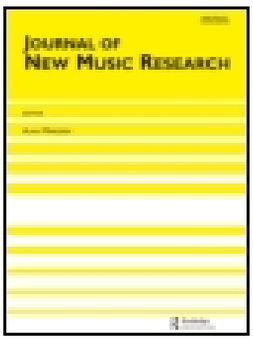

Journal of New Music Research

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/nnmr20

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To cite this article: Koray Tahiroğlu & Thor Magnusson (2021): Introduction to the special issue on socio-cultural role of technology in digital musical instruments, Journal of New Music Research, DOI: 10.1080/09298215.2021.1907421

To link to this article: https://doi.org/10.1080/09298215.2021.1907421

Published online: 13 Apr 2021.

JOURNAL OF NEW MUSIC RESEARCH
https://doi.org/10.1080/09298215.2021.1907421

Routledge
Taylor & Francis Group

Introduction to the special issue on socio-cultural role of technology in digital musical instruments

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ABSTRACT
This special issue, arising from a symposium in Helsinki in 2019, presents contributions from a diverse group of practitioners, representing a broad range of approaches in the making, thinking and writing about digital musical instruments. The authors consider the socio-cultural role of technology in current and emerging digital music practices with changing social roles, historical and critical reflections. This introduction explains the context and motivation for the issue and summarises the contribution of each of the eight articles. Together they provide what we believe is a unique contribution to the research of new interfaces for musical expression and related areas.

ARTICLE HISTORY
Received 8 March 2021
Accepted 19 March 2021

KEYWORDS
Digital musical instruments; socio-cultural role of technology; new interfaces for musical expression

Introduction

General development in technology has played a central role in the evolution of musical instruments, as instrument builders and makers adopt new equipment and methods in their work. Today, the increased use of digital technology in musical instruments, coupled with the demands of musicians to explore the potential of new instruments, has contributed to the growth of new musical practices. In addition to well-known synthesisers, digital audio workstations and digital instruments that simulate acoustic instruments, a domain of more experimental and innovative research and design practice called 'New Interfaces for Musical Expression' (NIME) has emerged in the past two decades, where current technologies in hardware and software are applied in the context of music making. NIME is an essentially investigative and explorative approach to new music making via new technologies and it is the context that this current issue positions itself in.

While today's musical practices are saturated with digital technologies that shape the way we make, distribute and listen to music, music itself has always been inherently a socio-cultural activity, supporting a wide range of social interactions (Tahiroğlu et al., 2020). Music, as a social practice, builds a space for the expression of our thoughts, feelings and ideas. These human experiences are articulated throughout our history with sound and reach far back into prehistoric times (Magnusson, 2019). This issue asks how the established research domains of music technology and new interfaces for musical expression point towards common concepts and practices of socio-cultural conditions. We further question how we might trace their trajectories and extrapolate in the context of the new music-technological situation.

In his article 'The Music-Culture as a World of Music,' Titon (2009) formulates a model that engages with the socio-cultural role of music and comprises the affective experience we have with it. In this model, the performance of music is built on 'procedures and agreed-on rules' that are guided and shaped by the more general music-culture. The music, then, is heard by the audience, a community that supports and influences the music as well as developing a collective memory and history of it. Titon's model brings attention to the underlying culturally informed factors in music, such as memories, practices and histories. In thinking about music, we note that technological and socio-cultural conditions impact upon the forms of musical creation, how music is performed, experienced, shared and distributed. Today, bar the hopefully isolated period of the Covid-19 pandemic, *musicking* is more of an interactive and social practice; going to a concert *is as much a musical activity as performing the music* (Small, 1998). Music is something we do; it is an action in which we participate. But, like humans, technologies have a certain agency and our interactions with new artefacts embody new relations between humans and technology, resulting in new music. In the following eight articles, our relationships

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with music and digital musical instruments are critically discussed, and we explore how these technologies and relationships shape embodied behaviours, expectations, beliefs, interpretations, perceptions and actions. We explore the socio-cultural role of technology in digital musical practices and look at how digital technologies condition us, frame the interactions and experiences we develop and enact. The articles in this special issue seek to open up a new field of inquiry around digital musical instruments focusing on the socio-cultural and techno-scientific nature of our expressive condition. In this issue, we seek to bring these conditions to a detailed focus.

The structure and the content of this issue are the outcome of a symposium organised by one of the guest editors, Koray Tahiroğlu, in Helsinki in November 2019 on 'Socio-cultural role of technology in digital musical interactions'. A diverse group of expert scholars, artists, musicians, practitioners from musicology, music performance, new interfaces for musical expression, sound and music computing and postphenomenology studies participated in a two days discussion on issues and challenges in social aspects of digital musical instruments and music technology. The symposium, followed by a one-day workshop, provided an opportunity not only for facilitating the exchange of thoughts and ideas but also to question, what does our relationship with music and musical instruments look like today? We are pleased to see the broad approach of the participants in the Helsinki symposium represented in the articles in this special issue of the Journal of New Music Research.

