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Horatio Oratorio: composing using historic sound recordings.

Abstract

Introducing a new performance and sound installation that employs archival sound sources, including some of the first recorded utterances and music. These are not only reproduced 'authentically' through phonographs and gramophones, but also used to extract pitches, rhythms and even supply a formal structure for the entire work.

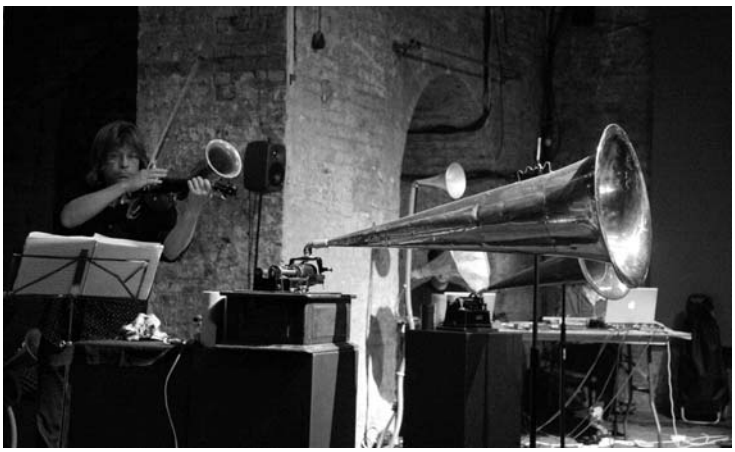
The presenters focus on their collaborative work in mapping the sound recordings using various computer-aided analysis techniques and re-interpreting them using either acoustic instruments or electronic sounds. Recordings are not only to digitally manipulated or transformed, but also become the very substance or building blocks of a musical composition.

Furthermore, archaic recording techniques have been used in this work to age and decay sound: Digitally registered voices, instruments and electronic music are 'processed' by re-recording onto wax cylinders and acetate discs creating temporal shifts within the composition.

A Stroh violinist improvises with an interactive music system that generates, in real-time, his own pre-recorded string sounds emerging from the horns of a remotely activated Stroh String Trio. Hand-cranked horn gramophones play specially recorded acetate 78rpm discs and vintage sound effects, while a complex sound diffusion from eight loudspeakers finds it's counterpart in a huge array of antique horns creating a unique liaison between the contemporary and the obsolete.

The Performance

Video clip showing overture: http://www.youtube.com/watch?v=m7M5fEhWEr8



Live wax cylinder reproduction on an Edison phonograph: Hamlet's speech to Horatio recited by Rose English (June 2008), together with a live interactive 'recitative' of electronic sounds triggered solely by the cylinder playback:
http://ranchonotorious.org/freuben/H.O./soundfiles/recitative%20(rose).mp3

The two extracts that open this presentation are from a performance entitled *Horatio*

Oratorio which took place in July 2008 at the Shunt Vaults under London Bridge station.[1] This work combines old and new sound recording and reproduction technology - mechanical acoustic with analog and digital - as well as live and recorded sound, including historic and newly made wax cylinder recordings, acetate and shellac discs and digital sound files.

The performance employs a large armoury of antique sound equipment and instruments, comprising gramophones, cylinder phonographs and a plethora of gramophone horns connected via long lengths of rubber tubing to electric compression horn drivers.[2] Added to this is an eight channel loudspeaker system along with computers, digital interfaces and microphones. Suspended from a central arch is a Stroh String Trio - Violin, Viola and Cello. Embedded in each of their horns are speaker driver units which during the performance are connected to a computer music system.

The entire set-up is operated by three players: A musician/computer operator generating live electronic music and sound transformation (F. Reuben); musician/computer operator responsible for the sound diffusion (Sebastian Lexer) and a solo Stroh violinist, phonograph and gramophone operator (A. Kolkowski).

Almost all the sound comes from recordings: either played on self-recorded wax cylinders and acetate discs, or on vintage shellac and vinyl 78 rpm speech and sound effects records, as well as from digital sound files and realtime generated electronic

1 Supported by the PRSF *Live Connections* Scheme, produced by *Recording Angels* in conjunction with *Sprawl*

2 The set-up comprises horn gramophones circa 1920; portable HMV gramophones circa 1927 and 1930; a self-made 'duplex' (double tone-arm) two-horned gramophone; two Edison wax cylinder phonographs (both from 1906) with large brass 'concert' type horns from the 1890s; 3 stands with attached gramophone and phonograph horns.

music. The exception is the solo violinist, sometimes playing from a score, but mainly improvising with the live electronics.

The Stroh violin and it's accompanying Stroh string trio is featured here because it is inextricably linked with the birth of sound recording -Augustus Stroh's 1899 patented violin being the first musical instrument specifically designed for recording.[3] As it uses the exact same form of mechanical amplification as the gramophone, via a diaphragm, resonator and horn, this violin can sound very much like a recording of itself. Thus the instrument blends seamlessly with the recorded sounds that make up this work.

