore. This work, on the one hand, is full of these unconventional techniques. It's very radical, it's an avant-garde musical work, but at the same

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[25] Böggemann, Markus. Translation: Jacobs, Robert. 2021. [online] Kairos-music.com. Available at: https://www.kairos-music.com/sites/default/files/downloads/0018004_iannotta_itunesbooklet.pdf.

time, there's something particularly 'classical' about it in its engagement with the string quartet tradition and the formalities of chamber music in general. For example, the piece uses string extended techniques to create sharp and harsh sounds, alternating between actual and fictitious noises, and rubbing a bow across the strings to create a non-pitched sound similar to white noise. On the other hand, it's a very classical piece. It consists of all these different oppositions or dialectical oppositions resolved in a dialogical way, as they are in the classical string quartets.

We can divide the work into two parts, the duration of which is evenly divided. In terms of the passages, the A and B sections are different in style, and the change of passage can be clearly perceived when listening. Goethe famously described Beethoven's quartets as four people having a conversation, but in this case a better analogy would be the integration of four people into one versatile instrument. It's like a big machine operated by four people. Each person is responsible for an area and that area is the instrument they play. In terms of weaving, the piece is full of a variety of material, some of which extends from traditional techniques, such as, firstly, the various trills. As you play the vibrato at different speeds, the friction between the fingers and the fingerboard varies, creating a sound that is not only customary but also a little noisier. The second section is the plucked strings in bar 124. The strings can be strummed in various ways, no longer just as a single percussive sound, but to imitate more percussive sounds. Thirdly, after bar 280, the four players of the quartet are asked to put their bows aside and play only pizzicato. The string quartet has become an imaginary guitar with different string. As mentioned earlier, Lachenmann attempts to fuse the string quartet into a new instrument.

Throughout the first part of the piece, there is an opposition between resonance and muting, where you hear these strange rustling sounds or just whooshing sounds or air noises that are generated by what Lachenmann calls a muted sound. For example, a cellist must gently hold down all four strings with his left hand in order to mute them so that they do not resonate.[27] Instead of dialogue and communication between instruments, they become one, as if a string quartet has become a super instrument with 16 strings. Throughout the work, there are various variations of this playing technique. There are all sorts of different ways of producing these variations in sound categories throughout the work. And the other oppositions are between sustained sounds and percussive sounds. This is kind of the opposition between playing with a bow on a stringed instrument and plucking a string. The third part is a subsidiary category to that idea of a muted diatonic resonant sound. Finally, this piece is between individual performances and relationships with each other. For example, Lachenmann calls a kind of super-instrument, no longer has any individuality in it.[28] In a string quartet you just effectively have a huge instrument, maybe made up of four people, but they all play at the same time in this almost robotic way, so there's no longer any sense of individuality.

Tom Service, in his *A guide to Helmut Lachenmann's music*, makes the following claim: "He [Lachenmann] tries to reach a new form of listening in which everything is revealed. "[29] I think one of the things that Lachenmann is constantly trying to do in his work is to get us out of this shell of habits that have built up over time that have never been properly questioned. He tries to reach a new form of listening in which everything is revealed.

These three examples for strings show a range of different approaches to working with noise timbres within classical concert music. In my music I follow a definition of noise as the sounds that are ignored or minimized

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[27] Samuel, A., 2021. *Helmut Lachenmann's String Quartet n° 2: Analysis*. Youtube.com. https://www.youtube.com/watch?v=IwsnHoIIFWw. Accessed 24 October 2021.

[28] Schultz, Rick. 2008. *All he asks is: 'Try to like it'.* Los Angeles Times. Available at: https://www.latimes.com/entertainment/la-ca-helmut13apr13-story.html. Accessed 2 September 2022.

[29] Tom Service, *A guide to Helmut Lachenmann's music,* A guide to contemporary classical music Classical music, © 2021 Guardian News & Media Limited or its affiliated companies. All rights reserved. (modern). Tue 12 Jun 2012, https://www.theguardian.com/music/tomserviceblog/2012/jun/12/helmut-lachenmann-contemporary-composers-guide. (Accessed 20 December 2021)

by traditional music. Noise could be a kind of musical genre characterized by an expressive use of sound that does not need to follow traditional musical rules and may possess a demanding sound signature.

Music can be 'instrumental', by which I mean placing in the foreground the physical production of sound, with traditional elements such as pitch, gesture and melody placed in the background. I will try to apply Lachenmann's understanding of music, where I focus more on the quality of the sound rather than the pitch. Such as how to create different sound effects, or how to use extended techniques to pile on the desired noise sound. For example, stringed instruments can have all sorts of possibilities, as if they were muted and prepared, supplemented by whistles, lion roars, percussion sounds, and other objects; wind instruments or brass instruments can create whistles, low-frequency resonances, bird calls, percussion sounds, and white noise. It may be that, in terms of imagination, one can use one's own singing voice to correspond to the sounds that can be produced by an instrument, of which Tanya Tagaq's *Sivunittinni* is a clear example.

From textures, timbres, extended techniques to complex ones, I hope that in my music I can:

1. find new sounds using old methods. For example, using extended techniques to explore more of the limits of the instrument.

2. organize the music through a variety of noisy materials. For example, I will figure out what noises I am sure I want and for a section of the piece limit myself to using only those that are filtered. In this way I can use categories of sound/noise as structural elements of the music rather than tonal centre as in tonal music.

3. Challenge the distinction between musical and non-musical sounds in traditional musical practice. This is like finding similar or very different but highly effective combinations through instruments and electronic music.

If the musical instrument or electronic music were to be extended even further, from its own transformation to the possibility of external sources, as in the case of the instrument transformation, it would not be a continuous imitation of life through noise, but rather a magical reorganisation through timbre and classical material. In this way, in addition to the familiar tones and sounds, noise music can become a new genre of music, reaching beyond purely emotional expression.

This will likely become an experimental process. Not satisfied with the use of ordinary, familiar objects, sounds, and instruments, I use noisy materials throughout the piece and devise highs and lows such that musical momentum can be generated through the new materials. Different noises bring different meanings and emphases to different pieces. By working with different players, we can also work together to develop innovative sounds. For example, through communicating with performers through adjectives, you would realize that each person's imagination of adjectives could be completely different. Variations on the discovery of new noises not only satisfy the creative ideas of the composer, but also add to the possibilities of noise music. This brings us closer to a future that promotes the use of imagination, rather than imitation, in assembling noise.

