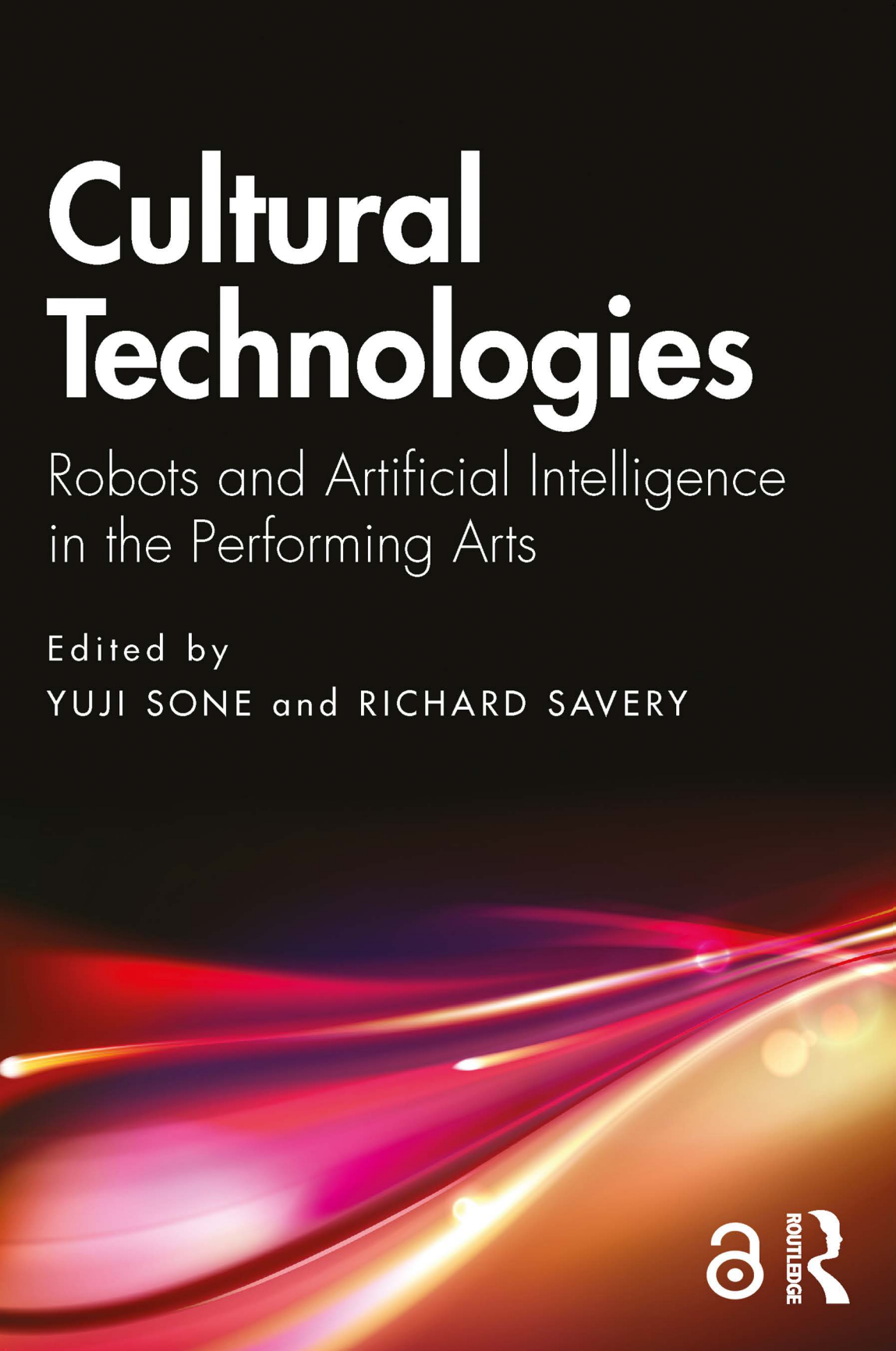
Cultural Technologies

Robots and Artificial Intelligence in the Performing Arts

Edited by
YUJI SONE and RICHARD SAVERY



CULTURAL TECHNOLOGIES

Cultural Technologies: Robots and Artificial Intelligence in the Performing Arts presents a diverse range of perspectives from leading scholars and artists on contemporary performing arts practices that engage with robotic and AI (artificial intelligence) technologies.