The first article is by **Marc Leman** who investigates the concept of co-regulating timing in music. Leman proposes a hypothesis about a music ensemble's co-regulated timing based on the notion of constancy, or balance, considering the prediction of constancy to be a key element of a shared intentionality in a music ensemble. The main contribution of this paper is a new Bayesian listener algorithm (BListener), which is a perception model of constancy based on Bayesian principles. The algorithm's behaviour (which exists as R package) is explained and tested on several datasets.

It is worth considering Leman's proposal in the context of digital musical interactions. Leman suggests that BListener could function as a perception module of an artificial musician capable of interacting with human musicians. The artificial musician would 'perceive and understand' the global dynamics of co-regulated timing with humans and adapt its proper actions. In the final part of the article, Leman suggests that constancy in timing (due to co-regulation) is correlated with interaction quality, and possible empowering effects when this quality can be realised through a performance. He claims that an achieved constancy is a homeostatic state that is correlated with feelings of control (or agency) in a music ensemble. Leman's concept of co-regulated timing can be understood in terms of collaborative actions and as a condition of desirable states of embodiment that has beneficial effects on participants.

The second article by **Simon Waters** builds on his previous work which regards musical activity as taking place within a 'performance ecosystem'. Drawing on modes of thought influenced by Lucy Suchman and Philip Agre, among others, he attempts to place contemporary approaches to instrument making within the broader historical perspective of human entanglements with instruments generally. He contends that historical musical instrument development has much to teach those involved in digital music making, as such instruments embody not only acoustic behaviours, but patterns of use, thought and belief. He distinguishes this from the field of organology, however, regarding organology as too concerned with decontextualised objects, measurements, and abstract classification systems, and insufficiently embedded in the sociology of human use of instruments in musicking.

Waters suggests that the digital music world's dependence on abstractions such as 'gesture' may be unhelpful in building compelling musical instruments (not least because designers tend to have an impoverished vocabulary of gesture and movement compared with those who really address the concept critically, such as dancers and choreographers). He regards the observation and analysis of *situated action* (Suchman, 1987) as crucial to understanding the qualities of successful instruments, and suggests that it may be as productive to study the conduct of and between musicians engaged in their practice, as studying the *interaction* between player and instrument. Waters's approach regards instruments as necessarily assemblages rather than objects and suggests that in historical terms the *non-standard instrument* can be seen to be typical of human/instrument entanglements. This – essentially an instance of performance ecosystems viewed in close-up – can be seen to aid a critique of current concerns with the ephemerality of digital instruments: their intimate relationship with their player/inventors, and with organological concerns for 'preservation'.

Next, **Tarja Rautiainen-Keskustalo** debates how the examination of material media theory could contribute to understanding music-making as a part of digital networks. Using a Bluetooth speaker as an example of an instrument, she aims to re-imagine the concept of musicking as a practice, which manifests the sonic experiences in digital environments. Important ideas in this sense are wayfinding and navigating introduced by the anthropologist Tim Ingold (2002). By applying these

concepts, the article debates how acknowledging human material and multi-sensory situatedness in (material) networks and infrastructures bring forth political and ethical topics, such as the role of algorithms in our society and issues of planetary sustainability. In this way, the approach gives way to examine musicking and the relationships with the musical instruments in a way that exceeds simple ideas about representations and invites to critically consider the digital world's complex trajectories.

In the following article, **Koray Tahiroğlu** explores how our current relationship with music as musicians, instrument builders, composers is conditioned by digital technologies. In the article, Tahiroğlu describes this as 'ever-shifting roles', a term to explore what consolidates in the social dimension of digital musical instruments. He further describes how the building, making, composing and performing with digital musical instruments has gone through a gradual socio-technological change. He presents his viewpoint on the growing use of artificial intelligence technologies in music. Tahiroğlu supports his investigation through particular musical instruments that provide advanced autonomous performance features. He argues that music-making still emerges as a social construct, a social activity even as a result of the mutual cooperation with human musicians and AI powered autonomous instruments. One of the most challenging tasks in this context is the analysis of the musical instrument in possible ways it incorporates its musical ideas through appropriate dimensions of its autonomous behaviour. In view of the autonomous behaviours of the AI-terity, Voyager and the GuitarBot instruments, Tahiroğlu presents the notion of the autonomous entity as not something like a possession of super-powers, but as an *agency,* that its characteristics in music-making brought into more direct focus through human musicians.

