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Compose/Decompose: unfixed acousmatic music

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Abstract

Compose/Decompose is a live-performed computer music work which exclusively uses sounds from Jonty Harrison's acousmatic piece *Pair/Impair* from 1978 (Harrison 1996). The work uses machine learning and music information retrieval to organise sounds according to their spectral properties. In this way *Compose/Decompose* seeks to add value to the acousmatic principle of a discourse guided by intrinsic properties of sounds, and investigate how electroacoustic composition craft can be reconstituted in the context of 21st century technology.

1 INTRODUCTION

Compose/Decompose is a live-performed computer music work which exclusively uses sounds from Jonty Harrison's acousmatic piece *Pair/Impair* from 1978 (Harrison 1996). The work originated as an improvisation to celebrate Harrison's 70th birthday in 2022 but has since been developed into a more extensive semi-generative composition, completed in 2026. The basis of the work is a corpus built from decomposing *Pair/Impair* into small sound fragments, using machine listening tools from Fluid Corpus Manipulation Toolkit (FluCoMa, Tremblay et. al. 2021, 2022). The fragments are arranged by similarity in a two-dimensional map, which is accessible via MIDI controllers. As the sounds are performed through navigating the plot, a texture is gradually built in response to performed control input.

Compose/Decompose aims to harness and transform the rich analogue synthesis sound palette and spectromorphology (Smalley 1997) of Harrison's work within a digital live performance where indeterministic algorithms and machine listening allow sounds to intra-act and influence the music through *systemic agency* emerging from a confluence of processes (Nyström, forthcoming). In this way *Compose/Decompose* seeks to add value to the acousmatic principle of a discourse guided by intrinsic properties of sounds, and investigate how electroacoustic composition craft can be reconstituted in the context of 21st century technology. Two underlying conjectures are that (1) the manual method is not inherently optimal to the acousmatic medium but largely influenced by 20th century technological circumstances, and that (2) technological interfaces and potentials influence musicianship. The piece contributes to research in AI music creativity by demonstrating how machine learning (ML) and music information retrieval (MIR) can be leveraged to forge new directions in aesthetics, composition and performance of electroacoustic music.

2 ORGANIC ARCHITECTONIC MUSIC

How, then, does the interleaving of listening, design, and practical work change considering artificial intelligence tools available to musicians? For Harrison, acousmatic music "relies on *perceptual* realities rather than *conceptual* speculation to unlock the potential for musical discourse and musical structure from the inherent properties of the sound objects themselves" (Harrison 1999). He terms this practice "organic" because it is guided by the listening judgement and manual craft of the composer rather than preconceived concepts. In contrast, he considers structure defined in advance of the practical implementation of a work "architectonic". This dichotomy has an obvious origin in electroacoustic music history, and Harrison cites *elektronische musik* as an example of architectonic modelling, which is contrasted with the organic practices of *musique concrète*. The view that acousmatic music is a manual craft is also echoed by Adrian Moore's who writes that "acousmatic composition begins with source material" (Moore 2016, 4) and: "Composition often begins with an idea. That idea is not normally a concept but a sound or collection of sounds" (ibid. 7). While we can acknowledge a remaining difference between basing a decision on quantitative data or rules, as opposed to direct listening judgement, we can also observe that algorithms for MIR and ML can derive and organise quantitative data in ways that are closely aligned with human perception and cognition. Arguably it is now possible not only for composers, but also for algorithms, to structure music from "perceptual realities" and "the inherent properties of the sound objects themselves". How significantly does this change the context in which we view concrete material and abstract structure?

3 DECOMPOSING, REGENERATING

In *Compose/Decompose* is performed with a software system built in SuperCollider (McCartney et. al. 2024)

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which is designed to respond to itself and control input, structuring sound in real-time. MFCC analysis (Davis and Mermelstein 1980) and novelty detection (Foote, 2000) are used to analyse and segment sound material in the music. The segments are arranged in a two-dimensional space using FluCoMa, and its implementations of unsupervised dimension reduction with UMAP (McInnes et. al. 2020), nearest-neighbour searching with KD-tree (Bentley 1975), and K-means clustering (MacQueen 1967) for self-organised grouping of sounds (Figure 1). In addition, wavetables derived from the sustained passages in *Pair/Impair*, and manual edits of some of the characteristic gestures in the work are incorporated. During performance, sounds are triggered through navigation of the two-dimensional map, while parameters and temporal deltas are stored and clumped so shorter figures can be regenerated using algorithmic techniques for manipulating data structures. Clustering is used to help create a relatively equitable representation of sounds from the whole map throughout the performance: the sound groups least represented in the beginning of the performance are prioritised in the generative selection of sounds at later stages.

