

The Silence Études

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EAST 407, Assignment B

February, 2022

## Preamble

My aim was to produce a series of études which would explore different branches of thought relating to how silence is perceived, how it can be used within a compositional framework, and the performance considerations for barely audible or inaudible works within the noisy spaces filled with people that we find ourselves in typically when listening to electroacoustic music produced in an academic context. I wanted to challenge myself to work at the very limits of my hearing and to include a wide range of sound sources and compositional methods while doing so. With the readings I had done on silence, the anti-noise or noise-pollution social movements, and the anthropocentric focus so prevalent when relating to sound, I prepared a bath of ideas and perspectives in which to soak in, and which allowed me to freely move towards different areas of exploring these concepts made possible through the experimentation I would embark on.

## First Étude - *precognition*

I knew that I wanted to work with barely perceptible sound, both in terms of amplitude and frequency, but the choice of sound materials was less clear to me. By chance I stumbled upon a sample pack of sounds recorded using microphones purpose-built and sensitive enough to capture radio frequency interference (RFI) from the electromagnetic fields (EMF) generated by electronic devices. This human-made electromagnetic radiation is not typically audible to us, but exists on both highly localized scales (the phone in our pockets) and globally (telecommunication signals). I thought this fit in nicely with the anthropocentric weighting of sound theory explored during the research in my first assignment, as electroreceptive animals including certain fish and the echidna in Oceania can sense electrical signals which we cannot. The silence that we experience with relation to the electromagnetic radiation all around us would not necessarily be felt as 'silent' in the same way by these sensitive species, and so these RFI recordings fit thematically within the context of my research this semester.

The noisy nature of these sounds also gave me a good direction to follow on Denis Smalley's Note / Noise spectrum as shown in Figure 1.

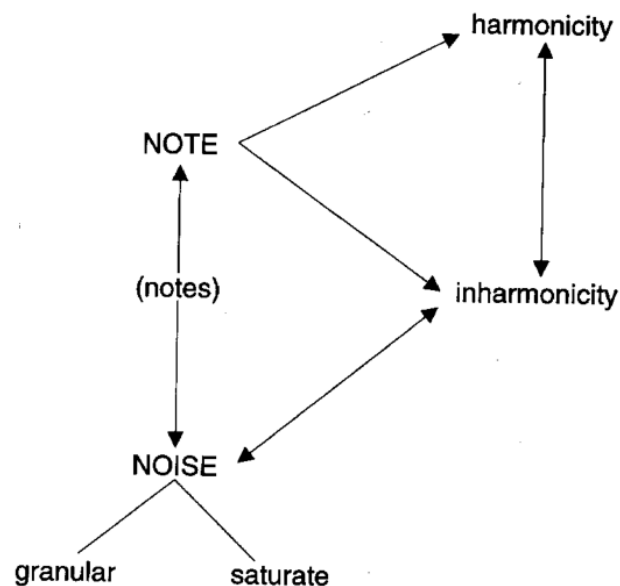


Figure 1. Reproduced from "Spectromorphology: Explaining Sound-Shapes." by D Smalley, 1997.

I set about creating a VCV Rack patch using a sampling wavetable oscillator that periodically took sonic snapshots of the RFI samples to generate its wavetables. I then ran the output through a series of high-pass filters to keep only the highest frequencies which were barely perceptible to my ears. I combined this with some quiet low-frequency content and recorded a live performance in which I played

the patch using a MIDI controller. I set my mixing levels so that I could only faintly detect the output through my studio monitors. The experience was unsettling, as the monitors themselves produce a certain noise and the ambient sound in the apartment meant that I couldn't always be fully certain of the source of everything I heard. To spatialize the étude for quadraphonic sound, I employed envelope followers and three dimensional representations of mathematical attractors to control the motion of the tracks used in the performance. With so much happening on the border of my hearing, I became reliant on spectrograms to give me a clear picture of the gestures taking place within the final mixing stage, for this and all the études.

I have included a stereo mix of this étude with a leading pink noise reference level that should be at a 'loud but not painful' volume in order for the subsequent étude to be played at the intended level.

While I was able to listen to the étude in quadraphonic at home, the ambient sounds of my computer made it desirable to book some studio time at Concordia in order to hear it in a quieter setting. After calibrating the speakers there and proceeding to the first listen, I became acutely aware of just how much extraneous noise was audible from other sources on the eighth floor of the MB building. The ventilation system was the loudest offender, but footsteps, the sounds of doors opening and closing and muffled conversation were all present. I found myself reaching for the master volume knob several times during this first listen, despite the fact that in doing so I was in some ways turning away from the intention of a silent étude. As the playback concluded I set myself the challenge of listening to it all the way through without changing the volume, and listened again.

Tiny, tickling sounds flirted along the ultrasonic hearing frontier. To focus on these sounds required a not-altogether unpleasant effort, and some of the spatial motion produced a very interesting effect on the sensory exertion. The noise floor of the studio helped the experience considerably, but external sounds from both inside and outside of the space made me again question what was part of the recording and what wasn't. This étude went a significant way towards answering two important questions I had at the beginning of this project. Firstly, does where sound falls on Smalley's note / noise spectrum influence the degree to which nearly silent sounds are perceived? And secondly, how are spatial gestures affected when the source material is made solely of very high frequency content?