Tahiroğlu discusses further in what ways this social activity in music is in a state of transition in its relationship with technology, by questioning the technological rationality in digital musical instruments. Tahiroğlu argues in the conclusion section that it is necessary to view the social factors and cultural conditions that make the course of technology in music-making present. This gradual change in building, making, composing and performing with digital musical instruments involves social and technological transformations in view of digital music practices.

In this special issue, **Don Ihde** looks at selected examples of player-instrument relations beginning with a single string (identical with hunting bows, earliest images, beginning with the Ice Ages, etc.) and moves to digital synthesizers and other contemporary instruments. The article follows a musically experimental trajectory from non-mediated musical sound through many centuries of musical innovation from the simplest forms of resonation to today's synthesised musics in electronic – digital and synthesizer musics – and questions how changes in musical technologies play roles in the social dimensions of musical instruments. Ihde examines further in this article the earliest relationship between listener – music performance audience – and music.

Ihde explores technological innovations and their impact on the musical instruments during the Renaissance of the fourteenth to seventeenth centuries. More specifically the article focuses on innovations in acoustic resonance, giving examples in classical musical instruments' shapes and electric amplification of 'electric' instruments. The article gives an overview of technical details of how the violin's sound changes with resonance holes as well as further discussions on the 'loudness' of rock music in relation to the amplification and its radical changes in audience-performance situation. Ihde brings in another angle to the discussion on social dimensions of digital instruments in the conclusion part of the article, reflecting a critical view on player – instrument and listener – music relations with electronic, digital and synthesizer instrument variants.

Following that, **Thor Magnusson** looks into the question of how musical instruments establish themselves as part of culture. The article aims to explore the techno-scientific conditions of musical instrument design as they emerge in local contexts and present the effect on wider global musical culture when instruments migrate. First, Magnusson examines the instruments as material objects and how they are adopted and adapted to new musical cultures. Magnusson argues that those cultures also change because of new musical instruments. The article presents the intense relationship we have with music and, through this material nature of both music and musical instruments, Magnusson questions further; 'how that material nature becomes parameters of culture specific context'. Applying the concept of ethno-organology the article will look into the complexity of the new music instrument design from both cultural and technological influences.

Magnusson discusses music-technical transmission through using the conceptual cluster of *ergodynamics*, *ergomimetics* and *ergophors*, providing a systematic analysis of musical instruments. In conclusion, he suggests establishing a framework that will help better understand technological and cultural transmissions that take place when musical instruments travel. This will inform the development of a new method of inquiry that would allow us to look at the socio-cultural role of technology from a more critical stance as well as a more effective tool for our research in NIME.

In the process of preparing this special issue, we felt that the composer's voice was lacking, someone who engages with instrument building and shapes new social contexts through their compositions, instruments and systems design. We could not think of a better person here than **Claudia Molitor** and we asked if we could interview her. The article is a conversation between Thor Magnusson and Claudia Molitor on certain aspects of her work, on the technical foundation and the idea of designing technology in the process of creating the social experience that is embodied by a new musical composition.

Molitor strongly argues that composition is a *human cultural technology* and composition cannot be thought of as something separate from technology. Later in the interview, she also points out that culture and technology are inseparable as well. It is interesting to read how she has been reflecting her composition idea on her work, as a system in which the composer, the performer and the listener explore potential investigations and interpretations. She discusses further her work, *Remember Me, No-where Land, You Touched the Twinkle on the Helix of my Ear and The Singing Bridge,* giving us further opportunity to know her ideas as a composer.

The final article by **Taina Riikonen** looks into digital anthropology by conceptualising multi-sensory listening in large-scale city sonic environments. Riikonen presents listening as an embodied, social and transforming phenomenon through the binaural recordings of Helsinki Metro tunnels. Reflecting on her own experience, Riikonen argues that listening is in fact a multi-sensory experience, not only through the ways different sensations could intertwine signals complementing the listening experience, but also pointing out the importance of the 'knowing' that emerges through the listening. She further argues that the listening act shifts from listening to music to listening to soundscapes and she explores her argument as a fossil capitalist kind of evaporation process.

Combined, these eight articles comprise a special issue of the Journal of New Music Research 'Socio-Cultural Role of Technology in Digital Musical Instruments' and provide what we hope is a strong contribution to the research and studies in new interfaces for musical expression, musicology, music performance and related areas. The impact of new music technologies on the music of the world cannot be looked at only from the perspective of technology itself: we need to explore the social context of how these technologies emerge and are taken into use by musicians. That, of course, is a circular process, as the human is always mired in technology, and the way we look at the world is always through a technological perspective. The articles in this issue come from diverse academic and artistic directions and we hope that the multiple perspectives presented can shed a new light on the social role of technology in new musical instrument development.

Acknowledgment

This special issue was supported by the Academy of Finland (project 316549).

Funding

This work was supported by Academy of Finland [Academy Research Fellow (project 316549)].

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