1.3 Notation issues

Music notation may be 'an idealized visual representation' of the sound of music, or it can be a set of 'instructions' used by a performer to construct a musical event.[30] However, 'in the case of music, it is important to state that its notation poses not only the problem of representing the sounds in question, but also the

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[30] Christopher Fox, Opening Offer or Contractual Obligation? On The Prescriptive Function of Notation In Music Today, Tempo, July 2014, Vol.68 No. 269, pp. 6-19

additional challenges of indicating their rhythms, pitches, and relationships to each other.'[31] While 'standard' music notation is excellent at notating rhythm, pitch, and relationships, it is not so effective at expressing nuances in timbre. This raises several problems for the composer of noise-based music because the basic materials used go beyond the realms of standard notation, both in terms of representing the sounds and in terms of presenting instructions for the performer.

One approach I explored was to use graph notation, using my own symbols with time represented by horizontal spacing. It is really hard to be clear and to decide which shapes, symbols, or notes to indicate precisely the sound desired. How do you apply notation to demonstrate the interaction between the instruments as they interact with one other, especially when composing an ensemble piece using more than one instrument? Are there more possibilities than some standard conventions? Or is it possible to create practices that can become standards for the sounds of new organisations? In time-space notation I use dotted lines in addition to time markers to mark the instruments that sound together and to remind myself of orchestration issues. In particular, the important relationship between the instruments is marked in the *Twist Roll*; in the *Brick Block*, there are clear simultaneous notations. Another approach is to use traditional notation, in which each beat aids the composer in visualizing and stacking sounds in the head, whether looking at the entire sound or looking horizontally at a single instrument. In either notation, for example, I first draw the shape of the imaginary sound on the score, such as a triangle, a curve, or a wave, and then fill in the spaces with notes. However, in this process, I figured out that sometimes using the simplest notation with words would be the best way to express what you truly want the noise to sound like. Furthermore, because what is written on the score can only affect others when it is performed, the notation should be structured in such a way that the reader/performer, who may have never heard the work before, may grasp it with tolerable precision. For the composer, it is important to be careful about the matter of notation, which ''requires marking the right amount of detail - not too little and not too much.'[32] Maintaining this balance, where the information required to make the precise sound desired is clearly provided, but performers still have the freedom to be performers, and that the notation is not overwhelmed with so much extra information that it becomes unreadable, is a significant challenge in working with noise timbres and extended techniques.

All my pieces use 'extended techniques'. Some of these I discovered through collaboration with performers, and others I found from internet tutorials: Trombone Lessons: extended techniques[33], Making Weird Noises on Brass Instruments[34] and the works of composers such as Lachenmann and so on. Some of these extended techniques already have an established notational practice which I can continue in my own music; for others I needed to develop my own notation. This was particularly the case with brass instruments, though there are many extended techniques videos on YouTube. In every weekly meeting, my supervisor and I were talking about how to notate the sound clearly. Because some marks are interpreted differently by each person, not all marks are intuitively consistent. Although the characteristics of the generated music remain the same, the noise state diversifies the potential interpretation of the work, thereby presenting a greater degree of sound variation in some performances. From films, I recorded the sounds corresponding to each notation and then filtered them to find the desired sound. For example, In *Brick Block*, I asked a cellist to demonstrate the sounds which I recorded as videos and included as part of the score. This not only avoids notation problems but also allows me to explore a wider range of sounds. Finally, I will refer to Helmut Lachenmann, Tanya Tagaq and Eli Fieldsteel approaches to notation in their works in the next paragrapg.

[31] Robertson-Wilson, Marian. The Challenges of Notating Music in General and Coptic Music in Particular: Observations of a Professional 'Cellist, Composer, and Linguist. Web. https://www.loc.gov/item/ihas.200156229/.

[32] Robertson-Wilson, Marian. The Challenges of Notating Music in General and Coptic Music in Particular: Observations of a Professional 'Cellist, Composer, and Linguist. Web. https://www.loc.gov/item/ihas.200156229/.

[33] Christopher Bill, https://www.youtube.com/watch?v=XfNNp0O8QRo; Chris Washburne, https://www.youtube.com/watch?v=Xmy1Ku57ePg, Recorded April 19, 2013.

[34] THE LESSON STUDIO BOULDER MUSIC LESSONS, © 2021 THE LESSON STUDIO. https://thelessonstudio.com/about-music-lessons/blog/trombone-lessons-making-weird-noises-brass-instruments

How do composers ensure that the sounds in their brains can be reliably and accurately conveyed and written down? From other composers, I find that there are some similar ways that help me to write down the score. I was trying to create the sound of turning the tuning pegs with strings, a sound that had been bothering me for a long time in notation. From Helmut Lachenmann: *Pression*, it helped me to solve the problem of notation. As you can see from the figure 1, in addition to the notation, there are clear instructions underneath to remind the performer how to create the sounds in the score. In addition to the sound of the pegs turning, I was also interested in white noise and the variety of different levels of pressure applied to the bow. From Tanya Tagaq: *Sivunittinni*, (Figure 2) in the performance note, we can see that she has used a variety of notations. Each notation clearly represents a different type of sound, and the difference in notation allows the player to clearly connect the notation with the actual sound. I am also interested in the sound of wind music for beginners. (Here I would like to refer to the beginners of the instrument. There are some harshnesses or noises that can occur if you don't use the right kind of force. For example, if you blow a reed in the wrong way, you may only get the sound of air, or you may get a splitting sound.) Besides the basic extended techniques videos, I also found Eli Fieldsteel's *Fractus IV* for Trombone and SuperCollider (Figure 3), which clearly organizes the notation for most of the extended techniques that can be used on the wind instruments. This not only helped me with my notation difficulties, but also helped me to communicate effectively with the trombonist. In addition to the textual descriptions of the sounds, the notation on the score allows the player to intuitively translate the sounds on the score into a functional response. For example, the warm-up exercises done before playing will be put into the piece, as everything in the piece is related to chi, and the use of chi in the warm-up exercises is part of this. By incorporating the warm-up concept or notation into the score, the musician can quickly understand the instructions in the score. This is as natural as encountering and playing Mozart on a daily basis.

