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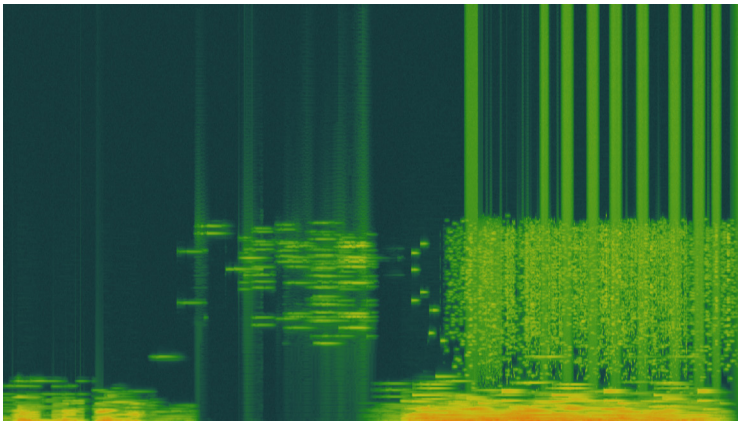

Jim Reeve-Baker
J.reeve-baker@sms.ed.ac.uk
University of Edinburgh, Reid School, Edinburgh, UK

Pink and Blue: Clusters and Layers of Time-Stretched Artefacts; Juxtaposition of Drones, Rapid Gestures, and Unaffected Blue Noise

Keywords: MP3, Data Compression, Artefacts, Noise, Composition, Aesthetics.

The work is part of a research project that is investigating the production and aesthetic of MP3 data compression artefacts and how they can be used for creative purposes. By cascading colours of noise and transient signals through MP3 encoders set to low bitrates and sample rates, effects and artefacts have been generated and act as the base material for composing with. Additional signal processing is kept to time stretching and arrangement, allowing greater opportunity in time and space to hear the artefacts. This work uses pink and blue noise and exhibits several compression effects, including birdies, bandwidth limitation, and signal gaps. The work seeks to explore the sonic possibilities of a process and aesthetic that is essential to and ubiquitous throughout digital communication, and attempts to harness a set of sounds whose creative potential can still yet be examined.

Description

The research project, which this artwork is a part of, is investigating the sonic quality of MP3 encoded audio, creating compression artefacts and effects that are then used in the process of composing fixed media sound art and music. Through tests and experiments, artefacts and effects have been generated, analysed, and categorised, creating a taxonomy and indexes in the pursuit of understanding their characteristics and generation. Once created, these artefacts are used as the fundamental material for composing sonic works.

The sonic characteristics of the MP3 have been studied for decades from engineering (Erne 2001; Herrera Martinez 2007), cultural (Sterne 2006), and artistic perspectives (Bienoise 2018), but there are still areas to explore and understand. As digital communications become increasingly relied upon, particularly during recent periods of mass isolation, so this medium and its characteristics are increasingly consumed.

The compression artefacts that form the sound quality of MP3 audio include the reduction of complexity in noisy signals creating pitched artefacts called birdies; the amplification of quantization noise causing a pre-echo effect; inconsistencies in stereo encoding creating movement across the stereo field; delayed attacks at the beginnings of encodings; amplitude fluctuations in textures and decays; gaps and breakages in a signal; and bandwidth limitation caused by low sample rates or brick-wall filters built into the encoders.

These effects and artefacts were produced by subjecting noise colours and transient signals to multiple passes through an encode/decode cycle of the iTunes and Lame MP3 encoders, a process called cascading. The noise colours being used are violet, blue, white, pink, and red noise which have different amplitudes across their frequency range. While white noise has, on average, a flat amplitude across the frequency range blue noise increases by 3dB for every ascending octave and violet noise increases by 6dB for every ascending octave. In contrast, pink noise decreases by 3dB and red noise decreases by 6dB for each ascending octave. After their production these artefacts are then arranged, using compositional techniques developed by microsound and electroacoustic composers such as Curtis Roads (2001) and Denis Smalley (1997).

It is a goal of this project to contribute to a wider artistic practice which considers media as not only a transmitter but also a generator of sound, and by appropriating this sound, to seek out new relationships between transmission and generation. This project therefore follows in the footsteps of various artists who have sought to reframe extraneous sounds as the theme of their work.