In Part One, "Robot/AI Cultures and Performing Arts Practices," contributors discuss how cultural understandings of robots and AI influence the audience's reception of performance works that feature such technologies and inspire artistic innovation. The chapters in Part Two, "Performing Arts Cultures and Robots/AI Developments," explore how theories and practices of the performing arts can engender critical dialogue on matters of cultural difference concerning culturally non-specific (though implicitly Western) framings of robotic and AI technologies within science and engineering contexts.

Reorienting the conversation around robotics and AI in the performing arts to place culture at its centre, *Cultural Technologies: Robots and Artificial Intelligence in the Performing Arts* offers thought-provoking analyses for advanced undergraduates, researchers, and performing arts practitioners interested in the relationships between music, theatre, and dance, and cutting-edge robotic and AI technologies.

Dr. Yuji Sone is a senior lecturer in the Department of Media, Communications, Creative Arts, Language and Literature at Macquarie University, Australia. His research has focused on the cross-disciplinary conditions of technologised performance.

Dr. Richard Savery is a developer of AI and robotics, using music and creativity as a medium to programme better interactions, understandings, and models. He is currently a research fellow at Macquarie University, Australia, developing new robotic musicians. His current research focuses on the creation of a new drumming and rapping robot, as well as robots painting to music and musical captcha.

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Routledge
Taylor & Francis Group
NEW YORK AND LONDON

First published 2025
by Routledge
605 Third Avenue, New York, NY 10017

and by Routledge
4 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN

Routledge is an imprint of the Taylor & Francis Group, an informa business

ISBN: 978-1-032-75859-6 (hbk)
ISBN: 978-1-032-75861-9 (pbk)
ISBN: 978-1-003-47597-2 (ebk)

DOI: 10.4324/9781003475972

The Open Access version of Chapter 7 was funded by Karl F. MacDorman.

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ACKNOWLEDGEMENTS

The impetus for this book comes from two symposium events: "Japanese Culture and the Acceptance of Social Robots" in 2021 and "Robots, AI and Culture" in 2023, which were funded by TIFO (Toshiba International Foundation). These two symposia catalysed the editors' thinking on the juncture of robotic and AI technologies as they were framed in terms of cultural context. One of the editors of this book, Yuji Sone, organised the two events (with Naoko Abe, for the first event in 2021). Karl MacDorman presented a keynote talk at the 2021 seminar, which provided the basis for his chapter in this book. Richard Savery and Janet Biggs also presented a related panel discussion at the 2023 event. The editors would like to thank TIFO for their support for the seminar series, which led to the new and rich conversations that constitute this book.

Japanese roboticist Masahiro Mori passed away in January 2025. Mori is best known in the literature for his concept of the "uncanny valley." For the first seminar in 2021, Mori provided us with a short text (translated by Norri Kageki) that was read out at the opening of the event. In it, Mori discussed the importance of intuition for scientific discovery, and that intuition is nurtured through activity specific to one's cultural environment. This book is dedicated to Mori.

CONTRIBUTORS

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Elizabeth Jochum is an associate professor at the RELATE Research Laboratory for Art and Technology at Aalborg University. Her research uses the visual and performing arts as catalysts for re-thinking how we design and implement robots and other assistive technologies. From industrial robots to exoskeletons, Dr. Jochum's work involves transdisciplinary collaboration in human-robot interaction, health, and engineering to develop creative, value-sensitive, and human-centred approaches to ensure the technologies we build to address the real needs of people. She coordinates the ImprovAIze project on machine learning, dance improvisation, and wearable technologies.

