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## Editorial

# Editorial: Embedding algorithms in music and sound art

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Music is a deeply algorithmic art form. One could argue that ancient music theories from around the world contain algorithmic programmes (from the Greek *prográphein*, to write beforehand or publicly), and the rhythms and melodies we listen to are embodied algorithms, patterns rendered alive. Formal algorithms in musical composition became more common with the invention of notation, the movable-type printing press, and later combinatorics of all sorts that result in unforeseeable music (Magnusson 2019). With the digital computer, we clearly have the perfect tool for inventing and describing new algorithms for music.

This issue of *Organised Sound* seeks to investigate how algorithms are embedded in the instruments, tools and technologies of contemporary music and sound art practices. How are algorithms, such as those of machine learning or artificial life, applied as part of new musical instruments, compositional processes and sound installations? This enquiry is very different from current uses of machine learning in music production, in services such as Suno or Udio; it is rather an investigation into how musicians and sound artists are doing what they have always done: exploring how new and emerging technologies can be applied as musical tools.

This distinction matters. Public discourse on artificial intelligence often swings between dystopian and utopian narratives, while the development of mainstream technologies is largely driven by the commercial imperatives of a small number of corporations. Artistic engagement with algorithms offers a way out of these binaries. When musicians and sound artists build, train, repurpose and improvise with algorithmic systems, they approach them as materials to be explored, questioned and reshaped – and at times as collaborators whose alterity, or 'wildness', lets the unexpected and the unheard in. Improvisation in particular becomes a way of understanding that alterity. In doing so, artistic practice makes space for collectively developing more diverse AI imaginaries (Saunier et al. 2025), grounded in artistic, situated and embodied musical knowledge rather than in the priorities of the technology industry.

The practice of embedding algorithms into tools for sound-making is limited neither to machine learning nor to the concert stage. Whilst closely linked to digital technology, the practice of embedding algorithms into tools for sound-making also transcends it. Different forms and concepts emerge in domains that can be analogue, digital, pertaining to recent or ancient technologies, tailored around the practice of a single individual or encompassing the behaviours of multiple players, even non-human ones. The articles collected here reflect this breadth, ranging from historical automata and electromechanical sound art to compositional processes shaped by environmental data and from co-improvising agents to the recommendation algorithms of social media platforms.

In the practice of embedding algorithms, knowledge and technology from other disciplines are appropriated and repurposed by sound artists in many ways. Algorithms can encode complex behaviours that may make the instrument adapt to the way it is being played or give it a degree of autonomy and agency. Sensors and actuators developed in other research fields are used for making new instruments. Similarly, digital data describing various phenomena – from environmental processes to the global economy – have been harnessed by practitioners for defining the behaviour of their sound tools, resulting in data-driven sound practices such as sonification. These aspects can have profound effects on the aesthetics and creative processes of sound art and electroacoustic music, as artists are given the possibility of delegating some of the decisions to their tools.

With the recent advances in artificial intelligence that have made it possible to embed machine learning models into instruments, new aesthetics and practices emerge in which curating a dataset and training a model become part of the artistic process. Contrary to commercial big-data extractivist logics (Crawford 2021), here artists are training models on their own data. These trends in music and sound art have sparked a broad discourse addressing notions of agency, autonomy, authenticity, authorship, creativity and originality. There are aesthetic, epistemological and ethical implications arising from the practice of building sound-making instruments that incorporate algorithmic processes. How do intelligent instruments affect our musical practice?

This demands an interdisciplinary critical enquiry. For this special issue of *Organised Sound*, we have sought to publish articles that address the aesthetic and cultural implications of designing and embedding algorithms for electroacoustic music practice and sound art.

Read together, the articles in this issue reveal several threads that cut across their different subjects and methods. Some trace the long history of algorithms embodied in physical mechanisms, from automata to motors and solenoids, reminding us that the practice predates the computer. Others address the political and ethical dimensions of algorithmic tools: the extractive economics of commercial generative AI, the values inscribed in data and sensing

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and the right of performers to define the terms on which algorithms interpret them. A recurring concern is the opacity of algorithms, how artistic practice can make them legible and negotiable, or perhaps embrace their unintelligibility as aesthetic material. The articles also question the cultural assumptions and narratives that tools carry, often unnoticed, into musical practice. Several contributions examine how agency is distributed among players, instruments, algorithms and audiences, drawing on relational and post-human theories to rethink what an instrument is, while others explore the same question in practice through human–machine co-improvisation. Finally, a number of articles look beyond the human altogether, finding algorithmic processes in the living environment and in environmental and cosmological data, and asking how claims of non-human agency should be framed.

Eun Ji Park's 'Embedding algorithms in musical instruments: From automata to artificial intelligence-driven music' provides a long historical view on the issue's theme. Through a media-archaeological reading of automata from antiquity to nineteenth-century mechanical instruments, Park shows that musical rules were embedded in physical mechanisms long before the computer and uses these 'material algorithms' to put current debates on agency, authorship and autonomy in intelligent instruments into historical perspective.

