
Editorial: Computation in the Sonic Arts

There are many ways to generate and organise the sounds of a composition. Notwithstanding the early precedents in musical dice games and the rules for contrapuntal voice leading, the use of formal procedures to make musical artefacts of a certain complexity without direct human intervention became practicably realisable with the advent of digital computers. This occurred in the second half of the twentieth century at the same time as artificial intelligence researchers were dreaming of a model of the human personage in which bodies and minds were more like machines than self-generating organisms. Some composers took the opportunity to develop algorithmic procedures to model works of the past, others to explore the representation of mathematically defined, natural and abstract processes that have no immediate connection to music such as set and group theory, probability distributions, Markovian stochastics, self-similarity, iterated function systems, adaptive networks and other combinatorial techniques.

More recently, attention has also turned to the sonic representation, or translation, of messy collected data, scraped from the internet, or gathered by monitoring human, natural, environmental and other activities and to the development of intelligent agents that collaborate in composition, improvisation and performance. Early collaborations with computational systems were met with some hostility by the musical establishment. Arguments ranged from whether or not, in replacing parts of the creative process with an automated system, we were de-humanising the resultant artefacts. Were we cheating by letting the tools do the work? Was it even possible to produce tools which can adequately challenge the intensely human ‘creative’ process? Did overtly reasoned processes have any place in musical composition in a domain of human activity which should be driven by feelings, intuition, and other non-algorithmic considerations?

Despite those early suspicions, composers have continued to actively engage with computation in the forming of new works. To date, many of the publications that document this work concentrate, through examples, on the ‘hows’ not the ‘whys’ of algorithmic composition. This issue of *Organised Sound* breaks somewhat from that tradition by seeking to go beyond descriptions of how specific compositional procedures are used in individual compositions in order to address the social and musicological dimensions of computation. In doing so, it aims to stimulate conversation

and interdisciplinary communication about the activity of computational design as it applies to the sonic arts.

In *Anacoustic modes of sound construction & the semiotics of virtuality*, Robert Seaback discusses some technical and aesthetic aspects of sound synthesis in the context of modes of sound construction that address the computer at its most fundamental level: the syntactic level of information. When sound is considered first as an informational construct rather than a material circumstance, the nature of signification is changed, as it ruptures the initial and dominant meanings that arise from our acoustic experience: In post-humanist, anacoustic modes, sounds can be considered as expressions of the materiality of information.

My own article, ‘Computational Designing of Sonic Morphologies’, examines the origin and consequences of a materialist sound-object mindset in which the hierarchical organisation of sonic events, especially those developed through notational abstraction, are considered antithetical to sounds ‘being themselves’. It argues that musical sounds are not just material objects, and that musical notations, on paper or in computer code, are not just symbolic abstractions but instructions for embodied actions between resonators and actuators. When notation is employed computationally to control resonance and gestural actuators at multiple acoustic, psychoacoustic and conceptual levels of music form, and it is possible for vibrant sonic morphologies to emerge and be sustained from the quantum-like boundaries between them. I argue that, in order to achieve that result, it is necessary to replace our primary focus of compositional attention from the Digital Audio Workstation sound transformation tools currently in vogue, with those that support algorithmic thinking at all levels of compositional design. This will afford the reinstatement of the use of symbolic logics in electroacoustic composition at multiple structural levels from microsound resonance generation and activation to corporally informed gesture models. Further, it offers the potential to stimulate and enable the creation of new alliances between the capacity of our auditory processing to produce only weak cognitive bindings to unknown sound sources and symbolic structures, and in doing so, enable metaphorical cognitive sub-conscious forms to emerge.

In ‘From Artificial to Extended Intelligence in Music Composition’, Artemi-Maria Giotti explores the relationship and disparities between human and computational

creativity by asking how well computational creativity systems currently perform creative tasks. She examines the assumptions about the nature of creativity in automatic composition systems, specifically with respect to novelty, surprise and value, and proposes, as an alternative to a competitive relationship between human and computational creativity, the concept of a distributed human–computer co-creativity, in which computational creativity, by expanding the space of creative possibilities, extends – rather than replaces – human creativity.

In ‘Aesthetics, Interaction and Machine Improvisation’, Henrik Frisk discusses the aesthetics of improvising with machines. The system he describes has limited intelligence and no real cognitive skills. While playing with it reveals systemic weaknesses, it also conveys some of the preconditions and aesthetic frameworks that a human improviser brings to the interaction. If we want autonomous systems to have the same kind of freedom, we commonly value in human players’ improvisational practice, we are challenged to ask ourselves what constitutes an ethical relationship between a human improviser and an improvising machine, and whether we are prepared to accept that it may develop in a direction that departs from our original aesthetic ambitions. Playing with a machine reveals a conceptual asymmetry between the embodied musician and their instruments on the one hand, and the abstract and disembodied computer on the other. For the author, this highlights a central obstacle in the development of musical improvisation with machines.

Jon McCormack, Patrick Hutchings, Toby Gifford, Matthew Yee-King, Maria Teresa Llano and Mark d’Inverno extend the theme of cooperation by suggesting, in ‘Design Considerations for Real-Time Collaboration with Creative Artificial Intelligence’, that machines that incorporate techniques from artificial intelligence and machine learning can work with human users on a moment-to-moment, real-time basis to generate creative outcomes, performances and artefacts. They define such systems as collaborative, creative AI systems and consider the theoretical and practical considerations needed for their design so they can support improvisation, performance and co-creation through real-time, sustained interaction. When doing so, they argue that the artistic goals and creative process should be first and foremost in any such design. In recognising that the field is in its infancy, they highlight the importance of understanding the scope and perception of two-way communication between human and machine agents in order to support reflection on the processes involved in conflict, error evaluation and flow.