In my compositions, I use descriptions of sound to find and refer to other composers' works to find the suitable notation. In order to give the performer a more concrete understanding of the sound on the score, I have incorporated text into the score as well as notation through images. I also provided little recorded excerpts to make sure that is the right sound.

Figure 1[36]

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[36] *Pression*, page 1 (1972), by Musikverlage Hans Gerig, Köln 1980, assigned to Breitkopf & Härtel, Wiesbaden. https://issuu.com/breitkopf/docs/eb_9221_issuu

Sivunittinni Performance Note

Tanya Tagaq
arr. Jacob Garchik

(1) circle with a slash through it

white noise, no pitch, with very light bow, like an inhaled breath
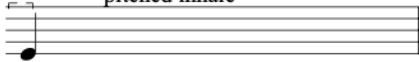
(2) rectangle, solid or open

heavy bow pressure, scratch, with or without pitch as indicated
follow contour

(3) triangle, solid or open

light bow pressure, to sul tasto, like an exhaled breath

(4)

c.l.t.

col legno tratto - no hair, a lot of pressure
pitched inhale

(5) x notehead

light left hand, right hand scratch with circular bowing
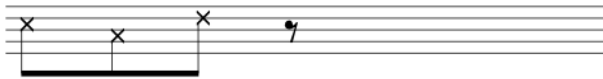
triangles with arrows

(6) vertical bowing: no pitch, move bow back and forth from bridge to fingerboard

(7) x notehead with arrows

combination vertical and circular bowing

(8) normal noteheads

bowed normally unless specified

Figure 2[38] *Sivunittinni*, page 1 (2015), Kronos Performing Arts Association, © 2016 Inner Sunset Publishing. Reprinted by kind permission of the publishers.

Figure 3[40] *Fractus IV*, page 1, © 2012, by Eli Fieldsteel. Reprinted by kind permission of the publishers.

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[40] *Fractus IV*, page 1, © 2012, by Eli Fieldsteel. https://www.elifieldsteel.com/works/electroacoustic/fractus-iv-bonesaw

Section 2: Noise Music in Practice

2.1 Introduction to the portfolio

In this chapter I will briefly describe the works in my portfolio and where I have used noise. After exploring the ways in which other composers have used noise, I will explain how I organise the new sounds I am inspired by and incorporate them into my compositions. I aim to learn and experiment with other composers' approaches to create better effects or express the mood of the music. This will be the process by which I break down, reassemble or create noisy sounds from these materials to make a noisy piece of music.

According to noise in communication system, there are two types of noise, one is external noise includes natural noise and man-made noise. The other is internal noise which is the fundamental noise that gets generated by the electronic equipment involved in the system itself.[41] In timbre of noise music, I try to sort of the noise in the way of words. That would make words become a tool which can help create noise sound easier. There are four quadrants base on all the types: loud, soft, simple and complexity. As the tracks develop and fluctuate, there are corresponding sounds. The corresponding keywords for *Toward the Sun Lives* are loud and soft; for *Twist Roll* are simple and complexity; for *Brick Block* are as soft as loud and complexity; for *Breathe* are simple and loud; for *Foam No.1* are all of the four words.

2.2 Toward the Sun Lives

Toward the Sun Lives is a piece for solo electric violin, live electronics and tape. It lasts approximately 5 minutes.

I arrived in the UK in the middle of the pandemic in Autumn 2020 and unsurprisingly this was an emotionally turbulent time for me. The excitement and anxieties associated with a new culture and new language were heightened by uncertainties about the virus, self-isolation, and lockdown. *Toward the Sun Lives* was the first piece I wrote in York and is like a diary to me: a record of my life when I first arrived. The tape segment includes church bells, automobile motors, and slamming doors, all of which have been heavily processed to the point where the original sound source is no longer discernible. Nevertheless, the slamming door has a special meaning for me: it's a form of therapy, a release of nervousness. We talked in the kitchen when I met my flatmate, and I started to feel like I could adjust to this new life. Furthermore, the extremely distorted electric violin attempts to find common ground with the tape part's obviously alien sound world. In the Covid period, people are unhappy and depressed. The piece's title, 'Toward the Sun Lives,' is a wish I wanted to express in Covid time.

In Towards the Sun Lives, I used the technique of recording the noises of my daily life in York and processing them such that their original source could no longer be discerned. I collaborated with the violinist to create live sounds that could interact with the timbral space in my processed, pre-recorded audio. I quickly realized that I required a much lower and "dirtier" sound than an acoustic violin could provide, so I used some basic transposition and distortion effects in Max. These are pushed to extremes, with a two-octave shift and strong distortion, and the original source of the violin sound, like the tape noises, is 'hidden.' Standard acoustic techniques of string tone distortion, particularly overpressure, are also employed, further obscuring the violin's 'tone' and making noise the primary sound component.

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[41] Y, Roshni, 2022. *What is Noise in Communication System? Definition and Types of Noise in Commincation System - Electronics Desk*. Electronics Desk. Available at https://electronicsdesk.com/noise-in-communication-system.html. Accessed 20 July 2022.

Noise was a means for me to handle the powerful emotions I was experiencing in this piece. There are 'heavy', threatening, sustained low frequency sounds that make me feel terrified or angry. There are also 'lighter' sounds, such as pizzicato, tremolo, ricochet, and glissandos, which come from the live electric violin. The contrast and mixture of these two sound forms are presented in the composition, matching the perplexing inner emotional environment I was experiencing at the time.

All the sound-types centre around the pitch-class G, although given the level of distortion this should probably be regarded as a 'frequency centre' rather than a 'pitch centre'. Although the sonic material of the piece might be considered 'radical', I chose a traditional formal plan of ABA'. It was important for me to have the clarity of this framework to work from when engaging with these new materials, and as a basic principle the ternary design has been used successfully across music and other art forms since time immemorial. The central part of the ABA' plan is for unprocessed electric violin alone and is therefore at a much higher pitch-register than the rest of the piece. This passage brings back echoes of faraway bells and a sense of a less dangerous world in my thoughts. In the last section, this sequence is captured in a buffer and then replayed through a granulator, with grain-rate matched to the inverse of violin amplitude. Despite the reappearance of the 'heavy' material, glimpses of a more optimistic, 'lighter' world are preserved in this way. The live violin material has also been transformed: energetic glissandi and frequent Bartok-pizzicato have been replaced with a gentler tuning peg manipulation, though the extreme transposition and distortion and tendency towards overpressure remain.