The entire composition uses as it's source material, the following historic recordings of speech and music:

> *"Mary had a little Lamb,*
> *It's fleece was white as snow;*
> *And everywhere that Mary went,*
> *The lamb was sure to go."*
> - Thomas Alva Edison's first tinfoil recording, 1877

3 The Stroh violin is distinguished by its large aluminium horn and diaphragm amplification system that replaces the hollow body and sounding boards of a conventional violin. It was invented by John Matthias Augustus Stroh in London,1899, and became widely used in recording studios during the acoustic era, as normal stringed instruments were insufficiently directional. The Stroh's construction is based on the same principle as the sound box and horn of a gramophone. It continued to be manufactured until 1942. For a detailed account of it's history see Alison Rabinovici, *Augustus Stroh's phonographic violin; a journey: Victorian London, Australia, Transylvania (*The Galpin Society Journal, Vol.LVIII, 2005).

"The touch of a vanished hand,
And the sound of a voice that is still." [4]
- William H. Applebaugh, General Superintendent, New York Telephone Company, publicly demonstrating the phonograph in 1878.
Papa, Mama.... ah, ee, oo, u, aw, e...
- Augustus Stroh and William Preece, Experimental speech synthesis, London,1878-9.[5]

There are more things in heaven and earth Horatio, than are dreamed of in our philosophy... I am a graphophone and my mother was a phonograph."[6]
- Charles Tainter's first recorded words on his newly developed wax cylinder Graphophone, the successor to Thomas Alva Edison's tinfoil Phonograph, in 1881.[7]

The musical sources are the only three cylinders that remain from live recordings made in 1888 of Handel's Oratorio *Israel in Egypt.* These are among the oldest surviving live recordings of music:[8]

I will sing unto the Lord for he hath triumphed gloriously

Thy right hand, O Lord, is become glorious in power

Sing ye to the Lord[9]

Recreations of all the spoken quotations were made by the actress Rose English, while digital sound files of the three existing cylinders of Handel's music were obtained through the Edison National Historic Site and subsequently re-recorded back onto wax cylinders. The newly made acoustic recordings of the digital sound files are surprising faithful to the originals. While registering none but the loudest of the original's surface noises - which were mostly too faint to be recorded- it simply replaced them with it's own.

Not only were all these source recordings reproduced 'authentically' via phonographs and gramophones, but as shown below, they are also used to extract pitches, rhythms and in the case of Handel's Oratorio, even supply a formal structure for the entire

4 From the poem by Alfred, Lord Tennyson: *Break, break, break,* 1834.

5 In a paper delivered by W. Preece and A. Stroh, *Studies in Acoustics: On the Synthetic Examination of Vowel Sounds,* Stroh's specially designed phonograph was demonstrated at the meeting of the Society of Telegraph Engineers, February 27, 1879. Of the experimental brass discs produced by Stroh, 98 survive today, some from 1879 with complete words such as "mama" and "papa" but most with sounds used to construct vowels. Thomas L. Hankins and Robert J. Silverman: *Instruments and the Imagination* (Princeton: Princeton University Press, 1995) p. 205.

6 Tainter misquotes Hamlet's speech to Horatio as Shakespeare's original reads: *There are more things in heaven and earth Horatio, than are dreamt of in your philosophy.*

7 See Oliver Read and Walter L Welch, *From tin foil to stereo : evolution of the phonograph* (Indianapolis, Ind.: Howard W. Sams, 1959) p. 29, 31.

8 On a note with cylinders: "A chorus of 4000 voices recorded with phonograph over 100 yards away*". Israel in Egypt* Composed by G.F. Handel, 1739; Conducted by August Manns; Record format: Edison yellow parafine cylinders Recorded by: Col. George Gouraud, foreign sales agent for Thomas Edison; Location: The Crystal Palace, London, England; Recording date: June 29, 1888. The source for this information via: Edison National Historic Site, URL: http://www.nps.gov/archive/edis/home.htm

9 The individual cylinders contain overlapping choruses and recitatives, the titles given here are an indication of the predominant section. URL: http://www.webrarian.co.uk/crystalpalace/index.html has a detailed analysis of the recordings by Chris Goddard.

work. In the latter case, we were to follow the exact order of arias, choruses and recitatives in Israel in Egypt, although we freely interpreted the content of these passages.

Before and after the concert Horatio Oratorio functions as a sound installation. The instruments, machines and horns remain as they would for the performance. But instead of manual operation, the phonographs and gramophones are connected to electric horn drivers enabling the antique horns to project sound from concealed CD players and amplifiers. The long rubber tubes transport the acoustic sound, mimicking the lengths of audio cable that electronically connect the Stroh instruments and phonographs.

Recordings used in the sound installation:

Phonographs

Spoken word: Thomas Alva Edison (1888 and 1927); Florence Nightingale (1890); W.E. Gladstone, Arthur Sullivan , Lord Stanley (1888); P.T. Barnum, Kenneth Landfrey (1890); Frank Lambert's Talking Clock (1878) and Rose English (2008).

