Book Review

Sonic Writing, Technologies of Material, Symbolic, and Signal Inscriptions is the first monograph by Thor Magnusson. It offers a thoughtful and creative insight into the past, present and future of music technologies. Questions, such as what is the origin of music, what is a musical instrument, what does the digital bring into musical practices, how do we write music and what do we write, are addressed throughout its 290 pages with the aim of understanding the nature, lineage and future directions of contemporary digital instruments. The captivating cover image, *Study no. 57*, is made by Ryan Ross Smith and belongs to an animated notation. The still image is an abstract visualisation that finely represents one of the main contributions of the book related to the nature of sonic writing when using digital musical technologies.

The book is thoughtful by establishing a philosophical, historical and musicological account of three modes of writing music since its origins, described as (1) *material inscriptions* produced by musical instruments, ranging from acoustic to electronic to digital musical instruments, (2) *symbolic inscriptions* created by different types of notation, spanning from symbolic notation with historical figures such as Guido d'Arezzo in Western notation to contemporary notations such as open notations, graphic notations, or machine notations, among others, and (3) *signal inscriptions* generated by audio recordings from instruments such as the phonograph and other analogue and digital recording devices. Magnusson's approach is creative by revealing the connection of these three modes with an exciting present and unknown predictable future of digital musical technologies, presented as an amalgamation and repurposing of these modes, which can then be seen as (yet) another new mode of sonic writing.

Magnusson's monograph has a solid philosophical stance influenced by philosophers of the school of phenomenology such as Husserl, Heidegger and Merleau-Ponty, which connects with philosophical disciplines such as ontology and epistemology. From this perspective, the musical instrument becomes a live object that can be seen not only as a tool but also as an object of study (p. 170), and it is this unique position of having two functions that make, according to

Magnusson, a good musical instrument. This live interpretation of the instrument as part of a broader ecosystem, a cybernetic system of ongoing mutual influence between actor, object and environment, turn both the actor and the object as agents. This transversal approach brought by a phenomenological stance about the evolution of musical instrument design helps the reader to interpret the existing diversity and variety of acoustic, electronic and digital musical instruments across the globe focusing on the Western musical tradition. From this approach, musical instruments can be seen as epistemic tools, which refers to an object becoming a scientific method of enquiry to search for knowledge, described as 'cognitive extensions of the human' (p. 56). Another related concept that forms part of this transversal lens is *ergodynamics*, which has both objective and subjective views that emerge from the object and refer to the way a musical instrument is played, the experience of interacting with it: 'This experience of ergodynamics recognises that an instrument is an object that never rests, or enters a period of stasis: that every time we pick it up there are new things to discover, new patterns our fingers know, because we have changed, the instrument has changed, and so has the world itself – the general performance context' (p. 12).

The publisher describes the work as a book that 'explores how contemporary music technologies trace their ancestry to previous forms of instruments and media. Studying the domains of instrument design, musical notation, and sound recording under the rubrics of material, symbolic, and signal inscriptions of sound, the book describes how these historical techniques of sonic writing implemented in new digital music technologies. With a scope ranging from ancient Greek music theory, medieval notation, early modern scientific instrumentation to contemporary multimedia and artificial intelligence, it provides a theoretical grounding for further study and development of technologies of musical expression.'

The monograph starts with an introduction entitled 'On Objects, Humans, and Machines' and continues with five parts: Part I, 'Material Inscriptions'; Part II, 'Symbolic Inscriptions'; Part III, 'Signal Inscriptions'; Part IV, 'Digital Writing'; and Part V, 'Conclusion'. In total, there are 19 chapters. The book is nicely structured with four chapters for each part except for Part V, which has three concluding chapters. Each chapter has a clear introduction and conclusion, which helps the reader to navigate through the concepts presented in the book.

In the introduction, 'On Objects, Humans, and Machines', Thor Magnusson presents the overall conceptual framework of the book. The framework is based on three 'music technological epistemes' (p. 6) that can be mapped to the three instrumental paradigms of the nineteenth, twentieth, and twenty-first centuries. The three epistemes are represented by acoustic instruments (first episteme), electronic instruments (second episteme) and digital instruments (third episteme). Magnusson's viewpoint is that 'the new technologies of digital music-making trace their design to the practices of material, symbolic, and signal inscriptions, or, in other words, to the design of instruments, notation, and recording technologies' (p. 6). Hence, this manuscript proposes a genealogical study on contemporary digital technologies, in which musical instruments are treated as objects that change and transduce ('ergodynamics').