Noise in *Towards the Sun Lives* therefore serves several purposes. It's a technique for making familiar sounds weird and foreign, similar to how the world felt to me in a foreign land, using environmental noises in the source material for the tape section and standard violin tone. Pitch is no longer a key focus since glissando and varying bow pressures focus on continuously morphing and strongly distorted sounds. As a result, emotional content can be explored through the distinct qualities of 'heavy' and 'light' sounds and their juxtaposition and combination. The central section shows a new dimension, in which 'noisy' warped timbres are no longer dominant, but pitch-clarity is nevertheless avoided by continual motion. Different approaches to the concept of 'noise' help to define the structure of the composition in this way.

How does a composer transform an everyday sound into music, apart from imitating the sound, and how to make the sound musical? I took inspiration from Michael Beil's *Swap*, for flute, oboe and clarinet, with live-video and -audio it is the transformation of 'real world' to 'musical' sound. At the beginning of this piece, I noticed the player using his mouth to make a bubbling sound to mimic the sound of a metronome, which then changes into a short skipping sound from the instrument. Sometimes it blends in perfectly with the skipping of the instrument, and sometimes the difference is clearly audible. Both the former and the latter are good examples of using everyday sounds to transform into music. This is the first step in the process of making noise music by mimicking everyday sounds and transforming them into musical material. This material is then combined with live-video and live-sound to build up from a sound to a phrase. In a similar way I built up my phrases from small units of sound material derived from 'real world' sounds.

Noise is infinite. I think noise can be a combination of sounds, from a single sound to multiple layers of sound that make up different kinds of noise music. If noise is the sum of musical extremes, I choose to make noise music in an extreme way, to express emotions and feelings. For me, the quality of the sound develops more than the single material.

There were two main challenges in notating *Toward the Sun Lives*. These were: indicating the tape material in the score and ensuring the violinist aligned with this; and presenting combinations of bow technique with pitched and unpitched violin material. My solution was to use a time-space notation with a timer visible for the violinist to follow on the electronics patch. Initially I used several colours and a variety of notations to indicate the different bowing techniques, such as dark blue for left hand; light blue for being heard clearly;

red for turning bridge pegs. However, after discussions with my supervisor I reduced the colours and symbols and relied more on text explanations.

2.3 Twist Roll

Twist Roll is a piece for saxophone, percussion, and tape for ensemble. This piece is 7-8 minutes.

This piece is dedicated to my friends and was created in conjunction with them through the use of videos, social media, and back-and-forth discussions between Taiwan and the UK. It was recorded in Taiwan on 6 December 2021. This composition, like others in my portfolio, functions as a diary of my creative process, with sections focused on electronics corresponding to times when I was alone, and sections focusing on saxophone and percussion relating to chats with friends. As I grappled with the conflicting feelings of my continued life in the UK, the overall expressive spectrum is moody and polarized. This process reminded me of a spiral, similar to the structure of a cookie Fried Dough Twist roll, so I dubbed the piece *Twist Roll*. Because the *Twist Roll* is a spiral, this piece has three main characters. Like the twist roll, although there are twists and turns, the fundamental thing is that the three twists, in this case the three instruments, spiral together to form the roll.

The relationship between the two instruments and the tape was my main focus with this composition, and I wanted to make sure that each section was treated equally. The compositional challenge was to locate a place where the various methods of sound production in each component could collide. This provided me with the opportunity to go more into noise sounds, which can be produced by both instruments and electronics. I was able to identify the noise- sounds on my instrumentalist friends' instruments that I was interested in and use them as the basis for my composition by collaborating with them. Such as these sounds were: the saxophone uses extended techniques to echo the distorted sound of the electronics. One of the keys focuses of the noise in this piece is a saxophone extended technique called flutter tongue without pitch. It sounds like a strong wind, and no one can predict which way it will blow; the rubbing of the super-ball against the drum skin is used to imitate distant thunder. Irregular and low frequency rubbing is the key to imitating the sound of thunder.

There are four parts, A for ensemble; B for Saxophone Solo with tape; C for percussion solo with tape; D for tutti. Like the name: *Twist Roll*, the music developed just like the title. There are three lines. *One* of them could be the main line that is controlled by loud sound. Such as *ff* is the highest peak and pp is the lowest peak. (Figure 4) The tape section has a number of passages that change rapidly from one to the next, each of which is a moody, albeit polarized, portrait of each week of the creative process.
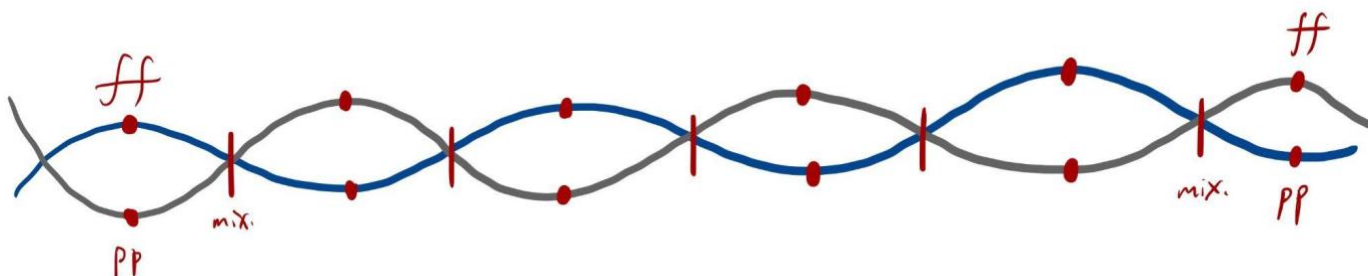

Figure 4 The spiral with highest and lowest peaks.