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Richard Savery is a developer of AI and robotics, using music and creativity as a medium to programme better interactions, understandings, and models. His research has received $3.3 million in funding and significant industry partnerships. His work has been featured in *Scientific American*, BBC Radio, and Disney +. He completed a PhD in Music Technology (minor in Human-Computer Interaction) at the Georgia Institute of Technology, graduated in 2021.

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Yuji Sone is a senior lecturer in the Department of Media, Communications, Creative Arts, Language, and Literature at Macquarie University in Australia. Yuji is a performance researcher who initially trained with the experimental theatre company Banyu-Inryoku in Japan. He teaches performing arts and creative industries courses with an emphasis on praxis in relation to cultural studies and media studies. His research has focused on the cross-disciplinary conditions of technologised performance. He is the author of *Japanese Robot Culture: Performance, Imagination, and Modernity* (2017), which examines Japanese affinity for the robot through contemporary performing robots.

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PART ONE

Robot/AI Cultures and Performing Arts Practices

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INTRODUCTION

New Conversations across the Performing Arts

Yuji Sone

This book explores the impacts of robotic and AI technologies on performance practices, highlighting the cultural contexts for the respective languages of music, dance, and theatre. When we speak of culture in this book, we are concerned with a culture's accumulated shared knowledge and stored information that binds people together within that culture and potentially beyond the confines of nationality. The aim of this book is to investigate how robotic and AI technologies, when they are used in music, dance, and theatre, shape or influence existing performing arts languages in a given culture. We are also interested in the other side of this question: How do music, dance, and theatre shape the translation, transference, and adoption of robotic and AI technologies? According to literary scholar Stephen Greenblatt, "creative *metissage*," a French term meaning syncretic processes, mixing, and hybridity arising from cultural and artistic encounters, ignores persistent forces for protecting boundaries and cultural impulses towards fixity (2009, 1). The varied discussions in this book's chapters likewise emphasise how "texts, images, artifacts, and ideas are moved, disguised, translated, transformed, adapted, and reimagined" (Greenblatt et al. 2009, 4). In fact, robotic and AI technologies, which, from some science and engineering perspectives, might see themselves as culturally agnostic products of science, not only bring attitudes, assumptions, and even embodiments across cultural boundaries but act as agents or catalysts for further productive cultural "metissage." Starting from this positive argument for the mixed results of cultural encounters, the contributors in this book, a mix of theorists, practice-based researchers, and an artist examine the contexts and occurrences of specific works as case

DOI: 10.4324/9781003475972-2

studies to illuminate the way that robots and AI are understood in a culture, as expressed in terms of the performing arts. As such, the book focuses on some key modalities of the performing arts (theatre, music, dance, and opera), placing them at the centre of discussions about robotics and AI in relation to culture rather than beginning with the technologies themselves, as in the dominant debates on robotics and AI. Part of our enquiry in this book involves considering how (sub)cultures of artistic practices actively and critically engage with robotics and AI.

Some Key Concepts in This Book

It is useful at this point in our framing of this book to consider "cultural technologies." Media and communication scholar Göran Bolin's *Cultural Technologies: The Shaping of Culture in Media and Society* (2012) discusses emerging media technologies in "cultures of technology" in which daily lives are infused with technologies (2012, 2). For Bolin, media cultural technologies are the tools that allow one to select, store, or edit the information "by which culture is formed, reproduced or changed" while culture and technology interact with each other in structuring and being structured (2012, 8). In this book, we keep such dialectic forces within the structured formats of the performing arts in mind, focusing on emerging technologies of robotics and AI. We investigate interactions between cultural languages of the performing arts, i.e., performing arts iteratively shaped by and shaping a given culture, and artistic adaptations of robotics and AI, which also involve iterative modes of reception and sharing of forms and modalities.