Fintan O'Hare's 'Machine Learning in Electromechanical Sound Art' surveys the use of neural networks in works where sound is produced physically through motors, solenoids and resonators, considering how technical, material and performative factors shape their design. The survey is followed by a practice-based case study, Seven Studies for Electric Motors, which embeds a small language model and translates the syntactic structures of the sentences it generates into motor-driven sound.

Misagh Azimi and Mo H. Zareei's 'The work of music in the age of commercial GenAI: Politicisation, prophecy, and participation' turns to the commercial generative AI platforms, such as Suno and Udio, from which we distinguished the practices in this issue at the outset. Where the other contributions explore alternatives to these platforms, Azimi and Zareei confront them directly: drawing on Benjamin, Small and Attali, as well as on critiques of extraction and technofeudalism, they analyse their sociocultural and economic consequences, argue that their trajectory stems from commercial imperatives rather than from the technology itself and present practice-based interventions that contest them.

Ali Balighi's review article, 'Embedding Data into Instruments: An Ethical-Embodied Framework for Electroacoustic Practice', develops a framework for examining how data, sensing and mapping arrangements shape relations of care, listening and musical agency. Drawing on feminist and decolonial listening practices, disability and critical data studies and discussing works based on gesture tracking, EMG, brain–computer interfaces and machine learning, it shows how similar technologies can either reproduce or contest surveillance, extractivism and aesthetic normativity.

Teresa Pelinski, Adam Pultz Melbye and Andrew McPherson's 'When AI doesn't sound like AI: Negotiating aesthetic expectations in technology-mediated musical practice' reconstructs the development of the Surfing Hyperparameters project to show how its sound emerged from a negotiation between what the system actually produced and the authors' expectations, informed by cultural narratives of ghosts in the machine. They argue that the aesthetics of AI-generated sound are often inspired by, rather than directly caused by, the technology, and that the stories practitioners tell about their tools actively shape what they make.

In 'Experimental sense-making, musicking and no control: Performing black box music instruments', Thomas Grill, Arthur Flexer, Angélica Castelló, Marco Döttlinger, Patrik Lechner and Christian Grüny report on Black Box Music, an artistic research project in which each musician improvises on an unfamiliar, complex instrument built by another member of the group, ranging from AI-based systems to assemblages of analogue devices. The authors describe how these instruments oscillate between transparent extensions of the body and quasi-autonomous others and how improvisation becomes a collective process of sense-making for performers and audience alike.

Thanos Polymeneas-Liontiris and Alexandros Drymonitis's 'Nodes, glitches and embedded algorithms: COMACROB and posthuman organology' discusses Composing for Acoustic Robots (COMACROB), a system combining live coding, AI-generated symbolic music and mechanically actuated acoustic instruments such as the Yamaha Disklavier and a MIDI pipe organ. Drawing on organology, actor-network theory and object-oriented ontology, Polymeneas-Liontiris and Drymonitis argue that algorithmic processes are not external controllers but co-constitute the identity of the instrument, which thereby becomes a participant in musical authorship.

In 'Notes aren't real: An anti-framework for entangled instrument design', Andrew McPherson argues that entanglement theories are most useful not as design recipes but as a means of unsettling assumptions that have become invisible in digital musical instrument design. He questions how analytical categories such as notes, pitches, onsets and gestures have been turned into the building blocks of technical systems, arguing that instruments enact the very musical concepts they take as given.

Vincenzo Madaghiele, Stefano Fasciani and Çağrı Erdem's 'Personalising behaviours of the multi-agent autonomous looper with a corpus of annotated co-performances' presents a method that uses a genetic algorithm and musicians' annotations of their own co-performances to adapt the behaviour of a co-improvising looping system to individual aesthetic preferences. A study with five expert improvisers suggests that such personalisation can support co-adaptation between musicians and artificial agents.

Otto Wanke's 'Spectralism reimagined: AI, orchestration and improvisation' argues that AI-based tools such as the orchestration system Orchidea and the co-improvisation environment Somax2 extend the logic of spectralist instrumental resynthesis into new computational and performative contexts. Wanke shows how spectral analysis underpins both corpus-based orchestration and real-time human–machine improvisation.

Tilemachos Moussas and Anastasia Georgaki's 'Embodied algorithms in vocal performance: Kinesthesis 2.0 and the transformation of player–instrument–algorithm assemblages' examines an interactive system that turns gesture and facial expression into real-time vocal processing, drawing on theatre productions that include co-improvisation with Somax2. The authors argue that computational mediation becomes seamless for the performer not

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through technical simplification but by rooting the system's gesture vocabularies in cultural tradition.