The concept of twisting the sound into a *Twist Roll* comes from Steve Reich's *Drumming*[42], where the stereo sound of the drums can be heard clearly, whether listening live or from a video. As well as the nature of the

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[42] Reich, Steve. 2017. "Steve Reich - Drumming". Youtube.Com. https://www.youtube.com/watch?v=uDhwFTw4VnI.

percussion itself, this 3D sound means that wherever you listen to the music, you can feel the stereo sound, with the sound coming from all sides of you, creating a 3D sensation. In *Twist Roll*, I post-produced the three sounds, for example, by adjusting the ratio between the left and right ears. I also checked with the recorder when recording the radio and used multiple microphones to record one instrument to ensure that the listener would get a sense of stereo when listening. I learned in John Adams' *Shaker Loops* that volume is also a part of noise production. Music sounds good at the right volume, but if the volume and intensity is designed in an uncomfortable and deliberate way, it is noise. If the deliberate design of volume levels to achieve noise is one way of doing this, the design of volume levels is both complex and meaningful, allowing the tension of the piece to come through. That's what Steve Reich and John Adams have in common, and it's become one of the key sources of *Twist Roll* in the future. This inspired me to use volume levels to design the balance of the piece.

I began to consider the timbre of noise in the tape part of *Twist Roll*. There are two thoughts that come to mind when I make electronic music. One is that I should see it as a new musical instrument or a sound-control system. The other is that I can compare the timbre of noise in different musical instruments while listening to the same electronic music. For a long time, I was engrossed in the quest for the sound. Another important component of musical sounds is timbre. The perceptual quality known as timbre distinguishes between two sounds that have the same pitch, loudness, and duration. 'Timbre is another key aspect of musical sounds. Timbre is the perceptual characteristic that separates two sounds with the same pitch, loudness, and duration.'[43] As I previously stated, I was wondering whether to arrange the electronic music as a kind of traditional instrument or to fill the piece as a background accompaniment during the composition process. I regarded the tape part as itself an instrument in the ensemble. The tape, rather than accompanying the work, is allowed to have an autonomous function in it due to the frequent changes of each section sound. It uses percussion and electronic sound to create a spiralling loop. It's the first thing that comes to mind when I think of electronic music, and the last thing that comes to mind when I start making it. It has something of the sound of science fiction, as the word spiral keeps reminding me of the sound of science fiction. When it gets to the two solo portions, it slows down and occasionally reveals a flair for tiny surprises. Each of the three 'instruments' is the protagonist just as each strand in a spiral is equally important.

With the notation, this time I used time-space notation in section A, and traditional notation in sections B and C. I used metric modulation and designed the shape of the wave through pitch and volume. Because this is an ensemble, I believe that using more graph notation will confuse performers as to how to play and imagine the sound. However, when performers interact with one another, I would like them to feel freer and more flexible. In addition, I need to make a clear timing to make sure that the twist would be going. I chose the time limit that not only meets the need for a clear indication of where the music is going but also gives the musicians the flexibility to play. In a recording session, the more clearly the score is recorded the more time the musicians have to work alone, such as seconds of individual phrases, and the more efficient it is. For example, in section A, although time-space notation allows the musicians to determine the flexibility of the music, time-space takes more time for the musicians to communicate with each other and to reach a consensus on the time notation. For example, this time we have even made a video of the timing of each phrase (e.g., three, five, seven seconds) to help with the performance. In terms of pitch and timbre, the pitch is based on the G in the treble clef and progresses upwards and downwards, as the treble clef starts with a G. Timbre, as mentioned earlier, needs to interact with and imitate each other. I try to link the words of the text to the timbre as much as possible as if to say that the sound of blowing into an instrument is to blow into the instrument visually. In notation, it is not enough to just write the text on the score, I use different notations to support it, for example, by replacing the notes with rectangular notation for the saxophone and adding arrows to convey the meaning of blowing into the instrument.

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[43] Town, Stephen M, and Jennifer K Bizley. "Neural and Behavioral Investigations into Timbre Perception." Frontiers in systems neuroscience. Frontiers Media S.A., November 13, 2013. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3826062/.

2.4 Brick Block

Brick Block is a piece for 2 violins, 2 cellos, and 2 double bass for ensemble. It is 26-27 minutes.

It was important for me to explore a variety of stylistic approaches in my portfolio, as I want to show that noise-timbres can be effective musical materials in a variety of contexts. After encountering the music of Reich and Adams during the writing of *Twist Roll*, I decided I wanted to write a piece of minimalist music.

In *Brick Block*, my approach is to separate and match the extended techniques of the string instruments. I wanted to be able to clearly differentiate between the timbres of the instruments, so I chose violin, cello and double bass. The viola was not chosen because the clear division between low and high, large and small instruments was important to me. The ensemble is therefore divided into two groups. (Figure 5) The division into two groups is intended to create an effect of sometimes opposition and sometimes fusion. There are infinite possibilities between the six instruments, which means that they are independent and can talk to each other. The multiple identities and layers, from small to large, can enrich the noise music.

Before I started writing, I designed a triangle shape (figure 6) in each part and seven noises (figure 7) for the strings to make noise sounds. This piece contains a combination of seven noise sounds. The first movement's main idea is that the timbre of sul tasto, ordinary, sul ponticello, molto sul tasto and molto sul ponticello in varied vibrato. Vibrato can be fast or slow, narrow or wide, even to the point of being a glissando. By combining and juxtaposing types of vibrato one can give the impression of time slowing down or speeding up. Playing with this illusion is the basic procedure of the first movement.
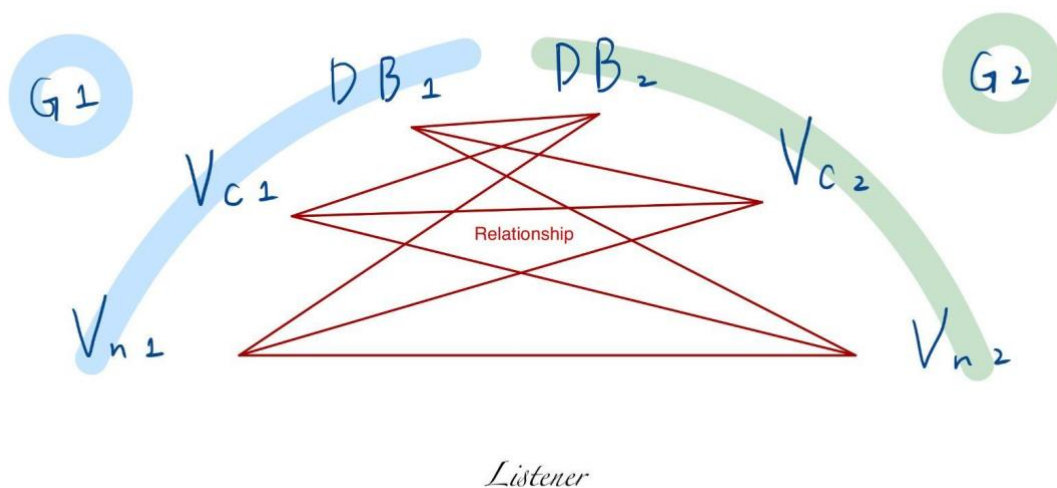