Musical selections: Extracts from G.F. Handel's Oratorio *Israel in Egypt* (1888); *Au Clare de la Lune* Édouard-Léon Scott de Martinville's Phonautograph recording of 1860,transcribed in 2008; Aaron Williamson (profoundly deaf singer) *Three Steps nearer to Thee* (A. Williamson) 2006; *Recording Angels* (A. Kolkowski) – Wax

Cylinder Recordings: 2002 – 2004. Phonograph cylinder noise (recordings of blank cylinders and phonograph mechanism).

Gramophones

*Nadelkurven (*A.Kolkowski, 2007) Surface noises and other sounds from 78 rpm shellac discs. *Weather Effects* (H.M.V.) Sound Effects Record c. 1920.

Hanging Stroh Instruments

Music for Stroviols (A.Kolkowski, 2006 – 8).

Horn Installation

Mechanical Landscape with Bird (A. Kolkowski, 2004, extracts); *Horatio Oratorio* – Incidental music by Federico Reuben (2008)*, What Hath God Wrought?* (A. Kolkowski, 2004, extracts)
for Stroh String Quartet .

Alongside moments from the birth of recorded sound are recent recordings made on the same medium of wax cylinders. This is a soundscape where past and present can freely intermingle. The gramophones play recordings of pure surface noise or wind sounds suggesting a residue from missing recordings, while the hanging Stroh instruments reproduce their own sounds in ghostly fashion. The Horn Installation, consisting of three constructions, each carrying three gramophone or phonograph horns of varying sizes, play a condensed history of all previous *Recording Angels* events.[10] Federico Reuben's incidental music for *Horatio Oratorio* played on these horn trinities, together with the phonograph quotations and recordings of surface noise, link the installation to the performance.

The four component parts of the installation are played simultaneously. The programme content of each part or group is played randomly (using the 'shuffle' mode on CD players). The audience may wander freely, the directionality of the horns allows for separation of sound and for individuals to best hear the sounds only when directly in front of each bell. When situated in front of the entire installation however, one can experience the entire spectrum. The recordings are not substantially modified, rather the modes of reproduction, the quality of sound reproduction produced by the antique drivers and horns and the effect of funneling through tubing over long distances serve to reinforce the sound-carriers as metaphors for memory.

10 *Recording Angels* was formed by A. Kolkowski in 2002 and is a continuing series of projects that explore relationships with recorded sound through live performance and installation work.

In order to perform with the installation, automatic is replaced by manual control, the horns and string trio are reconnected to an audio interface and a live Stroh violinist completes the string quartet.

Compositional Strategies and Computer Music Systems

There are several different strategies adopted in *Horatio Oratorio* that deal with using recordings and other borrowed material as compositional tools. The first we will examine is what John Oswald termed as Plunderphonics in his 1985 manifesto "Plunderphonics, or Audio Piracy as Compositional Prerogative".[11] Oswald defines this term as the use of audio samples as a technique for composition and argues in favour of using recordings of other music as building blocks for a new work by cutting and splicing them; by changing their speed and filtering them as well as other audio processing techniques: "As a listener my own preference is the option to experiment. My listening system has a mixer instead of a receiver, an infinitely variable speed turntable, filters, reverse capability, and a pair of ears. An active listener might speed up a piece of music in order to perceive more clearly it's macrostructure, or slow it down to hear articulation and detail more precisely".[12]

http://ranchonotorious.org/freuben/H.O./soundfiles/plunder1.mp3

http://ranchonotorious.org/freuben/H.O./soundfiles/plunder2.mp3

The second strategy used in *Horatio Oratorio* is taken from Clarence Barlow's concept of *Musica Derivata* which refers to the idea of transforming existing music with

11 J. Oswald, *Plunderphonics, or Audio Piracy as a Compositional Prerogative,* (Wired Society Electro-Acoustic Conference, 1985), URL: http://www.plunderphonics.com/xhtml/xplunder.html

