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GUEST EDITORIAL

# Personal and ubiquitous computing, special issue: "Sonic experiences: interaction, connectivity, and multi-sensory technologies"

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This special issue is a collection of papers from the Audio Mostly conference held in Trento, Italy, in 2021. The theme of the conference was, "*Sonic Experiences in the Era of the Internet of Sounds*". Unfortunately, the conference was held during the time that there were COVID restrictions, which impacted upon people's attendance, meaning that the majority of the conference was held virtually. However, the conference was a great success. This special issue gives an insight into the conference and provides authors a platform to further develop their publications and the wider community to get a chance to get a deeper understanding of the work presented at the conference.

The Audio Mostly conference is an interdisciplinary conference which brings together researchers and practitioners from a range of academic backgrounds and domains. A key focus of the conference, as the title might suggest, is the community's interest in all things concerning the audio domain. Over the years, the conference has grown to encompass research pertaining to Human–Computer Interaction, Artificial Intelligence (AI), Design, Musical Performance and more recently, the emerging field of the Internet of Musical Things.

It is complex to fully appreciate the impact which emergent technologies, such as the Internet of Things (IoT) and AI, will have on our interaction in the world, particularly when the interaction is mediated through audio, has a social element and has audio as a research domain, such as in the case of musical performance. This volume provides an overview of some of the emergent issues in such contexts, and in engaging with the papers in the collection, we hope that people start to think about the intersections of different technologies and the ways that these might come together to support and enhance the parts of our world relating to our engagement with mostly audio technologies.

Since the conference, an IEEE Emerging Technologies Committee has been established, 'The Internet of sounds.' "The aim of this emerging technology initiative (ETI) is to foster research and innovation surrounding the design, development and evaluation of sound-based communications. Current sound-based practices and systems developed in both academia and industry point to convergent research trends that bring together the field of Sound and Music Computing with that of the Internet of Things." [1]

We would like to thank all of the authors and people who made the Audio Mostly conference possible, and we pass the baton on to the organisers of the next Audio Mostly conference, held at St. Pölten University, Austria. This special issue adds to a growing collection of collected works from the Audio Mostly conference series [2].

Many thanks from the Editors of this issue—Luca, Alan and Maria.

## 1 Papers in this issue

Title–Auditory Feedback in Tele-Rehabilitation Based on Automated Gait Classification
Authors–Victor Adriel de Jesus Oliveira, Djordje Slijepcevic, Bernhard Dumphart, Stefan Ferstl, Joschua Reis, Anna-Maria Raberger, Mario Heller, Brian Horsak, Michael Iber

About–We see that this paper directly explores and addresses issues pertaining to IoT and audio as applied to

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the domain of rehabilitation and physical therapy. As the IoT and audio research field grows, we need to think about the wider application areas of such technologies. In this paper, we see the development and evaluation of a system that uses "a wearable auditory biofeedback system based on a sensor-instrumented insole" to support the user in their rehabilitation.

Title–Investigating Performance Ecologies Using Screen Scores: A Case Study.
Authors–Raul Masu, Mela Bettega, Nuno N. Correia, Teresa Romao.

About–How do we understand the ways in which actors interact and engage with artefacts in musical performances? This paper starts to unpack this and explore the ways in which real-time musical scores can support and aid our understanding of such issues. Through interviews and field notes (observations) that "for a good "usage" of a given musical system; the relevance of accounting for the entire ecology of artifacts; and that different conceptions of affordances should be used to understand different perspectives of an ecology".

Title–ENSA dataset: A dataset of songs by non-superstar artists tested with an emotional analysis based on time-series.
Authors–Yesid Ospitia-Medina, José Ramón Beltrán, Sandra Baldassarri.

About–Music and the sonic world often elicits an emotional response from people, but how can we start to look at this in a meaningful way, and how can we start to appreciate the ways in which different parts of songs have different meaning for people within the song? This research starts to examine this and, in so doing, develops a dataset that can help us start to understand some of these issues by "considering the emotional variation that characterizes a song during the listening experience, in which the intensity of the emotion usually changes between verse, bridge, and chorus."

Title–Towards a Unified Terminology for Sonification and Visualization

Authors–Kajetan Enge, Alexander Rind, Michael Iber, Robert Höldrich, Wolfgang Aigner
About–Core to our understanding of sonification and visualisation is the need for a unified set of terms that we can use to describe, engage with, and understand the interplay of the sonic and visual. This paper looks towards further understanding this space and develops a strategy to further understand and design audio-visual systems using a novel multi-part model.