As we have indicated above, this book aims to bring perspectives from the performing arts "cultures" as they encounter technology forward, rather than start with the technology, per se. Having said that, it is necessary to indicate that analyses of these technologies have not ignored culture, the interface between technology and the arts, or technology and creativity. Researchers outside the creative arts in more recent years have been examining notions of "creativity" in a broader context. From scientific perspectives, several studies have analysed the relationship between creativity and technology, such as Du Sautoy (2019), Veale and Cardoso (2019), Miller (2014, 2019), and Varela (2021). As AI technologies have become very sophisticated, arts practices utilising technology can be regarded as a field of research for varied disciplines. In *The Creativity Code: Art and Innovation in the Age of AI* (2019), mathematician Marcus Du Sautoy discusses AI through a frame of relationality between humans and machines, positing art and mathematics as games that require creative intelligence. Computer scientists Tony Veale and F. Amílcar Cardoso posit

their study of creativity as a branch of scientific study of artificial intelligence in *Computational Creativity: The Philosophy and Engineering of Autonomously Creative Systems* (2019). Narrowing the focus of his previous book *Colliding Worlds: How Cutting-Edge Science Is Redefining Contemporary Art* (2014), which discusses how aesthetic works can be produced at the nexus of science and art, in his book *The Artist in the Machine: The World of AI-Powered Creativity* (2019), science historian Arthur Miller surveys creative endeavours with AI technologies including practices in visual art, music, text, and musical theatre, and looks at positive possibilities in creative use of such technologies. Web developer Miguel Escobar Varela's *Theater as Data: Computational Journeys into Theater Research* applies uses of computational methods, such as statistical analysis and data visualisation, to theatre disciplines, highlighting tensions in such interdisciplinary approaches of the digital humanities (2021). The chapters in this book, on the other hand, deploy specific contextual frames for current practices and related discussions on the use of AI and robotic technologies within selected disciplines of the performing arts.

This book also moves away from broader views of "art" and its intrinsic relationships with technology within wider creative contexts in humanities as in existing studies such as McCormack and D'Inverno (2012), Broadhurst and Price (2017), Zylinska (2020), Audry (2021), Bown (2021), or Filimowicz (2023). Before the current AI boom, the combined themes of computer, art, music, and creativity were already explored in *Computers and Creativity* (McCormack and D'Inverno 2012) by artists and researchers in computing Jon McCormack and Mark d'Inverno. Performance studies scholar Susan Broadhurst and researcher in Human-Computer Interaction (HCI) Sara Price's *Digital Bodies: Creativity and Technology in the Arts and Humanities* (2017) explores possibilities of creative engagement with technology, covering diverse themes such as the performing body, HCI, fashion, museum, and medical simulation. Similarly, a positive vision for the use of AI in the visual arts, installation art, and performance art is highlighted in *Art in the Age of Machine Learning* (2021) by transdisciplinary artist-researcher Sofian Audry. Music video maker and researcher Michael Filimowicz's *AI and the Future of Creative Work: Algorithms and Society* (2023) discusses the emerging hybridised nature of creative practices and industry practices with computer and digital technologies. From a practitioner's point of view, musician and musicologist Ollie Bown discusses the impacts of automation and computational creativity through generative technologies concerning art and music from multidisciplinary perspectives, including computer science, psychology, and creative art research (2021). Media artist and scholar on new media Joanna Zylinska, on the other hand, engages with "AI art"

with the view that human creativity is "partly computational," critiquing corporate technology-driven visual artworks as foreclosing critical engagement (2020, 54). The focus of our book is deliberately narrower than these existing book-length publications on artistic creativity and cutting-edge technologies of robotics and AI, seeking to highlight cultural inflections in these performing arts practices with robotic and AI technologies.