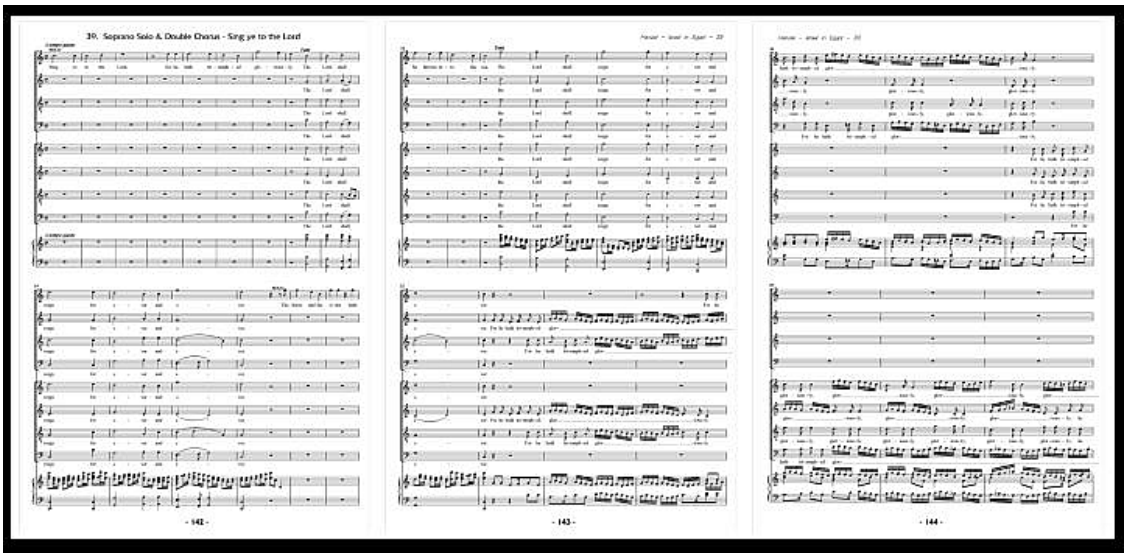
12 Ibid., J. Oswald, 1985.

Computer Aided Composition (CAC) tools to create “music that is compositionally based on other music” (C. Barlow, 2000).[13] In his piano trio *1981* (1981), Barlow used the score of trios by Clementi, Schumman and Ravel to generate his own composition. Through an algorithmic system, Barlow combines the score information of the three compositions through a statistical distribution of notes, creating interpolations (a transformation from one recognizable audible source to another) between the original trios.

In Barlow’s approach, it is the score information and not the recording that is used as musical material for the new work. Therefore, we can make a theoretical differentiation between *Musica Derivata* and Plunderphonics in that the latter appropriates the recording itself from the original musical source. In *Musica Derivata* the sound itself - including timbre, rhythmic drive and other performance practice elements, etc – is not appropriated; what are appropriated, are the instructions to the musicians from the score that normally comprises of pitch, rhythm, dynamics and expression.

In the *Soprano Solo and Double Chorus No. 39* of *Horatio Oratorio* we used the phrase structure from Handel's score of the same chorus in *Israel in Egypt,* in order to overlap different electronic sounds. Each voice in Handel's score, which originally represented an individual instrumental and vocal part, is here made to represent a different layer containing a sound derived from a different category of sources (vocal/speech, synthetic, recordings of the same piece, harps and percussion). As some of the layers are audio recordings themselves, we are combining *musica derivata* and *plunderphonic* techniques simultaneously.

http://ranchonotorious.org/freuben/H.O./soundfiles/musica_derivata.mp3

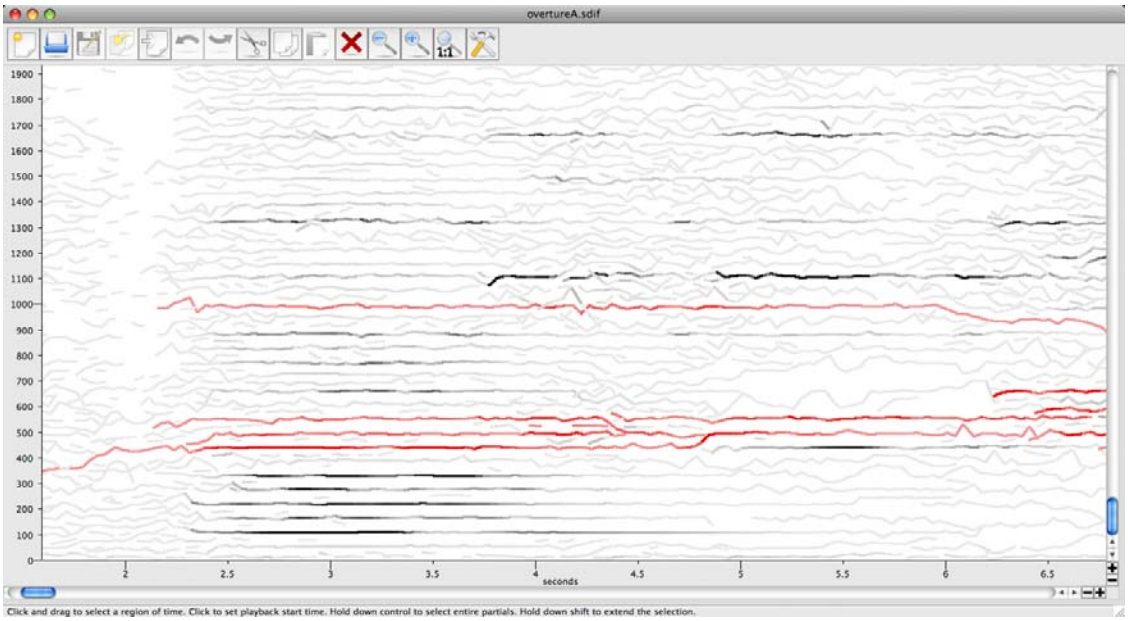


A third strategy adopted in *Horatio Oratorio* for using appropriated material is one