Figure 6 The seat map.

Figure 6 A triangle shape in the structure.

Figure 7 Seven types of noise.

The second movement focuses on heavy and short noises. The noise sound inspired by Tanya Tagaq, I created a set of related timbres: 'sounds of machine running'; slap string; short sound with glissando; vibrato in different way; overpressure on the strings or ricochet; overtone with glissando; Bartok pizzicato. I tried to classify the seven kinds of noises.[44] In addition to grouping two similar ones into one group of sounds, I also grouped completely different sounds. For example, at the beginning of the second movement, I put the slap pizzicato between the machine sound. It could be heard and made an interesting point. On the other bar, I put a quarter note triplet with cut really short glissando. It could break the sense of continuity of the phrases and make the phrases have different ups and downs with the rhythm. I used the rhythm to make the whole piece keep continuing and make sure the connection between each part.

I listen to a lot of ensemble music, of which Tanya Tagaq-*Sivunittinni* is one of my favourite works. In addition to the string quartet version, I even found Tanya Tagaq who first did this vocal demo which was then transcribed and arranged for. This version of the Vocal Demo better illustrates how extended techniques or

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[44] I am not the first composer to work with in this way – Radulescu's 'sound compass' is another classification system used to help direct large-scale structure, for example – but each composer's classification system is necessarily personal and particular to the requirements of the piece in hand: in a different piece I may have approached the classification differently.

instrumental sounds can be used to create narrative noise. Clear and imaginative. The noise function of this piece has to do with a variety of air sounds such as muffling, panting, blowing, hissing, and growling. I also apply this concept to the jitter of the strings. Different amplitudes, positions and string tensions affect the sound.

In the string quartet, *Sivunittinni* has several parts with an impressive noise sound, the study of which has been important in developing my own approach, both as an inspiration and through more specific following of Tanya Tagaq's approach to noise. In the first section of *Sivunittinni*, the noise sounds like a very hard throat singing; the notes are restricted to E-flat and F, and the tension makes the noise audible. This inspired me to use strings to imitate a very hard sound. Overpressure on strings, for example, (where the bow is kept in constant motion and the sound is a continuous 'scrunch') is one of those noisy materials that makes the listener feel pressured and harsh because of the force of the loudness. The second part focuses on rhythmic rhythms and notes from E-flat to G and builds up to a small peak of complex passages. Here I use legato rhythms to interlock the six instruments with the aim of creating a chaotic cacophony of noise that can be sustained over time. At first, it is a superimposition of the material from the previous section, then a dialogue between the instruments begins to emerge. As the dialogue slowly diminishes, this low sound continues to develop through the rest of the piece. The third part of the piece is where the sound is shaped like two triangles with the top and bottom upside down. The design of moving from a single instrument to multiple instruments and back to a single instrument form the first peak of the piece. The shape of the triangle is not just a rhythm or a special symbol for me, I have outlined the whole structure of the song in simple symbols before I start writing. Thus, the triangle plays a role in my compositions as a determinant of orchestration and volume. It is particularly important. In the final section, Tanya Tagaq used the motives of the first part to develop white noise. Not only the long C and A but also the heavy pressure on the strings. This section made me think about the part on white noise. Although many ways of creating white noise are known, none of them has yet found a way to perfectly match the imagination of being noisy and yet light. The words 'noisy' and 'light' create a contradiction in my mind. What sound can fit both adjectives? The sound of scraping fish is only noisy; the sound of sandpaper rubbing against each other is too granular; the sound of rain dripping on the floor is too light. So, I have tried a number of ways of creating white noise and have finally found that the best results are achieved by gently scraping the bow hairs up and down the strings. The piece has a noise material that runs through the whole piece and even has a high point of ebb and flow designed to make the piece interesting. The different noises give different fragments different meanings and focus. This is the most powerful use of noise in the piece.

Developing an effective notation for this piece was a major challenge. Every meeting my supervisor and I figure out how to use clearer notation to record what sound that I want. In order to allow the six instruments to make different rhythmic noises, I wanted each instrument to play a different legato. The purpose is to allow the instruments to alternate with each other and to create a chaotic noise. In the early stages, the notation was so free that the players would not have known how to play accurately. In the middle stages, the handwritten ratios were often inaccurate and the different legato and rhythms could not be scaled up and down like a computer, which made it difficult to read the music and understand it immediately. This was the reason for the need to type the score later on. Finally, the final notation of the rhythms was made possible by the need to keep an accurate record of when each sound occurred. The result is a messy, orderly noise music. How do you translate sounds that use extended techniques into notation on the score? It should not be too complicated, nor should it rely too heavily on verbal explanation. I use similar symbols to show the sound that can be really clear, see the process and develop in the score. When I was struggling with how to notate the sound, I studied the scores of G.F. Haas, *String Quartet No.2*, and Tanya Tagaq, *Sivunittinni*. I really like G.F. Haas and Tanya Tagaq both of their styles, not only in terms of the sonic treatment of the music, but also in terms of the clarity and cleanliness of their scores. I also found similar notations that corresponded to the sound. It is like the slash triangle symbols with arrows on the score. I have listed this notation in my drafts and visited my friends in string music. I found that if you want a vertical bowing: no pitch, moving the bow back and forth on the bridge and fingerboard, the sound of the different notes with the arrows

is the best and most intuitive way to express it. Their music is a clear expression of the sound they want to make through different symbols. Despite the noise of notation, they are able to simplify it in the most straightforward way possible, and often the simplest is the best way. Even so, they add a textual narrative to bring the performers closer to the sound the composer intended. Their music and their scores have been a great inspiration to me. By following their example, I was able to standardize the technique of the whole score of *Brick Block* to prevent misunderstandings with performers or readers.