Part I, 'Material Inscriptions', looks into musical instruments as new inventions that carry musical and cultural ideologies into their bodies. The first chapter, 'Instrumentality', explores, from a historical and sociotechnological account, the nature of musical instruments. Chapter 2, 'New Instruments', investigates the impact of electricity and digital computers on the cosmology of musical instruments, which brings a more accelerated speed of development. Chapter 3, 'Epistemic Tools', looks into the epistemic character of instrument design and the new materialities provided by digital instrument design with the open question of how to analyse a digital system, which is 'material in its body, electric in function, and symbolic in control' (p. 57). Chapter 4, 'Digital Organology', connects digital instruments as part of the organology of musical instruments, and looks at the musical instrument as an epistemic tool and an ergodynamic artefact.

Part II, 'Symbolic Inscriptions', investigates the evolution of musical notation using abstract symbols and how it has influenced digital technologies. Chapter 5, 'Writing Music', inspects the role of notated music compared to oral transmission of musical works and how notating music establishes the foundation for sonic inscriptions. Chapter 6, 'Printing Music', studies the meaning of musical work in history up to the present focusing on the printed score as 'a fundamental element in defining the ontology of the musical work as we understand it today' (p. 93). The emphasis on the musical score for understanding digital musical instruments is one of the main contributions and assumptions of this book, the question remaining of whether the origin of digital musical instruments can be also explained by removing the musical score of the equation. Chapter 7, 'New Languages', examines the foundational role of avant-garde and experimental music in the change of the musical score as a material

object and the emergence of digital practices. Chapter 8, 'Machine Notation', analyses how the computer has been and is used to notate music with the genesis of new notational languages and thus new music that integrates a multiplicity of software and hardware elements.

Part III, 'Signal Inscriptions', discusses the mechanical notation of sound produced by machines with a turn from symbols to signals. Chapter 9, 'Inscribing Sound', deals with a historical account of mechanical writing including the revolutionary invention of sound reproduction technologies and the corresponding access to the audio signal instead of using symbols, the latter previously discussed in Part II. Chapter 10, 'Recording', considers the implications of phonography and the recording studio in how we conceive music at present, where recorded music is essential in private and local spheres. Chapter 11, 'Analysing', tackles the ability of the computer to read and analyse musical signals, bringing new approaches to composing music through visual or audiovisual techniques. Chapter 12, 'Machine Listening', is a follow-up of Chapter 11, focusing on the potential of machine listening for understanding and producing musical systems that can listen for particular features or musical patterns of the audio signal at a large scale.

Part IV, 'Digital Writing', presents how the concepts discussed in the previous parts are represented in digital musical instruments combined with new ontologies such as computational, interactive and generative elements. This part is one of the most substantial contributions of the book, which starts with Chapter 13, 'Transductions', in which digital instruments are presented as fluid instruments that inherit from the history and tradition behind acoustic and electronic musical instruments but are also modified by machine learning and its evolution properties. A question that comes to light is 'What is the instrument that is being composed for and how would one notate for it?' (p. 177), assuming that some form of a score is needed. Chapter 14, 'New Notations', explores new ideas for musical composition using new technologies departing from the notion that music can be expressed fluidly, non-linearly and socially situated in time and space. Chapter 15, 'Machine Writing', looks into computers making music and how deep learning is challenging the future of music technologies including unanswered ethical and technical questions about authorship or transparent processes, among others. Chapter 16, 'Music in Multimedia', examines the commonalities of different artistic digital manifestations (e.g., photography, film, animation, games, virtual reality, installations) found in digital musical instruments. Multimedia is understood here in its general sense, as opposed to the popular usage of the term in artistic domains related to interactivity and hypermedia originated in the 1990s.