13 Clarence Barlow, *Musica Derivata* [CD], hat[now]ART 126, Hat Hut Records Basle, 2000.

where several types of computer analysis of recordings are used to extract data that then become building blocks for the new composition. With the development of digital information processing (specially those innovations of the 1980s), the possibility of analysing micro-components of sound has lead to a wide use of computer analysis as a tool for composition. The precision of computer signal processing allows for a rigorous analysis of sound that has been used by a group of composers that now are know as the school of spectralism, to write music for acoustic instruments based on spectral information that resulted from an FFT (Fast Fourier Transform) analysis. These composers include Gerard Grisey and Tristan Murail and many others who worked at IRCAM in the 1980's. In the 1990's IRCAM released the AudioSculpt and Open Music software that composers such as Jonathan Harvey, Marco Stroppa, Hugues Dufourt and Philippe Hurel to name but a few, have used to extract information from a spectrogram (visualization of an FFT) and then transfer it to a notated score. While such composers have employed these techniques to analyse the timbral characteristics of isolated sounds, we have used them here to extract information from recordings of music and of speech in order to generate musical material for the composition.

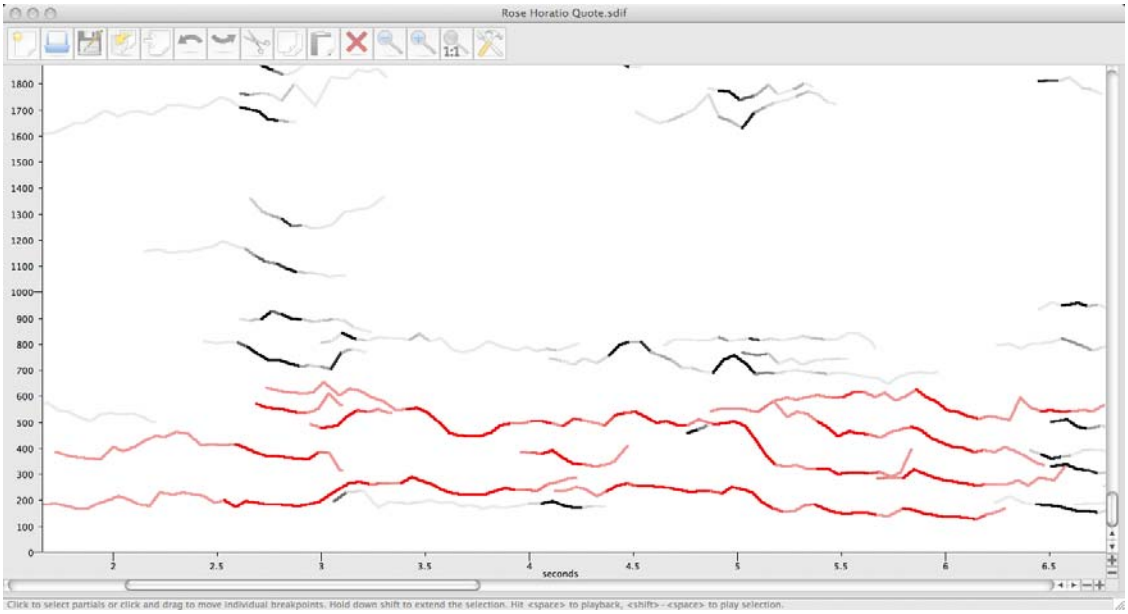
One of the difficulties encountered using a computer analysis of a recording and to derive from it a musical score, is how to deal with the huge amounts of data that the analysis carries. For these and other reasons, we decided to use an open source software application called SPEAR, which has been developed by the composer Michael Klingbeil. SPEAR uses a variation of the traditional *McAulay-Quartieri* procedure and "attempts to represent a sound with many individual sinusoidal tracks (partials), each corresponding to a single sinusoidal wave with time varying frequency and amplitude." (M. Klingbeil, 2007)[14] It is then possible to select the individual sinusoidal tracks and extract the partials you consider are more important for your composition.