2.5 Breathe

Breathe is a piece for trombone solo. Duration 10 minutes.

This piece is based on everyday breathing. When you are nervous, your breathing becomes short and rapid; when you are sleeping, your breathing becomes long and deep; if you are an athlete, your lung capacity is larger than the average person and so your breathing is different. As wind music is closely related to breathing, I tried to think of the phrase in terms of breathing when composing this piece, even though I do not play any wind instruments. I also tried to breathe in different situations and tried to translate the different breaths into the piece, which can be seen in the score. The first is a deep breath followed by an exhalation. In the score I express this as breath in and out. The second type I use is to inhale, whisper through the instrument to express a sharp change of breath or a gasp (with some mumbling). The third type is a shallow breath in contrast to a heavier breath, and I use open sound to contrast both. Finally, glissando is intended to convey the difference in the use of breath when there is a difference in the level of emotion.

In *Breathe*, what is the musical aim of what I am doing? When I started to write this piece, I had the purpose: I wanted to write using noise-timbres. So, I searched and tried to focus on more extended techniques on the trombone. I decided to make breathing my central thought, in particular its continuous cycling nature. My materials were as follows: slap tongue, flutter tongue, accent with whisper, percussion sound(hit), different position and mute. Then, I have selected some groups of noise sounds that have been associated with each other. To organize that noise, it has two parts. One part I relate to breath: lines, generally long and smooth; and the other part is 'dots' – short, staccato gestures. Breath is the main idea of the whole piece. I presented several breathing patterns in this work: accent represents shortness of breath, while singing and playing at the same time are the interweaving of breathing in and breathing out. Breathing through the muted instrument generates a 'vibration sound', which to me represents the process of friction and circulation between air and internal organs. Breath contains everything in this piece. Such as take a deep breath and exhale into the instrument and then breathe in fragments.

George Lewis, who composed *Oraculum* (2016), is also a trombone player. He is quite familiar with the habits and idioms of the trombone. In addition to standard extended techniques, he used a mute to create any even greater variety of sounds. My favourite part occurs at 5'43" in the recording made by George Lewis[45] on YouTube. Combining unpitched air technique with varying the mute position creates fascinating interference patterns. Although there are relatively few innovative extended techniques in this work, there are many conventional combinations of extended techniques which the composer has organised in a striking manner. For example, the wind effect is notable for the addition of a muted accent to highlight the fact that the sound can be twisted to a limited extent, in addition to the variation in size. The warm-up exercises, which are meant for beginners, are also amplified into an interesting sound in this piece. This fits with my imagination and experience of breathing and is a good way to try this out. In the extremely low range, the breath and the vibration of the instrument are used to create the sound of friction and rolling. I transformed this sound, wanting to amplify the sound of exhalation and instrument vibration to become the main noise for my piece.

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[45] George, Lewis. 2016. "Lockdown Tapes #9 - George Lewis: *Oraculum* (2016)". Youtube.Com. https://www.youtube.com/watch?v=03KtVKRu5Q.

In section A of *Breathe*, the phrase keeps looping, and each loop expands more than the previous one to form a circle. When the circle rolls forward, it becomes a line. However, the circle is continuous, only dismantling the current structure. It is a continuous circle in which there is a variety of circular material that organises these disintegrated circles into a continuous circle. It is like the relationship between chords and broken chords. The circle is like a chord, and the broken circle is like a disintegrating chord. This circle can even be interpreted as a wheel, where rolling along the surface leaves a line. What this means for 'breathing' is that all breaths leave some trace of the previous breath and gradually expand the cycle. It is similar to the way material in music leaves a bit behind in different sections and further develops slowly. Even though the individuals are different, the main body is the same. It's as if the three-dimensional graphics are assembled and assembled in front of your eyes. People can imagine that the exhalation is the beginning of a circle, and as the breath fills up, the circle forms a line. As one exhales, one can imagine that the original is being deflated, gradually deflating into a line. However, the breath is circular, the circle continues uninterrupted. In section B of *Breathe*, it is relatively more dotted than section A, which is mainly phrase based, while section B is rhythm based. The sound is scattered in every corner in a limited sense of space. It also tries to imitate the sound of percussion, interspersing the sound with scattered music in a rhythmic pattern that is somewhat like a march. The rhythmic pattern is somewhat march-like, but not so march-like, forming the main body of the scattered music. This has the effect of expressing the irregularity of breathing and the occasional rush between breaths.

I would like to directly relate the sounds the trombonist makes to physical processes and to states of being. The nature of the trombone can effectively amplify the effect of certain emotional situations, as if in the manner of the breathing signatures. Therefore, I put two types of noise in one group and then sort of in three ways to deal with noise. As mentioned in the previous paragraph, the first part is the 'line and circle' part. When you take a deep breath, the air enters your body slowly. This is intended to convey the image of how it is possible to inhale and exhale when you have a very long breath. Such as breathing in and out into the instrument without pitch. Then, because the amount of breath inhaled affects the duration of the breath, the accented part is modelled or even choking. It can also be seen as a short, sharp change of breath. The air attaché is the best example of it. Secondly, the percussion sound part is in fact a chance for the musician to breathe, to rest when he/she is about to reach his/her limit. To me, when I see brass, I can't help but think of the sound of a march. So, I've brought a sense of march rhythm into this part, which sounds a bit like a march. Finally, the different position I think is a cool thing. It's like a string position, it has its own position chart. When I asked the trombonist, it was hard to imagine how to divide the air into sections, each of which would produce a different pitch and sound due to the vibrations. But that's exactly what I'm talking about, it's all about the breath. We tried different pitches to find the best way to express the control over the direction of the "breath".