These works include Music for *Blank Cassettes* (2018) by Phil Maguire wherein an ostensibly blank cassette is played back, exhibiting the format's sonic qualities; and Ryan Maguire's project *The Ghost* in the MP3 (Maguire 2014) which uses the audio that would be removed during the MP3 encoding process as its aesthetic focus. Additionally, the musician Pole has used damaged audio equipment to create idiosyncratic glitched loops in his records *1* (1998), *2* (1999), and *3* (2000), leaning into the agency of the machine and exploring the relationship between accidental and intended sounds; and, beginning in the early 1960s, Milan Knižák created new assemblages and collages of music by gluing sections of broken vinyl records together, exploring the limits and affordances of the format, resulting in the *Broken Music* series of works (1979, 1983, 1989).

Through analysis, amplification, and arrangement, this project seeks to work the thematic shifts described above – extraneous to intrinsic, ignored to heard, and accidental to intended – into the sounds and artefacts of MP3 compression, and in doing so attempts to bring these sonic qualities into a wider artistic discussion that repositions the medium at the centre of the work.

The Piece

The submission has been created using pink noise encoded at a bitrate of 8kbps and a sample rate of 24kHz, and blue noise encoded at bitrates of 8kbps and 16kbps and a sample rate of 24kHz, creating birdies, signal gaps, and bandwidth limitation.

The amplitude qualities of blue and pink noise have resulted in artefacts sitting in different areas of the spectrum. As pink noise has a higher amplitude in its lower frequencies, when it is encoded as above, artefacts are fixed within a range of up to 4kHz. Blue noise, however, has greater amplitude in higher frequencies, therefore after being encoded using parameters above, the artefacts sit in a wider range: from 500Hz to 11kHz, with greater concentration of artefacts above 4kHz.

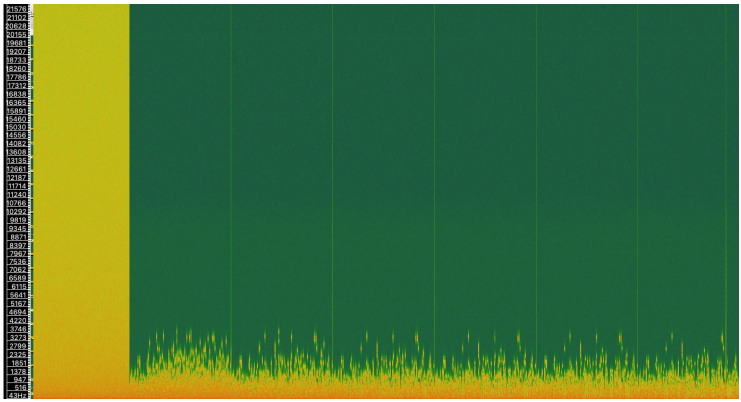

Fig. 1. Spectrogram showing a compilation of unencoded pink noise followed by six iterations of cascaded pink noise encoded at 8kbps and 24kHz. Bandwidth limitation can be seen between 0Hz and 4kHz, and birdies artefacts between 1kHz and 4kHz.

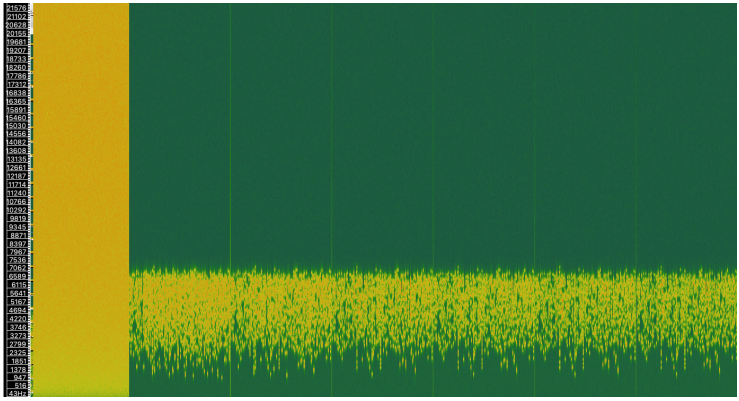

Fig. 2. Spectrogram showing a compilation of unencoded blue noise followed by six iterations of cascaded blue noise encoded at 8kbps and 16kHz. Bandwidth limitation can be seen between 500Hz and 11kHz, and birdies artefacts can be seen between 1kHz and 2 kHz.