The sounds I used for this étude were exclusively noise-based, and this enhanced the brain's tendency to confuse similar, extraneous sound sources with those originating from the composition. I would test these findings against my next étude in which I would move towards the note end of the spectrum. I

found that spatial gestures lost a significant degree of their power or ability to be perceived when the motion was occurring at this very high register. On several occasions the sounds felt to be originating inside my head as I was listening to the étude. Swift, precise spatial gestures may not be an ideal choice for this type of sound material.

The title of the étude, precognition, refers to the link between the research on RFI and the discovery I would make in the third étude.

## Second Étude - supradiatonic

For the second étude I wanted to include an exploration of the 19-equal division of octave temperament (19-edo) as an alternative to equal temperament (ET). This would place the étude on the note end of Smalley's spectrum but due to the microtonality expressed within its composition it would fall somewhere between the inharmonicity and harmonicity continuum, depending on the musical background and tastes of the listener. In order to showcase the intervals and chords possible with 19-edo, the étude features a 16-voice polyphonic wavetable synthesizer and four channels of processed noise using the previously referenced RFI soundpack as a source. These twenty tracks were again filtered to remove much of their low-to-mid frequency content, and panned within a quadraphonic space using a very close integration between note selection and movement. As notes, intervals and chords were played, so too would their position within the space be altered. Once the system was created and tested in VCV Rack I recorded a session directly into a multichannel audio file without monitoring the performance. I adjusted the balance between the tonal and noise channels, but otherwise did not process the results.

The resulting play within the 19 note, supra diatonic scale proposed by Joseph Yasser in his *A Theory of Evolving Tonality* produced eerie clusters of frequencies, enhanced by their appearance at the limits of my hearing. Further alienness was achieved by the inclusion of the high-frequency noise sources, which occasionally made identifying whether the sounds produced were interference sounds, or chords from this strange tuning. Upon listening to the piece I was reminded of one of my favourite electroacoustic compositions, *Blue Veils and Golden Sands*, realized by Delia Derbyshire for the BBC Radiophonic Workshop in the late 1960s. There is a shifting, textural quality to the unfamiliar grouping of frequencies that can just barely be perceived as they move around the space. I have included a stereo mix of this étude with the same leading pink noise reference level.

Before listening to this étude in the Concordia studio, I told myself I would not touch the volume dial on the first listen. I would allow myself to adjust it louder on subsequent listens, but wanted to experience the 'calibrated' levels as the initial intention. The ambient sounds were a lot more noticeable when listening to this piece, and I had the feeling of being in a submarine - sounds originating outside the studio were perceptible, but most of their high frequency content was being filtered. Only the ventilation system produced full-band noise to challenge the low noise-floor design of the space. I felt very much like my piece was being drowned out even in this relatively 'silent' space, and this feeling vexed me. In that moment of frustration I created a connection how Yasser and the countless other proponents of

non-ET temperaments must have felt when their arguments were drowned out by the immovable, imperfect monolith of equal temperament.

The highlights of the listening sessions were moments where chords and intervals seemed to dissolve out of the ether, suspended in space and then just as quickly evaporate back into the silence. Although there were similar moments of ‘am I hearing this or imagining it?’ the climax of the étude was more-distinct and more-perceivable than the preceding moments, and so in that way it felt more like a contemporary composition elevated in frequency and lowered in amplitude but still resonating within a recognizable form. Again, parallels to be made to the 19-edo temperament which serves to differentiate notes from one another but does so in a way that shifts the perception in a different direction than what’s possible with ET.

I did find myself wanting to listen to the étude at a much higher volume, in order to perceive the gestures more clearly and to open myself more to its 19-edo DNA, and I sat with this impulse for awhile, contemplating whether I was truly interested in ‘silence’ or simply ‘quiet.’ This has been at the heart of a lot of internal debates throughout the development of these études, from whether any part of the development of the sound patch and subsequent performance should be done at ‘regular volumes’ to whether the final piece should be barely audible or truly below or outside my range of hearing. I have aligned myself with sounds that *would* be audible by humans, but tried to keep the amplitude barely perceptible for the final performance, but really have struggled with whether this decision should play a part at every stage of the composition. I will eventually explore a piece created entirely within the silence, I think just so that I no longer have to wonder what that experience would be like.

It is not a surprise that this étude’s leaning towards the ‘Note’ end of Smalley’s continuum made its perception easier, and less prone to the sound source confusion experienced with the first étude. Our brains are perhaps conditioned through a lifetime of listening to music to be able to pick out the ‘idea’ of notes and harmony even when they are on the limits of our hearing. With so much research pointing to how hard-wired our brains are to perceive the human voice, I wonder how we would experience a ‘silent’ composition made up entirely of human voices.