I have searched a lot for the notation of this piece. When looking for noise sounds, many trombonists will tell the audience the usual notation or a way to express the meaning clearly by videos. There is a website *The Orchestra: A User's Manual*[46] that includes some contemporary extended technique skills. From this audio and video information, I have gained a lot of contemporary notations. In particular, I have benefited from the Eli Fieldsteel, *Fractus* score. I got some notation for the noise that has been filtered. So, I didn't spend a lot of time imagining or worrying about how to notate the sound. Instead, I spent a lot of time checking with the player to see if the notation connected with the sound I wanted. Different trombonists have different sensitivities to notation and different conventions of notation. I spent a lot of time checking with the two trombonists and making sure that I had a consensus on both sides, so that all the notations could be read clearly from the score even when I wasn't there.

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[46] Hugill, A. (2004) *The Orchestra: A User's Manual*. Available at: http://andrewhugill.com/OrchestraManual (accessed 20 December 2021)

2.6 Foam No. 1

Foam No.1 is for electronic music and is my first work without classical instruments. It is almost 5-6 minutes.

This is my first piece of pure electronic music. As I said before, I have a habit of writing a weekly diary with music. This time, rather than a personal diary, my piece derives from the experience of visiting a scotch whisky distillery. During my search for noise, I kept wondering what the factory would sound like. Over spring break, I visited Scotland with friends. As I am interested in whisky and there is a whisky distillery in Scotland, it was a good opportunity for me to visit the factory and record the noise. This work is the journey of an imaginary bubble in the distillery's production process. If the listener has visited a whisky distillery, I hope the bubbles in this piece create a tangible sense of immediacy. At the distillery, the alcohol goes through a number of processes before reaching the storage stage, such as being heated at least twice and distilled to a low simmer in an urn. The bubbles I have described also have to go through different levels, like the first level of survival in a multitude of bubbles, with a very low bass vibration to express the feeling of being very crowded and competitive.

In *Foam no.1*, what is noise meaning in this piece? I think that I should limit the space in a factory which has a lot of noise. Such as machines working, the high temperature notice, people shouting, and shoes rubbing loudly against the floor. I have tried different types of sounds. Whether it's with pitch, including extreme highs or lows; like the scary and terrifying sounds of a ghost movie; the noise of everyday traffic; or like the sound of John Cage- 4'33" in whatever space it was recorded in that didn't meet people's expectations. After screening my electronic sound source, from those many noises, I decided to use the boiling bubble sound as my main material. Other noises are part of the bubble journey. The noise of the bubble sound is used at extremely low frequencies, such that it is not possible to discern the pitch.

Before I started to create this piece, I was listening to Eli Fieldsteel: *Fractus IV* for Trombone and SuperCollider. When I first listened to this piece, I was really caught by the first sound. It is like the universe shaking and opening at that time. I first noticed this piece when I was searching for trombone music, but I've always wanted to separate the trombone and electronic parts. The electronic part, apart from the science fiction sound, has a lot of details that start to change behind the sound. Such as people walking into an illusory world. When I listen to this piece, I find that I am not distracted from other things. Because every part is designed to make you want to know what unexpected changes will happen later on. It also makes you want to know what will happen when the electronic music is combined with the trombone sound. There are different models for the solo part of electronic music, the most common being the progression from a small voice to a very loud one, followed by a decorative phrase. To me, it's a bit like fireworks, slowly rising from the ground and bursting into beautiful sparks. When you look at the remnants of those sparks in the sky, the trace of light remains in your vision for a little time after the sparks have vanished. This approach has further influenced how I use sound. When I use sound, I try to close my eyes and imagine the bubbles in these processes and whether I can get a concrete sense of space from the sound. This is what I tried to capture in my piece.

It uses the structure A (A/A'/A''). I used the DAW Logic to make bubble material. The sound is interspersed between two bands of low and very low frequencies, using this difference to create a bubble of stereo. This material is used throughout the piece. I deal with two materials. One is like white noise and the other one is more grown-up and has more pitch in it. I would like to use not too much material because I think I will lose on those things. Therefore, I only had to organise two or three materials as well as their variations. This is the fantasy journey of the bubble. The form is from A to A 'and back to A''. One can imagine, while listening to this piece, to incarnate oneself as a bubble in a factory pipe with boiling bubbles, cooling bubbles and bubbles turning upwards. The bubbles in the pipe affect each other. Some of the bubbles have just disappeared, but most of them are moving on to the next stage.

It was a relief after the challenges of notating for performers not to make a score for this piece of electronic music. Nevertheless, visual representation within the DAW was important for my construction of *Foam No. 1*. When you try to make some difference in the same instrument that you need to add so many tracks to create a sense of dimension. I use colour and graphs (lines, dots) to remind myself to remember sound direction. It is really helpful to let you know the direction and development of the whole piece. But most of the time, your ears are the best filter. Hearing is a very direct sense, and when you listen to your work many times over, you can tell exactly where you need more or some changes.

Conclusions

I am not the first composer to make noise the focus of my attention, but the five pieces in this portfolio offer a personal exploration of the area, demonstrating the stylistic diversity available within noise-based music. This project has broadened my perspective of what defines "noise" and deepened my fascination with noise-timbres.

Two particular areas emerge from this study for further attention. Firstly, music which explores the noise timbres shared and interacting across a variety of instruments, or instruments and electronics. Secondly a systematic categorisation of noise types. In addition to the seven types of noise already mentioned above, explore the possibilities for more types of noise. We can construct a list of noise or a system to categorize the types of noise from sources in the future. We could more easily characterize the sounds.

As this portfolio has shown, both the notation and performance of noise-music is a difficult challenge. It's tough to make the sounds and it is tough to represent them in a score. But through these approaches, instruments, as well as electronic music, are becoming increasingly diverse in terms of sound. Even if it is an arduous effort, I believe it is one of the reasons why music fulfils and retains people's interest in it.

Noise has no boundaries, and every day, a new noise is suggested, despite the fact that it is constantly present. I want to keep expanding and enriching the sound field, including the noise field. While I have mimicked environmental sounds in this portfolio, or taken pre-existing music as my model, I believe this is a step on the way to being able to mix and reorganize according to my own vision.

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