



Research > **COMPOSING WITH PROCESS:  
PERSPECTIVES ON GENERATIVE AND  
SYSTEMS MUSIC**

Generative music is a term used to describe music which has been composed using a set of rules or system. This series of eight episodes explores generative approaches (including algorithmic, system-based, formalised and procedural) to composition and performance primarily in the context of experimental technologies and music practices of the latter part of the twentieth century and examines the use of determinacy and indeterminacy in music and how these relate to issues around control, automation and artistic intention.

Each episode in the series is accompanied by an additional programme featuring exclusive or unpublished sound pieces by leading sound artists and composers working in the field.

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# COMPOSING WITH PROCESS: PERSPECTIVES ON GENERATIVE AND SYSTEMS MUSIC #6.1

## Space

The sixth episode in the series considers the relationship between process-based music and space. It explores how musicians and composers have used acoustic space as an active element in music composition. Some historical precedents, such as Tibetan and medieval chanting, are included; acoustic space has not only been explored externally, but also internally, as physiological space. We look at several examples of music which explore these principles, including: Austrian composer Peter Ablinger's exploration of acoustic space using silence and noise; and Italian composer Agostino di Scipio's 'Audible Eco-Systems' which explore the real-time interaction between digital signal processing (DSP) and the space in which it is located. The show closes with two performative works which differ in their approach: '495,63' by Yasunao Tone and Carl Michael von Hausswolff's `freq_out` project.

## 01. Transcript

Welcome to the sixth episode of COMPOSING WITH PROCESS. Time, space and music are inextricably linked. Just as music can be described as an art of time, it can also be described as an art of space.

Sound can be described as a sequence of pressure waves that propagate through a compressible medium such as water or air. Sound can be reflected, refracted or attenuated by different materials in the environment such as walls or other objects. When we perceive sound, we not only hear the direct sound. We also hear the effect of the space, materials and objects within it, upon that sound. Historically, musicians and composers have incorporated these acoustic principles into their music, many prior to any knowledge of the physics involved. An example of this is Gregorian liturgical chant which was written for medieval cathedrals with very long reverberation times. Bach wrote pieces for organ designed to explore reverberation. Many composers, such as Perotin composed hymns specifically for certain cathedrals including Notre Dame.

Recent findings in archeology suggest that some Neolithic burial sites display unusual acoustic properties. At Newgrange, a prehistoric burial mound located in Ireland, archeologist Aaron Watson and acoustician David Keating experimented with sound in the central chamber. They found that some frequencies resonate to produce standing waves. A standing wave occurs when the wavelength of a sound is related to the dimensions of the space. It is thought that the people who used these sites for religious ceremonies would have utilised this phenomenon.

Acoustic studies carried out by Igor Reznikoff and Michel Dauvois in prehistoric caves near the French Pyrenees, suggest that the people who lived there 20,000 years ago, were aware of areas in the cave which produced strong resonant responses. After testing different notes with their voices, they produced a 'map of resonance' of the caves, and found that cave paintings were clustered around these points. They also found that there were more paintings at locations with the strongest resonance. Chris Scarre from the Department of Archeology at the University of Cambridge says:

'Drums, flutes and whistles may have been used in cave rituals – bone flutes have been found at several Paleolithic sites in Europe of roughly the same age as the paintings. The potential of cave resonance would however, be elicited only by the much greater range of the human voice.'

It is interesting to draw a parallel between external acoustic spaces and the physiological spaces within the body which are used to make vocalised sound: the lungs, larynx and mouth cavity. For example, in overtone chanting, as practiced in



[Newgrange, 2006. Photo by Shira]

Mongolia and Tibet, the singer manipulates resonances – or formants – to produce melodies. The partials of a sound wave made by the vocal chords, can be selectively amplified by changing the shape and size of the resonant cavities inside the mouth and larynx.

In the following piece, conceptual artist Julia Heyward demonstrates not only Mongolian overtone singing, but several other techniques for producing unusual sounds using the oral and nasal cavities. In the first section we can hear overtone singing. In the second section, she practices yodelling. Here the sound is produced primarily in the back of the throat. Modulation is achieved by changing the shape of the mouth cavity and also by breathing at different rates. Towards the middle of the piece Heyward uses her nose flute technique – where sound is projected through her nasal cavity.

Normally, during speech and vocalisation in general, sound is produced by the vocal folds in the larynx. The larynx controls pitch and volume. Sound is then altered as it travels through the vocal tract and is manipulated by the position of tongue, lips, mouth and pharynx. It is worth noting however, that it is possible to produce speech without using the larynx. This type of speech is known as Buccal speech. Here, sound is produced entirely inside the mouth. Buccal speech is produced by trapping air between the cheek and the jaw, and driving air through the small gap between or behind the teeth into the mouth.