Part V, 'Conclusion' is also a substantial contribution that discusses the potential future of digital musical technologies. Chapter 17, 'A Future of Music Tech', envisions that customised use of big data and machine learning can bring new musical aesthetics and formats that can coexist with previous formats. This approach entails ensuring open-source technologies and circulation of information, which is publicly available for anyone to inspect, criticise and become inventive from. Chapter 18, 'Transformation of Tradition', recognises that 'whilst digital instruments may lack the material depth of their acoustic counterparts, its unique qualities, haecceity, and haptic feedback, they can augment the embodied performance by various other means, such as motion capture analysis, machine learning, and auxiliary representation through visual or haptic means for example using screens and motors' (p. 238). It also mentions that digital instruments repackage musical pieces as musical systems due to their complex and hybrid nature. Chapter 19, 'New Education', discusses music education under the umbrella of how to teach new practices and inventions while also preserving the fundamental traditional properties of music-making. It is not a coincidence that the last concluding chapter covers music education, which is our best hope for a better future. Some important points made include that 'the model of the "virtuoso performer" can no longer be the purpose of music education' (p. 241) and that 'the new inventors of music will be interdisciplinary makers and creative thinkers whose research, engineering and creative skills will have been trained through music' (p. 242). An emphasis on the relevance of having an inventive spirit is made: 'The direness of the current situation is such that we cannot engage in resistance any longer, as Derrida, Deleuze, or Lyotard suggest, but we need to actually *invent*' (p. 243). Ultimately, music is related to the act of inventing, where music is described as 'a search, a probe, a *ricercare*, an invention' (p. 244).

One key question that emerges is why the format of *Sonic Writing* is a traditional book when the main focus is on understanding and forecasting the inscriptions of the present and future digital era. In the preface, Magnusson explains that it is a conscious decision related to the unique value and experience that can be obtained from the traditional process of writing a book, which aligns with the breadth and depth of the content of the book. 'Considering the wide scope of the book … I felt that the format of the book would provide the necessary constraint and focus that I was after' (p. xii). It is worth mentioning that the companion website (www.sonicwriting.org) provides a complementary, audiovisual and live version of the book.

This monograph adopts an artefact-driven perspective of the history of music technologies. Thus, a continuum is traced from acoustic musical instruments to digital musical instruments, in which digital musical instruments inherit ideas from the past. As part of this heritage, there is the score, which is argued to adopt new forms suitable for the digital realm and contemporary musical practices. 'Writing is not disappearing, it is simply drastically different' (p. 180) is a core principle of the book, which builds on a transformational notion of writing to interpret the materiality of the digital applied to the music domain. Several questions arise with respect to the focus embraced by *Sonic Writing*. What if the new digital musical instruments are inclined to reject the role and figure of the score or more broadly digital inscriptions? Is there space for ephemeral, mutable, orally transmitted, intangible music in the digital domain? There is a risk that a strong attachment to history can limit the possibilities of the present and the imagination of the future in the creative realm. What if, similar to the spirit of the artists during the avant-garde of the twentieth century, new digital musical instruments are created with an intention to rupture with the past and create a new order? Can we identify new vocabularies and cosmologies, new epistemologies and ontologies in the new digital and AI-powered musical instruments without such strong influence from the acoustic and electronic periods? In conclusion, what can new technologies bring as a counterpoint to what we already know?

Sonic Writing is foundational for understanding digital musical instruments that are emerging in the twenty-first century speaking to both the traditional luthier who wants to know more about the digital world and the digital luthier who wants to understand the roots of what she is doing. Magnusson presents a monograph that is well-informed, didactic and illustrative. Academics, composers, practitioners and creative professionals alike will find the book inspiring and can bring new perspectives to their work. The book will be particularly relevant to the readership of the *Organised Sound* journal and the sonic arts community. A historical review of using sound as compositional material is found in Chapter 10, 'Recording'. In Chapter 11, 'Analysing', software for electroacoustic music listening is presented, such as Pierre Couprie's EAnalysis software developed as part of the research project 'New Multimedia Tools for Electroacoustic Music Analysis' by Simon Emmerson and Leigh Landy. The way sound analysis is performed by machine listening algorithms can be informed by Pierre Schaeffer's four listening modes, pertinently discussed in Chapter 12, 'Machine Listening'. Sound art as music is considered in Chapter 16, 'Music in Multimedia'. The last two chapters are also of interest. Chapter 18, 'Transformation of Tradition', looks into

new musical composition practices, such as DIY musical systems or installations. Chapter 19, 'New Education for New Music', investigates what can be learned from the new musical practices and technologies that can be brought to a new music pedagogy, which includes contemporary practices from sonic arts.

This book is timely at a moment when humanities are under global transformation that brings a certain degree of uncertainty. Magnusson's monograph is an exemplary manifestation of why digital humanities are important by bringing a new fresh perspective from a humanities standpoint. *Sonic Writing* shows how digital humanities are helpful for understanding complex phenomena rigorously and creatively, in this case, to interpret the past, present and future of music technologies.

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