Focusing on technology-based artworks in performing arts settings, the current book differs from books about interactive art, new media art, or performance art that utilise sophisticated media technologies with algorithms and automated systems. These forms have been examined in Leonardo publications (Cubitt and Thomas 2013; Rinehart and Ippolito 2014; Broeckmann 2016; Penny 2017). A similar approach is deployed in *Robots and Art: Exploring an Unlikely Symbiosis* (Herath, Kroos, and Stelarc 2016), which examines contemporary robotic art, reflecting viewpoints of artists, engineers, and scientists. As well, sound art and the visual arts are discussed in *Cultural Robotics: Social Robots and Their Emergent Cultural Ecologies* (Dunstan et al. 2023). With an emphasis on social robotics, the evolving technological environments for sound art and the visual arts are discussed as "cultural ecologies" that include practices outside the creative arts disciplines. While sound is the key medium of enquiry in *Sound and Robotics: Speech, Non-verbal Audio and Robotic Musicianship* (2024) by Richard Savery, its focus is on "sound out from the robots" in their interaction with humans (2024, 2). These publications highlight strategic arguments for technology-based arts' intersection with disciplines of HCI or HRI (Human-Robot Interaction), interdisciplinary research fields, combining enquiries of philosophy, anthropology, sociology, psychology, cognitive sciences, biology, or ethology. This collection, in contrast, brings in authors who deploy tools of musicology, theatre studies, and dance studies, while referring to other disciplines, to examine works within the frames of the performing arts that separate the audience from the performer on the stage.

Rather than broadly situating creativity and contemporary technologies in the contexts of media, science, philosophy of art, media art, or the visual arts, this book stresses the viewpoints of practitioners in the performing arts. The case studies in this volume examine the nature of events that interact with robotics and AI technologies within performance frames that foreground their relevant disciplinary language(s). In other words, the authors address the challenges faced by the works' creators that are specific to the performing arts when a work engages with robotics and AI technologies. Therefore, critical questions such as these are necessarily considered:

- Debates on robotics and AI have tended either to celebrate or condemn the advancement of robotic and AI technologies, eliciting responses such as hope or fear. Can discussions in music, dance, or theatre avoid such gross generalisations if they choose to focus on these technologies *and* the cultural context in which such technologies are presented?
- On the other hand, how do the practices of a particular cultural context inform the use of robots and AI in the music, dance, and theatre of that culture? And, relatedly, what is at stake in the context of globalisation?
- Does the use of AI in music, dance, and theatre generate a reification of these art practices in a particular cultural context? For example, in the case of music, AI treats music as an end product, as opposed to musicking, referring to the more common and historically past idea that music is a process. Similarly, does AI only treat dance in terms of obvious patterns and forms rather than recognising a particular dance's meanings in the context of culture?
- When the audience views robots on the stage, they may change their reactions according to presented narratives that contextualise these robots. Is it possible to see such adaptive changes as catalysing new understandings in the appreciation of performance by an audience that is witnessing the work precisely at the meeting place of the "language" for that artistic discipline and newer technologies' contribution?

In the course of each chapter's enquiry, this book highlights nuanced differences and the closeness between some performing arts practices when they are working with robotics and AI. This is another area that existing studies of music, theatre, and dance that utilise robotics and AI and have not explored: the interconnections and differences between performing arts genres in relation to their use of robotics and AI. The authors present their discussions in styles that are aligned with the standards and expectations of their own disciplines. *Cultural Technologies: Robots and Artificial Intelligence in the Performing Arts* offers a starting point for such conversations across the performing arts disciplines.

It is necessary to first discuss different paths that have been taken by scholars of music, theatre, and dance studies on themes of robotics and AI.

Music has had a long engagement with technology. For example, music theorist James Perone traces back the history of the relationship between music and technology to Pythagoras of ancient Greece and his tuning system, and then chronologically discusses historical technological developments of musical instruments, notation, and recording (Perone 2022). The contributors to *Music and Technology in the Twentieth Century* (Braun 2002) discuss notable developments in music in the 20th century such as the 45 RPM record, the tape recorder, and the synthesiser. Mark Katz, a