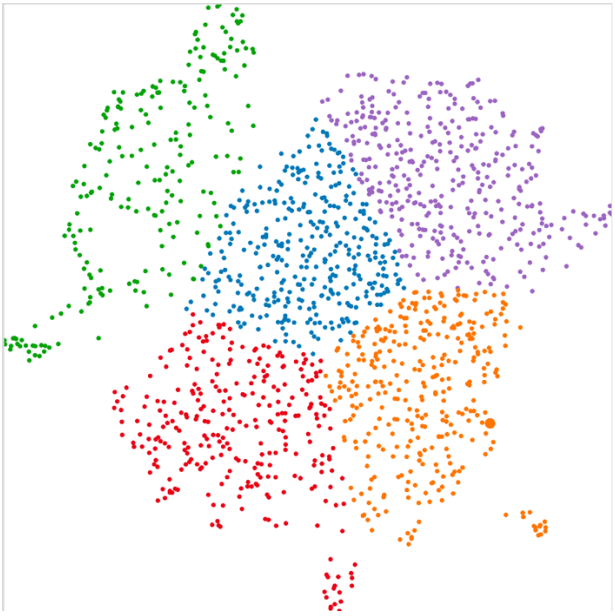


Figure 1: Plot of sounds arranged with UMAP. The coloured fields show grouping generated by K-means.

3.1 Digital Synthesis

Compose/Decompose approaches digital technology as a paradigm to which decomposition is inherent, using processes whose added value lies in the affordances of discretisation. This is not only reflected in the use of techniques for analysing audio and mining data but also in the audio processing techniques, which, for instance, depend on access to discrete audio data for the intermittent deletion of wavesets (Stowell n.d.), and the reproduction of samples in an input signal based on probabilities of a Markov chain (Bozkurt n.d.). Such discretisation processes cause audible disintegration and distortion, synthesising technological texture and materiality.

3.2 Structure

The work is structured into six separate sections, somewhat like an acousmatic suite of movements. The sections feed data unique to the specific performance into one another, which are manifest as variations on morphological figures and textures. Sections one and three have an emphasis on direct causal control of sounds in performance; sections two and five can be described as generative textural states supervised by the performer, without direct intervention; sections four and six have minimal control input, consists of pre-composed indeterministic processes which incorporate stochastic variations on data accumulated through the performance.

3.3 Spatial Design

The short fragments of the corpus are mostly organised within textural masses or iterative figures, alongside sustained tones and gestural events. Sounds are distributed to create a spatial texture that is spread out across an eight-channel speaker array, either by assigning random positions to sounds or by differentiating synthesis parameter settings for simultaneous spatially distributed streams of sound (Nyström 2018a, 2018b). Important for the present discussion is that spatialisation is not directly controlled in performance but driven by automatic selection of data and mathematical scaling of parameters. This may be considered “architectonic” when contrasted with *Pair/Impair*, a stereo piece with a strong gestural framing to be emphasised in the practice of live diffusion, where the diffuser controls sound projection to a multi-speaker array manually, by ear, from a mixing console.

4 CONCLUSION

Compose/Decompose aims to situate electroacoustic composition within contemporary technological means of sound organisation and performance, retaining the value of spectromorphological discourse within a dynamic environment which mobilises algorithmic techniques. “Organic” structuring of sound is maintained through real-time performance with material which has been organised through classifying and linking sounds according to properties derived from MIR and ML. Simultaneously, data are processed using operations that are undeniably parametric, quantitative and rule-based, and closer to serial and other, “architectonic”, formalised music practices (Xenakis 1992). While quantitative operations are inescapable in a work that is constructed as a computer program, as opposed to a hand-made arrangement of sounds, they also offer possibilities for organising and transforming sound that cannot be executed manually, especially in a live performance. More to the point, a key purpose of the generative processes is to enable an organic interaction among sounds and structures of the work in real-time. Thus, by making fluid, or ‘unfixing’ a fixed work, perhaps *Compose/Decompose* adds value to Harrison’s original suggestion of *Pair/Impair* as an “an extension of the relationship between dynamic and static musics (and their confusion) — a relationship which in itself can fluctuate between the dynamic and the static” (Harrison 1996).

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