### Third Étude - notron

For my third étude I wanted to move entirely outside of Smalley's noise / note spectrum and use silence itself as a compositional element. I wanted it to be a recorded performance similar to the first étude, and used the image of the Mellotron as a blueprint of a keyboard instrument that played fixed samples polyphonically. I took my handy Tascam DR-05 - which I used extensively during my EAST 361 class with you when I was staying on the coast of Prince Edward Island - and recorded 'silence' in 37 locations in my apartment, one for every key of the original Mellotron and two failsafes. I didn't want to listen to or preview the locations before or during the recording of them, so that their silence would be discovered during the compilation stage. I recorded in appliances, fire escapes, under my bed, closets, drawers, and even inside instruments in the studio.

After I had gathered all the recordings I uploaded them to my computer, and then discovered to my horror that every single one was saturated with varying levels of RFI. I know that microphones can be sensitive, especially if they're on the same electrical grid as other powered devices, but my recorder is battery powered and I'd never encountered any interference before. I became concerned about the implications - could there be a significant enough source of electronic radiation in my apartment that it would overwhelm the sensitive recorder of my device? After looking online to see the symptoms from a worst case overexposure to EMF, they included sleep disturbances, depression, tiredness and fatigue, lack of concentration, memory changes, nausea and pain - all symptoms that are part of my difficult-to-diagnose disability, which first appeared three months after moving into this apartment. This really did not help me feel more comfortable, and so I looked into what equipment I had at hand that could measure EMF, as well as local "EMF inspectors" who sweep through houses with gauss meters in order to test for dangerous levels. In the end I discovered a thread of people complaining about the Tascam DR-05's high susceptibility to RFI and the telltale 2KHz, 4KHz, 6KHz, etc banding which was present on all my recordings. This took the pressure off of my EMF-poisoning fears, but I still look forward to when a friend will come over with a spectrum analyzer to fully put those fears to rest.

My plan to record three dozen tracks of silence and create my own 'notron' had not succeeded, but in lieu I had original recordings of localized RFI, and so I set out to alter and expand the sonic parameters of the previous études. I would use vocoder techniques and spectral morphing to transform the raw recorded sounds by constraining their frequency bands to those present from recordings taken in other parts of the apartment. I also used an envelope follower to animate a resonant high-pass filter, and the use of resonance magnified parts of the spectra that would otherwise not have been as pronounced. In



the end using those techniques I had 16 channels of spectrally unique sounds which I decided to group into pairs of two and assign to a single speaker within an octophonic space. Movement would not be between speakers, but changes in amplitude and the relative similarity of the source material might generate the illusion of spatial movement. To enhance this, I experimented with some convolution processing on the signals to give them a ‘space.’

I was unable to hear the piece in an octophonic setup, but in the 5.1 setup of the Concordia studio I found that there were issues with my approach. Whichever speaker had the most ‘audible’ pair of tracks, would grab listening focus, and even if the sound faded in that speaker the sense of hearing seemed to be ‘trained’ on it to the near-exclusion of the other speakers. It seemed as if the brain had sampled the speakers to determine which one it would have the most success in straining to hear. This produced a very static effect and made the whole spatial element feel less effectively realized. I had anticipated this possibility, and so brought with me a small USB-powered MIDI controller with eight faders. I thought of the French electroacoustic tradition of live mixing or diffusing a piece for a space using a mixing console, and decided I would try that.

The results were achieved intuitively, as the sounds themselves were still barely audible, but they were on the whole a lot more dynamic and interesting than before. I added crossfading of varying lengths between unrelated channels so that the sound source pairings would not always be diffused through the same speaker, and really liked the results. The only problem was that an adjacent studio had become occupied and the deep bass rumblings and dynamic rhythms blasting through the soundproofing separating us made the final listen within the studio truly impossible. I would have to wait to experience the piece in the classroom to really hear what I had accomplished.

I have included a stereo mix of this étude with the same leading pink noise reference level, and reduced the amplitude even further to account for the 8:2 channel mixdown.

## Next Steps

Presenting the research I had conducted and my third étude for the class was an enlightening experience that spoke more directly to the ideas and concepts at the heart of this journey into exploring silence. The reactions of myself and the other members of the class to listening to such a quiet composition, surrounded by other sound-producing humans inside an open acoustic space were really phenomenal, and not something I had been able to experience working and mixing on the piece alone.

There were comments around the emotional impact of surrendering sonic agency as a sound-producing being to the pressure of conforming to social norms around politeness and respect for the composer and fellow members of the audience. News of the establishment of places for ‘designated cultural loudness.’ Questions about how the performance of the piece would be received in a quieter, or noisier setting. Explorations of the internal quiet space that some students found themselves in as they shifted from looking outwardly for sounds to reach their ears and instead turned their attention inward. These discussions and impressions were absolutely invaluable to me and will certainly impact my work going forward.

I have given some thought to what Assignment C will be, and I feel it must be something live and reactive in order to complete the journey from theoretical silence measured digitally on a screen to the perceived silence of a space in which other people inhabit. I am preparing for an important concert of a piece of mixed music for ondes Martenot and electronics composed during EAST 406 which premieres on March 12th, and so that has recently absorbed most of my focus. I will let the feedback and conversations that grew out of my presentation percolate and then regroup to develop that assignment clearer once I have finished preparations for the concert.

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