In ‘Idiomatic Patterns and Aesthetic Influence in Computer Music Languages’, Andrew McPherson and Koray Tahiroğlu argue that it is widely accepted that acoustic and digital musical instruments shape the cognitive processes of the performer on both embodied

and conceptual levels, ultimately influencing the structure and aesthetics of the resulting performance. They examine ways in which computer music languages might similarly influence the aesthetic decisions of the digital music practitioner, even when those languages are designed for generality and theoretically capable of implementing any sound-producing process. By focusing on the idiomatic patterns of instruments or languages – those that are particularly easy or natural to execute – they also examine the basis for querying the non-neutrality of tools and find a complex interplay between language, instrument, composition and performance that suggests that the creator of the music programming language should be considered as one party to a conversation that occurs each time a new instrument is designed.

In ‘Digital Musical Instruments as Probes: How computation changes the mode-of-being of musical instruments’, Koray Tahiroğlu, Thor Magnusson, Adam Parkinson, Iris Garrelfs and Atau Tanaka, explore how computation opens up possibilities for new musical practices to emerge through technology design. Using the notion of the cultural probe as a lens, they consider the digital musical instrument as an experimental device that yields findings across the fields of music, sociology and acoustics. By considering how computation plays an important role in the authors’ personal performance practices which reflect the changed mode-of-being of new musical instruments and their individual and collective relations with them, they suggest that using an instrumental object as a probe is a means for artists to answer questions that are currently often formulated as part of an artistic-research methodology outside semantic language.

Digital games offer fertile environments for exploring novel computer music applications. While the use of games in composing music long precedes digital computers, it flourishes now in a rich landscape of music-making apps, sound toys and playful installations that provide access to music creation through game-like interaction. One pervasive characteristic of these systems is the avoidance of a competitive game framework, thus reflecting an underlying assumption that notions of conflict and challenge are somewhat antithetical to musical creativity. In ‘Evaluating Digital Games for Competitive Music Composition’, Thomas Studley, Jon Drummond, Nathan Scott and Keith Nesbitt report on a comparative user evaluation of two original games that frame interactive music composition as a human–computer competition. The games employ contrasting designs so that their juxtaposition can address questions of how player perceptions of musical creativity are shaped in competitive game environments. A user study revealed significant differences in system usability, and also creativity and ownership of musical outcomes. Further, that a high degree of

musical control was widely preferred, despite an apparent cost to general usability. These findings offer new insights for the design of future game-based composition systems, and reflect more broadly on the complex relationship between musical creativity, games and competition.

In 'Screenplay: A topic-theory-inspired interactive system', George Meikle describes an interactive computer music system that draws upon various computational styles from within the field of human-computer interaction in music, allowing it to transcend the socially contextual boundaries that separate different design and implementation approaches in the spheres of experimental/academic and popular electronic musics. A key aspect of the design of ScreenPlay is the novel inclusion of topic theory, which also enables it to bridge a gap spanning both time and genre between Classical/Romantic era music and contemporary electronic music. In doing so, the author suggests it provides new and creative insights into the subject of topic theory and its potential for re-appropriation within the sonic arts.

In the first of two off-theme articles, 'Reclaiming and Preserving Traditional Music: Aesthetics, ethics and technology', Mirko Ettore D'Agostino relates how sonic artists and electronic music composers have experimented with the use of new technologies to integrate traditional musical elements in their works. He argues that, along with local identities and cultures in general, in a world characterised by widespread globalisation, traditional musics are at risk of being neglected or even forgotten, and that the preservation of these traditional elements could represent an important contemporary goal. Informed by his research into the use of traditional music from southern Italian region of Campania, he asks whether there are ways to develop a form of expression that could reach a wide and diverse range of listeners, while accommodating recent trends and studies in electronic music while preserving the main distinctive features of traditional repertoires.

In 'The North Indian Sarode and Questions Concerning Technology', Matthew Noone documents some work of non-Western electroacoustic composers who incorporate traditional material or indigenous instruments in their music. His research builds upon a discussion of several articles in previous issues of this journal concerning non-Western instrumentation in electroacoustic music, to address concerns about intercultural issues such as misappropriation. Through a consideration of his own practice composing and performing electroacoustic music with the North Indian sarode, he attends to the complexity of being in-between musical cultures through a critical engagement with theories relating to hybridity, orientalism and self-identity.

As our lives become increasingly infused with computational processes and products, and artificial intelligence slowly drags itself out of self-reflexive rationality, it is natural that inquisitive minds will explore new concepts and techniques to extend their practice beyond a bricolage of 'sound objects' into liminal transitions in material, gestural and symbolic discourses that reveal themselves through sound. It is my hope that, in some small way, this issue stimulates such conversations and interdisciplinary communications about the activity of computational sound designing in the sonic arts, for, as my anagrammic poem on 'organised sound', in Volume 3(1), ends:

*Edgard onus is on
unison so graded
in us, soon Edgard,
odd sonar genius
drags unison odes
and serious dong,
redoing sound as
undoing ear's sod.*

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