The Austrian composer Peter Ablinger has composed music for orchestra and installations. Several of his works question commonly held assumptions about Occidental music and its relationship to time and space. In his work *Weiss / Weisslich 24*, Ablinger recorded 40 seconds of the nocturnal sound inside twelve Austrian churches. These recordings of ambient sound are played in performance one after the other at high volume. In the second part of the piece, loud white noise is projected into each church from its eastern side, and recorded for 40 seconds from its western side. In each case, the white noise is transformed by the size and reflective properties of each space. The piece is presented in four parts: parts one and two consist of 40 second recordings of the empty churches; and parts three and four are the same churches with the same duration of white noise. The recordings in each section are edited together so that there is no silence between them.

Ablinger thinks of white noise and silence as two ends of a spectrum – one being completely empty of sound, the other as completely full of sound. He uses these extremes to foreground the character of the space itself. Here therefore the space becomes both the instrument and the music itself. Despite existing at extremes of a spectrum, both silence and noise take on similar characteristics in Ablinger's works.

Agostino di Scipio is an Italian composer whose work explores the real-time sonic interaction between performers, machines and environments. In his *Audible Eco-Systems* for live electronics, di Scipio explores the reciprocal interaction between a DSP system and the space in which it is located.

A simple example of this type of system is audio feedback between an audio input and an audio output. Di Scipio utilises such a system in his 'Audible-Eco Systems No. 2a'. The sound source here are Larsen tones – or audio feedback, which is deliberately generated. The computer regulates the feedback to avoid over saturation, and the sounds are transformed using information tracked from the sound source.

In 'Audible Eco-Systems No. 1' pulse trains are played over loudspeakers into a space containing microphones. These pulse trains are processed directly in real-time by computer, and the parameters controlling these processes, are derived from impulse response information, that the DSP system receives from microphones placed around the space.

In these works, di Scipio describes the room as part of the 'network of performance components.' He goes on to explain: 'Some sound source elicits the room resonances, which are analyzed by the computer, and the analysis data is used to drive the computer transformations of the sound source itself. What is implemented is a recursive relationship between human performers, machines, and the surrounding environment.'



[Peter Ablinger]

In these pieces, the music is not pre-determined prior to its performance, instead it emerges from the process of interaction between the various components of the system. In 'Audible Eco-Systems No. 3a' the sound source is the background noise of the performance venue. This noise is amplified and the room's response is analysed by computer and manipulated using this data. When the sound gets oversaturated, the process is discontinued and restarted. In this recording the process is restarted five times.

In 'Audible EcoSystems No. 3b' the same process is applied to small sounds produced in the mouth cavity of a performer. Di Scipio explains the process:

'The computer transforms these mouth sounds, but in so doing, it is driven by properties in the sound itself, mainly amplitude, density of events, and some spectral properties. The analysis data then drives simple filters and granular transformations of the mouth sound. When the performer changes the mouth posture, the resonances of the vocal tract cavities change, and the computer adapts to the new situation.'

In 2007 Yasunao Tone was commissioned to produce a new multi-speaker piece for Sheffield's central reference library called '495, 63'. The title was taken from the reference number of a Chinese Dictionary which Tone chose from the shelves. Using a graphics tablet he transcribed characters from this book which were projected over four screens. The piece was developed from an earlier work, where a composite sound was created from loops of different durations, this was split into different frequency bands, each of which was routed to a individual speaker. As Tone transcribed characters, the length of each stroke was measured and used to determine which speaker would be subject to ring modulation. In this piece therefore, there are two responses to the space. Firstly, specific frequency components were given a spatial position. Secondly, the strokes used in a character, generated a spatial pattern quite different from the character's two-dimensional form. Here is an excerpt from this piece which originally lasted two hours.

freq out, which is somewhat similar to Tone's distributed spectrum, is a piece devised by the Swedish artist Carl Michael von Hausswolff. Here twelve artists are given a specific frequency range to work within and each is given their own loudspeaker. Yet the frequency zone also has a commensurate spatial zone that the artist is able to investigate. An effect of the work is to demonstrate the 'space-specific' nature of sound and frequency.

Using the environment's resonant personality, some sounds can be separated from their source and thrown around the space.

The writer Brandon LaBelle has written:

'The acoustical interplay between sound and space is more than a physical fact. As the legacy of sound art demonstrates: such interplay is rich in detail, laced with a potential to activate perception, redraw architectural borders, fashion forms of inhabitation out of the transient sparks of sonority, create new relations in and amongst the crowd. In this regard, "sound" and "space" are no longer separate entities or concepts, but a synthesized totality whose definition is specific to each location, each event, each instant of their interplay. A radical ecology, the sound-space interplay is an organism spawning dramas of perception and interaction, and what it means to be situated.'

The piece has been presented as both installation and performance at a number of galleries and festivals.

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## 02. Acknowledgements

Recorded at The Music Research Centre, University of York, UK.

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