Once the partials are isolated, it is possible to obtain the frequency and amplitude

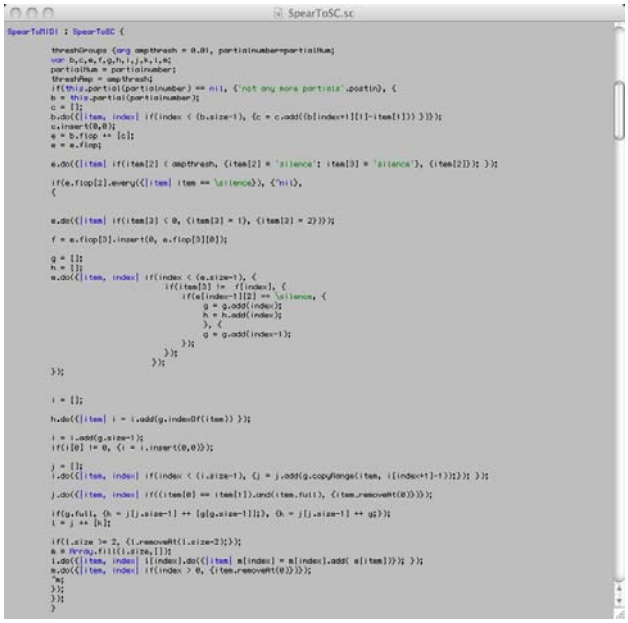
14 Klingbeil, M. 2005. "Software for spectral analysis, editing, and synthesis." Proceedings of ICMC. URL: http://www.klingbeil.com/spear/

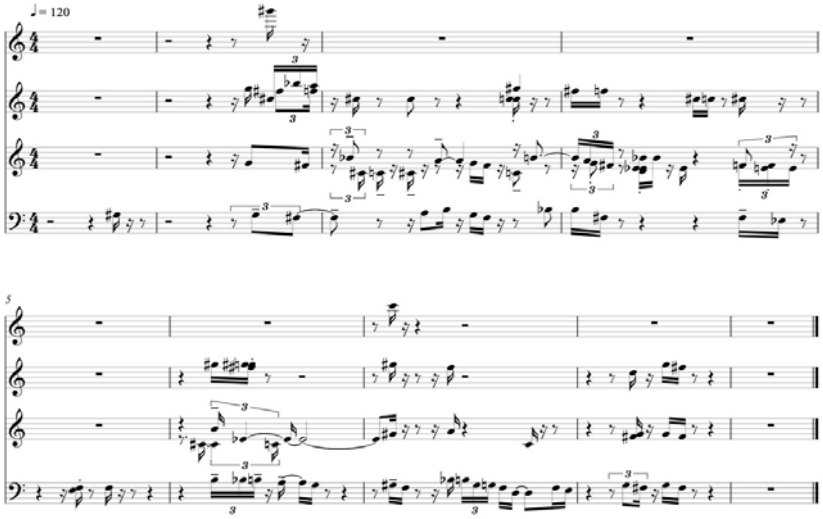
information in a text file. Nevertheless, this information is given by frame, in computer terms, and therefore that information must be reduced in order to use it for a musical score. For these reasons we wrote an application in the SuperCollider language (by James McCartney) that reduces the information of each partial.



By mapping the frequency shifts from an upward to downward motion (within a delimited range) and isolating the pivot points, we reduce the frequency information and can use it as pitch material. In a similar fashion we can take away the sections of the partials that go below a given threshold. In the specially written application it is possible to obtain this information as *glissandi* and as single notes and to divide the pitch material in a given amount of staves. Thereafter, it is possible produce a MIDI File with the reduced information that can be opened and edited in a conventional notation program such as Sibelius or Finale. It is also possible to use this information as a score for electronically generated sounds and to have microtonal divisions of equal tempered semitones. In *Horatio Oratorio* we used the latter technique for the Overture. In the following video clip you will hear music, which was composed using this application and notated as a conventional score. This score was then performed on the Stroh instruments and recorded. During the concert, the recording was played back through speakers placed inside each of the hanging Stroh instruments.

http://www.youtube.com/watch?v=mTvSq4iWmEg





Working with Sound Sources

Sound sources for *Horatio Oratorio* were not confined to speech, music and other recorded sounds, but went as far as including the extraneous noises produced by the phonographs, gramophones and their sound-carrying media: wax cylinder crackle, shellac disc surface noises, end or lock groove loops, mechanical sounds etc.
This material yielded interesting results because it resembles analogue impulses and noise. Therefore, we decided to use this material in computer synthesis models instead of analogue techniques:

Granular Synthesis:
We produced a granular sound by first recording and then isolating single grains of

cylinder crackle or surface noise. This was achieved by measuring the "noisiness" level of the signal by using the FFT percentile analysis technique, which: " Calculates the cumulative distribution of the frequency spectrum, and outputs the frequency value which corresponds to the desired percentile."[15] For example, to find the frequency at which 90% of the spectral energy lies below that frequency, one needs the 90-percentile. As the value goes higher than the given percentile, the computer is assigned to record that grain. In this way, we ended up having numerous data buffers, each containing a "crackle grain". By shuffling the buffer order and controlling the density of their playback we produced granular synthesis with shellac and wax cylinder noise.

http://ranchonotorious.org/freuben/H.O./soundfiles/gain.mp3

http://ranchonotorious.org/freuben/H.O./soundfiles/granular.mp3

http://ranchonotorious.org/freuben/H.O./soundfiles/noise.mp3

Filtered noise:
We also filtered noise using traditional analogue studio techniques.
For example, using a bank of band-pass filters to filter cylinder the "crackle grains" instead of analogue impulses.