Title–Foggy sounds like nothing—Enriching the Experience of Voice Assistants with Sonic Overlays
Author–Margarita Esau, Andrew Marsh, Veronika Krauß, Gunnar Stevens

About–In recent years, we have seen the development of voice-based and text-based systems grow. However, many voice-based systems only provide the audio of a voice, there is no associated background noise or soundscape overlay, and the authors of this research believe this means that the "interaction is still monotonous and utilitarian". In order to explore this, they design a series of sonic overlays and use these as a way to explore their approach by working with 15 participants in their study.

Title–Perceptive vs Reflective: Spectator Interpretation of Multimodal Artworks
Authors–Oliver Bramah, Sue Adams, Fabio Morreale

About–The object of this paper is an empirical investigation into spectator interpretation of multimodal artworks, focusing on the sense of audition and vision as well as on their interaction. The study involved 48 participants who responded to an online survey. The resulting thematic analysis allowed to clustered participants' interpretation into two main categories: reflective and perceptive. This research provides knowledge for the inclusion of multimodal experiences in the presentation of art expanding the possibilities for inter-sensory dialogue in the arts.

Title–Leveraging Compatibility and Diversity in Computer-Aided Music Mashup Creation
Authors–Gonçalo Bernardo & Gilberto Bernardes

About–In this paper, the authors describe a multimodal optimization music mashup creation model for loop recombination at scale. This work adopts an artificial immune system algorithm to efficiently compute a population of compatible and diverse music mashups from loop recombinations. Optimal mashups result from local minima in a feature space representing harmonic, rhythmic, and spectral musical audio compatibility. The approach, validated with listening tests, was shown to advance the state of the art by overcoming current methods such as genetic algorithms.

Title–Understanding the Musical Interaction of Children with Autism Spectrum Disorder using Elastic Display
Authors–Ivonne Monarca, Monica Tentori & Franceli L. Cibrian

About–The authors of this paper present the results of a 2-month deployment study describing how 11 children with autism spectrum disorders (ASD) used an elastic display called BendableSound. The results of the study showed that children with ASD maintained their musical motivation over the course of the study. Moreover, during this time, children with ASD could manipulate and were exposed to a wide range of variations in sound and musical structures. The musical interactions triggered using BendableSound influenced the type of gestures performed by the children involved in the study. The authors further reflect about the lessons learned and discuss directions for future work.

Title–Visualyre: Multimodal Album Art Generation for Independent Musicians
Authors–Gamar Azuaje, Kongmeng Liew, Elena Epure, Shuntaro Yada, Shoko Wakamiya and Eiji Aramaki

About–Thanks to the ever-increasing amount of online music platforms, independent musicians are also able to distribute their music worldwide. However, album art and the overall visual imagination play an important role in conveying the musical aesthetics of the bands to their audiences. As not all artists have the resources for hiring a team of graphic designers, the authors of the paper developed "Visualyre", an innovative interface capable of synthesising images based on the musical material and lyrics. The tool is based on Generative Adversarial Network models that enable the musicians to design their album art on their own.

Title–Musical Metaverse: vision, opportunities, and challenges
Author–Luca Turchet

About–In this paper, the author proposes a vision for the "Musical Metaverse", which is the metaverse part which is dedicated to musical activities. The article presents and discusses the artistic opportunities as well as the technical, artistic, ethical, sustainability and regulatory challenges of this emerging field of research.

Title–A web-based distributed system for integrating mobile music in choral performance
Author–Luca Turchet, Martina De Cet

About–This article proposes and evaluates an Internet of Musical Things system designed to enhance the singing practices of conventional vocal ensembles with electronic sounds generated by smartphones. The system comprises a small loudspeaker connected to a smartphone running a web-based app that generates sounds locally to the chorister, who uses it while singing. The results of the evaluation conducted with a choir showed that the application can be successfully utilised to augment the practice and experience of choir singing, leading to novel forms of musical expression.

Title–On the relation between the fields of Networked Music Performances, Ubiquitous Music, and Internet of Musical Things
Authors–Luca Turchet, Cristina Rottondi

About–This article aims at delineating the differences and commonalities between the three fields of Networked Music Performances, Ubiquitous Music, and the Internet of Musical Things. The motivation for this inquiry is to help avoid confusion between such fields and achieve a correct use of the terminology. The authors identify a trend towards the convergence between such fields and speculate that is plausible to expect that in the future their evolution will lead to a progressive blurring of the boundaries identified today.

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