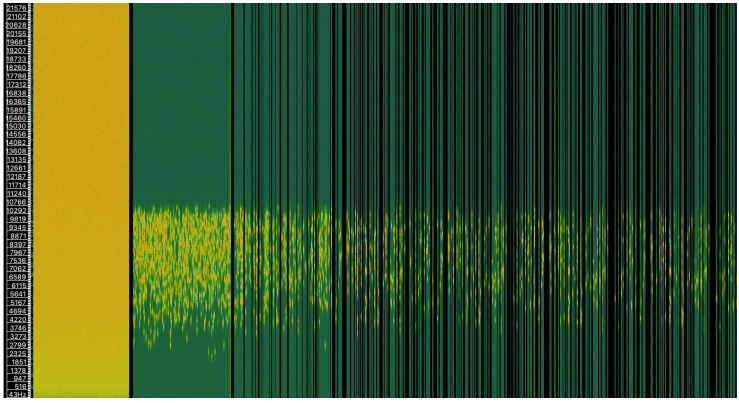

Fig. 3. Spectrogram showing a compilation of unencoded blue noise followed by six iterations of cascaded blue noise encoded at 8kbps and 24kHz. Bandwidth limitation can be seen between 2kHz and 11kHz, signal gaps can be seen throughout.

The two different bitrates of blue noise have created varied coarseness of texture. The higher bitrate of 16kbps results in a more continuous texture, while the lower 8kbps bitrate has a rougher sound made up of shorter artefacts, resulting in clearer, discrete birdies and signal gaps.

As the artefacts created in this process are on a micro time scale – that being 'a time scale that extends down to the threshold of auditory perception (measured in thousandths of a second or milli-seconds)' (Roads 2001, 4), many were time-stretched and arranged giving more time and space for their characteristics to be heard, to increase sonic variety, and to apply electroacoustic compositional techniques.

Layering artefacts, or series of artefacts, in their natural micro timescale, has resulted in shifting densities of rapid discrete artefacts exhibiting their textural and gestural qualities. By shifting artefacts time scales from micro to sound-object (a basic unit of musical structure, ranging from a fraction of a second to several seconds) to meso (groupings of sound objects into hierarchies of phrase structures, measured in seconds or minutes) (Roads 2001, 3), they could be arranged into various densities that change over time. These include clouds, clusters (Roads 2001, 14-17), streams, flocks (Smalley 1997, 116-117) and allow for greater exploration of artefacts' morphological content, while also exploring their potential for sonic variation.

The clusters and layers of artefacts create sound masses of 'sustained frequencies that fuse into a solid block' (Roads 2001, 15). This is particularly effective with the sinusoidal qualities of the time-stretched birdies, and, as individual voices are added or removed, movement is created over a period of minutes, acting as a valuable means of structuring the composition. Artefacts were arranged in time and space using a DAW, which allowed for automated manipulation of the stereo field and amplitude of voices. This gave greater opportunity for artefacts' properties and morphologies to be heard, while also creating a greater sense of motion and gesture within larger densities of sound.

The overall structure is split into three sections. The first two sections are made up of clusters of meso length artefacts created from pink noise in the first section and blue noise in the second section. The third section uses meso length pink noise artefacts acting as drones over which micro and sound-object length blue noise artefacts are layered. Bursts of raw blue noise appear throughout the third section, eventually acting as the final voice into which the other artefacts disappear.

Conclusion

The work explores the aesthetic of the MP3 format, regarding it not just as a transmitter or archival technology but also as a means of generating and affecting sound. By cascading signals, artefacts and effects have been stressed and amplified and act as the primary material for arranging and processing in the pursuit of composing sonic art and music. The artefacts and effects contribute to a sonic and musical vocabulary that is specific to compressed digital media, and is also an echo of artistic and musical practices that incorporate extraneous noises, ignored and accidental sound, and technological mediation. Using compositional techniques from microsonic and electroacoustic fields, the work investigates artistic possibilities of the effects and artefacts being generated through MP3 data compression.

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