http://ranchonotorious.org/freuben/H.O./soundfiles/filtered_crackle.mp3

Perhaps the most important source material was spoken word taken from each of the aforementioned historical quotations. Similar techniques to those employed above were used to detect the "noisiness" level of the speech signal. In such a way we were able to isolate consonances from vowel sounds in speech. Since consonances have a more percussive sound than vowels, we used vowels as pitched material. We therefore tuned the vowel sounds approximately. Since vowel sounds are also shifting in frequency, we stretched them to emphasize the glides and to hear them more markedly as *glissandi.* We also created a kind of granulation with the short percussive sounds of consonances.

http://ranchonotorious.org/freuben/H.O./soundfiles/consonance1.mp3

http://ranchonotorious.org/freuben/H.O./soundfiles/consonance2.mp3

http://ranchonotorious.org/freuben/H.O./soundfiles/vowel.mp3

http://www.youtube.com/watch?v=omKyMa3RjYg

The final example we will give of a computer-aided technique used *in Horatio Oratorio* involves real-time pitch extraction from the incoming signal of the Stroh violin - related to the third compositional technique mentioned above but in a real-time situation. We wished to simulate a string quartet, the suspended trio of *remote* instruments would react to the improvisations of the *live* Stroh violinist, their sounds played via individually assigned speakers inserted in each of the suspended Stroh instruments' horns. For the harmonic material we used spectral information from the

15 D. Stowell, *Signal Analysis* - SuperCollider Plugins - MCLD Ugens., 2007.

incoming signal and isolated the three strongest partials of an FFT. Thereafter, we classified these frequencies for their closest pitch class and assigned them to three different instruments. For each virtual string instrument we set a pitch range, as well as harmony and voice leading rules that calculated the new harmonic setting. By doing this in real-time and in a purely improvised situation, we were able to create coherent harmonic relationships with whatever the improvising violinist chose to play.

In addition, we used 5 types of string articulation (legato, staccato and jeté bowings, pizzicato and harmonics) that were statistically divided. A midi controller was used to set the probabilities for each articulation as an improvisatory element. The string sounds where pre-recorded on the same instruments and then pitch-shifted to match the harmonic material of the computer music system. The string sounds where then triggered by onset detectors that would have two inputs to choose from: one from the Stroh violin signal and another independent one that gave rhythmic and dynamic autonomy from the Stroh violin input. By manipulating various parameters through the midi controller, the live-electronic performer had the freedom to be able to improvise together with Stroh violinist.

To sum up, the computer music system would adapt certain elements including harmony and dynamics to the input signal from the improviser but still allow some adjustable parameter controls that could be then used as improvisatory elements for the live-electronics performer.

http://www.youtube.com/watch?v=MO0INaUd0Bg

Real-Time to Past Time

Outside of the digital realm, sound processing techniques of an altogether different kind are employed in *Horatio Oratorio* which are purely mechanical and acoustic. By using antiquated recording and reproduction techniques it is possible to 'age' sound and afford a play with time that can be both retrospective and prospective. I have described this distinct form of temporal manipulation as working with 'sound patina'[16] and it has been a feature of all prior *Recording Angels* performances and installations[17]

Disruption of the linear concept of time within musical composition has it's roots in the technological advancement of mechanical reproduction technologies during the 1920s, the development of cinema and the onset of sound reproduction devices appearing in music-making: “Imagining possible temporal zigzags provided modernists such as Paul Hindemith and René Clair with mechanical paradigms through which to explore the manipulation of time and motion-as infinitely divisible properties-in the decade that witnessed Lindbergh's transatlantic flight, the first radio broadcasts, and an increasing addiction to Edison's Duplex Telegraph wire.”[18]

16 A. Kolkowski *The Wax Cylinder Phonograph in the Age of Digital Reproduction* A discussion of contemporary works with wax cylinder phonographs, including examples in film and art installation work that feature archaic technology and the process of decay. (*CHARM RMA* Annual Conference: "Musicology and Recordings", Royal Holloway, September 2007, URL: http://www.charm.rhul.ac.uk/content/events/2007conference_prog.html#abstracts

17 Notably *Mechanical Landscape with Bird* (A. Kolkowski, 2004) which uses interjected wax cylinder recordings to create the effects of analepsis and prolepsis (or *flashback* and *flashforward* in cinematic terms).

18 David Trippett, *Composing Time: Zeno's Arrow, Hindemith's Erinnerung, and Satie's Instantaneisme*

Subsequent developments in electronic analogue and digital technologies have made it possible to manipulate sound to an astonishing level in comparison. In particular, the techniques of granular synthesis and time-stretching give the composer tools in which to distill and magnify musical events.[19] However, one area still relatively unexplored in music, is temporal manipulation using recordings - a play of retrospective and prospective time using various types of sound recording and reproduction techniques. In *Horatio Oratorio,* recordings are etched onto wax cylinders and acetate discs in order to age and decay sound.[20] The patina produced by these recordings and their mechanical reproduction, the cylinder crackle and lathe chatter, or the soft rushing sound of shellac surface noises becomes a signifier of the distant past. Taken as pure noise, it also becomes source material for further sonic exploration as previously described, and just like the source recordings it becomes totally abstracted. Electronic music is also recorded and reproduced on wax cylinders, so there is a deliberate ambiguity at play, with work taking place simultaneously on many different levels.