In 'Emotional inference as embedded algorithm in live performance: From recognition to dramaturgy', Gadi Sassoon discusses TEAL, a multimodal system that maps musical and gestural data onto composer-defined emotional parameters, generates narrative text with a locally hosted language model and feeds its output back into the performance through a Disklavier and generated visuals. Sassoon proposes 'emotional sovereignty' – the performer's right to define the affective ground on which algorithms operate – as a design principle and an alternative to universal emotion recognition.

Tanguy Pocquet du Haut-Jussé's 'Mapping of d.i.y. neural networks' processing data in audiovisual compositions: digital waste, algorithms' idiosyncrasies, and transfictionality of data-evoking aesthetics' takes a non-generative approach to AI, mapping the 'waste' data produced while training neural networks onto sound and image. Linking this trace of the algorithms' operation with the aesthetics of glitch and digital malfunction, the work exposes audiences to the opacity of these ubiquitous processes while turning their data into creative material.

Paolo Montella's 'Maybe yes/maybe no: Negotiating with Instagram's algorithm in a performance assemblage' presents *Concrete Reel*, a research-creation project that turns doomscrolling on Instagram into audiovisual improvisation. Framed by DeLanda's assemblage theory and Barad's agential realism, the performance treats the platform's algorithm as a non-human actant and uses a rule-based protocol, disrupted by the audience, to make the workings of an opaque commercial system perceptible.

Frederick Rodrigues's 'Algorithms, animals, autonomy and agency: Ludic framing in sonic arts' observes that terms such as agency, autonomy and collaboration carry divergent meanings across biology, computer science and cultural theory and become fragile when applied literally in more-than-human sonic art. Moving from interspecies to algorithmic practices, and reflecting on the installation Synthetic Ornithology, Rodrigues proposes treating such framings as ludic – creative and explicitly non-ontological – rather than as claims to be proved or disproved.

Nicholas Denton Protsack's 'Vibrant algorithms: Sonic collaborations with the living environment' addresses an often overlooked area of algorithmic composition: music made in conversation with the natural world, whose rules are not of human origin. Proposing the term 'vibrant algorithm' for such practices, the article discusses a range of musical examples and raises ethical questions about the agency of the living environment, including entities not conventionally regarded as animate in westernised and urbanised worldviews.

Luciana Perc's 'Telling life stories through algorithms embedded in compositional processes' discusses instrumental and electroacoustic works in which environmental and astronomical data are embedded in musical materials and structures. Drawing on Ursula Le Guin, Karen Barad and Donna Haraway, Perc uses these works to narrate more-than-human processes, from the displacement of plant species and the formation of galaxies to bird flight and the pollution of the seas.

This issue also includes five articles that fall outside its thematic focus. Due to an error, Özgür Turan's 'Experimental luthiery in Latin America: A postcolonial and acoustemological approach' was not published in issue 31/1 as originally planned and appears here instead. Drawing on postcolonial theory and acoustemology, and on the work of artists such as Walter Smetak, Marco Antônio Guimarães, Joaquín Orellana, Wilson Sukorski and Tania Candiani, Turan examines experimental instrument-making in Latin America as a site of cultural memory, resistance and alternative forms of knowledge.

Bowen Wu's 'Reflecting on China's electroacoustic music: Rethinking the Chinese-Western dualism and exploring ecological perspectives' traces four decades of electroacoustic music in China and argues that the 'China versus the West' framework, together with the positioning of 'Chineseness' as a compositional strategy, now constrains its development. Wu proposes instead an ecological perspective that moves beyond cultural essentialism, discussing a selection of compositional practices including the author's own *Mixobloodify*.

In 'The materiality of radio art: Towards a theory of radiophonic matter', Natalia Kowalska-Elkader draws on new materialism, sonic materialism and writers such as Christoph Cox and Gregory Whitehead to examine how the radio medium co-creates artistic sound. The article outlines seven dimensions of the materiality of radio art, emphasising the relational character of sound as it interacts with environment, technology and listener.

Stewart Worthy's 'Audiovisual transformation strategies for object-based sound installations' presents a set of strategies, developed through the author's installations combining objects, projection mapping and electroacoustic sound, that imagine how studio processes and broader conceptual links between sound and image might be translated into visual form. The strategies are offered as a resource that other artists can adapt beyond the context of sound installation.

Adam Rosiński's 'A spherical microphone prototype for multichannel recording: Technological design, artistic applications and compositional implications' presents a microphone with ten motorised capsules whose orientation and polar pattern can be adjusted in real time. Compared with commercial ambisonic microphones, the prototype offers dynamic control over spatial recording, effectively turning the microphone into a performative instrument for live performance and interactive sound art.

Taken together, the thematic contributions offer diverse answers to the question posed in this thematic issue: how does the design of intelligent instruments affect our musical practice? Intelligent instruments offer new sounds and new means of control and redistribute decisions between players and algorithms. In so doing, they bring to light assumptions about music that have become so ingrained as to go unnoticed. They also ask practitioners to take responsibility for the data, models and values their instruments embody. Far from settling these questions, the articles gathered here show how much remains open – and how experimental artistic practice can keep it so.

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