The use of authentic reproduction (the playing of recordings on period instruments and machines) is fundamentally important in this work, as it is much about challenging notions of obsolescence. As objects, these machines have power: they are historic artifacts that allow us to engage physically with the past. The machines also function like instruments: they are directional, they have presence, the recording is conjoined to the reproducer. The digital electronic sound, by contrast, although crystal clear in it's definition, is virtual or illusionary. Juxtaposing the two creates a shifting aural perspective, and this, combined with sound diffusion and strategically placed loudspeakers, makes it possible to move sounds temporally - from then to now - simultaneously moving the electronically amplified recordings from the back of the space to the front and visa versa.

The following video clip shows three extracts that demonstrate our use of acoustic gramophones and disc records: The first plays part of a composition for strings recorded onto two acetate discs based on the partials from Thomas Edison's 'remake recording' in 1927 of "Mary had a little lamb",[21] and an example of decayed sound. The second features vowel and consonant sounds played on *Linguaphone* instructional records in five different languages.[22] This follows a wax cylinder reconstruction of the results of William Preece and Augustus Stroh's 1878 experiments in speech sythesis using specially designed phonographs.[23] The third extract shows an attempt, using vintage 78 rpm sound effect records, to illustrate sonically the “Ten Plagues of Egypt” and “Parting of the Red Sea” as narrated in Charles Jennens' libretto for *Israel in*

(Michigan: Journal of Musicology, 2007), p. 580.

19 For the earliest notable examples of these methods see: Barry Truax, *Real-Time Granular Synthesis with a Digital Signal Processor,* Computer Music Journal 12, No. 2, 14-26 (1988) and B. Truax, *Composing with Time-Shifted Environmental Sound* (Leonardo Music Journal, 1992, 2, 1, 37-40, The MIT Press)

20 Recordings were made using an Edison phonograph c. 1907 and an *Ufa* model disc-cutting lathe, Germany, c. 1935, on new and old stock blank cylinders and discs.

21 August 13th, 1927, Edison re-enacted his first tinfoil recording to celebrate the 50 year anniversary of the phonograph. The moment was captured by *Fox Movietone* newsreel cameras.

22 *Linguaphone* language records c. 1930, 'sounds' discs, with vowels and consonants spoken in French; German; Spanish; Italian and Russian.

23 See note 5.

Egypt.[24]

http://www.youtube.com/watch?v=G778Prw6-C0

Conclusion

What started as an idea to combine acoustic and digital sound technologies, developed into a multi-faceted composition allowing us to experiment and discover new ways of working with recorded sound.

On one level it became a rumination on the very process of recording: Rose English's numerous and varied interpretations of the same script, along with mistakes which were initially intended to be edited, were reproduced in their entirety (each attempt being transmitted by a separate loudspeaker). This approach to working with recordings, of exposing the artifice, gave *Horatio Oratorio* a transparency that's not commonly found in electro-acoustic compositions.

The faithful reproduction of the recorded source material and the physical manipulation of the mechanical devices resulted in a performance that was strongly contextualised.

Rather than a play of stark contrasts, a high state of cohesion existed between the live, mechanical and the electronic, brought about by drawing from the same source material. As was shown, all the electronic sounds produced *in Horatio Oratorio* were a direct result of work with these shared sound sources. Through electronic manipulation, historic recordings were also made to function in a similar fashion to a *cantus firmus* or a subject in a fugue, allowing for subsequent variation, inversion, transformation or abstraction, with the end result being an attempt to create a "meta-counterpoint" of recorded material.

It was also very much a collaborative endeavour by three composers, each contributing from a specialised area of knowledge and practice giving rise to an abundance of creative ideas. This is still very much a work in progress and we are currently examining ways of developing the work further. For example, expanding it to include a chorus and live musicians, and to integrate more fully the different methods of sound reproduction and live music-making.

We'll close this presentation with an example of one simple but highly effective way in which wax cylinder phonographs and loudspeakers were combined in *Horatio Oratorio*: the acoustic cylinder machine plays it's recording and gradually becomes overshadowed by the very same recording, relayed through loudspeakers, which rises in a slow crescendo.

http://ranchonotorious.org/freuben/H.O./soundfiles/chorus%20(Cristal+Elc).mp3

24 The plagues of frogs; flies; locusts; hailstones; fire; smiting of first-born etc., sung in the aria No.5 and choruses Nos. 6 -12 reinterpreted via a collage of sound effects using original studio made recordings from 1920s and 30s