The Ethics Gap in the Engineering of the Future

This page intentionally left blank

The Ethics Gap in the Engineering of the Future: Moral Challenges for the Technology of Tomorrow

EDITED BY

SPYRIDON STELIOS

National Technical University of Athens, Greece

AND

KOSTAS THEOLOGOU

National Technical University of Athens, Greece

emerald PUBLISHING

United Kingdom – North America – Japan – India – Malaysia – China

Emerald Publishing Limited
Emerald Publishing, Floor 5, Northspring, 21-23 Wellington Street, Leeds LS1 4DL

First edition 2025

Editorial matter and selection © 2025 Spyridon Stelios and Kostas Theologou.
Individual chapters © 2025 The authors.
Published under exclusive licence by Emerald Publishing Limited.

Reprints and permissions service
Contact: www.copyright.com

No part of this book may be reproduced, stored in a retrieval system, transmitted in any form or by any means electronic, mechanical, photocopying, recording or otherwise without either the prior written permission of the publisher or a licence permitting restricted copying issued in the UK by The Copyright Licensing Agency and in the USA by The Copyright Clearance Center. Any opinions expressed in the chapters are those of the authors. Whilst Emerald makes every effort to ensure the quality and accuracy of its content, Emerald makes no representation implied or otherwise, as to the chapters' suitability and application and disclaims any warranties, express or implied, to their use.

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN: 978-1-83797-636-2 (Print)
ISBN: 978-1-83797-635-5 (Online)
ISBN: 978-1-83797-637-9 (Epub)

INVESTOR IN PEOPLE

'To our students, engineers and citizens of tomorrow'

This page intentionally left blank

Contents

About the Editors *ix*

About the Contributors *xi*

Acknowledgments *xv*

Prolegomena: Mind the Gap! Now and for Ever *1*
Spyridon Stelios and Kostas Theologou

Section 1: Artificial Intelligence

Chapter 1 Who Should Obey Asimov's Laws of Robotics? A Question of Responsibility *9*
Maria Hedlund and Erik Persson

Chapter 2 Criminal Justice in the Age of AI: Addressing Bias in Predictive Algorithms Used by Courts *27*
Rahulrajan Karthikeyan, Chieh Yi and Moses Boudourides

Chapter 3 Ethical Challenges in the New Era of Intelligent Manufacturing Systems *51*
Emmanouil Stathatos, Panorios Benardos and George-Christopher Vosniakos

Chapter 4 From Croesus to Computers: Logic of Perverse Instantiation *83*
Goran Rujević

Chapter 5 The Gradual Unavoidable Colonization of the Lifeworld by Technology *105*
Kostas Theologou and Spyridon Stelios

Section 2: Biotechnology

Chapter 6 Ethical Aspects of Promises and Perils of Synthetic Biology *119*
Ivica Kelam

Chapter 7 Adapting (Bio)ethics to Technology and Vice Versa: When to Fight and When to Collaborate With Artificial Intelligence *137*
Iva Rinčić and Amir Muzur

Section 3: Space

Chapter 8 Are Space Technologies Untimely? *159*
Tony Milligan

Chapter 9 Moral Vistas to Xenic Beyonds: Fostering Moral Imagination to Pre-empt Monsterization in Future Encounters With Extraterrestrial Life *177*
George Profitiliotis

Chapter 10 Planning for the Future in Space – With or Without Radical Biomedical Human Enhancement? *201*
Rakhat Abylkasymova and Konrad Szocik

Chapter 11 Building Better (Space) Babies: Bioastronautics, Bioethics, and Off-World Ectogenesis *215*
Evie Kendal

Index *229*

About the Editors

Dr Spyridon Stelios is a Teaching and Research Associate at the National Technical University of Athens (Faculty of Applied Mathematical and Physical Sciences/Department of Humanities, Social Sciences and Law). He lectures at several schools of NTUA, and his main research interests are in ethics, epistemology, and experimental philosophy. He has authored several book chapters, articles in international peer-reviewed journals and conference proceeding in these areas. He also serves as a reviewer for several academic journals.

Kostas Theologou is a Professor at the Faculty of Applied Mathematical and Physical Sciences of the National Technical University of Athens (and Director of the Department of Humanities, Social Sciences and Law); he is also the Director of the journal Signum http://aked.ntua.gr/signum.html. He is the Vice Director of Studies of European Civilization studies and the Moderator of the module 'Social Theory and Modernity" of the School of Humanities of the Hellenic Open University. His research interests focus on the History and Philosophy of Culture (technology, urban space, collective identities, bioethics, biotechnology, etc.).

This page intentionally left blank

About the Contributors

Rakhat Abylkasymova, independent researcher, Poland. Her areas of interest are linguistics, international business, and future challenges affecting humanity, with a focus on our future in space. She has published in *the International Journal of Astrobiology* and *Space Policy*, among others.

Panorios Benardos currently serves as an Assistant Professor in the School of Mechanical Engineering of the National Technical University of Athens (NTUA) in the field of 'Intelligent Manufacturing". He received his Diploma in Mechanical Engineering in 2001 and his PhD in 2009 from NTUA. He has worked as a Lecturer and an Assistant Professor in the University of Nottingham from 2014 to 2018. He has participated in 21 nationally (GSRT, EPSRC, Innovate UK) and EU-funded research projects (FP7, H2020, HE). He has published 42 papers in international scientific journals and conferences (24 and 18 respectively) and coauthored 2 book chapters. His current research interests involve the application of artificial intelligence and machine learning methods in modeling and optimization of manufacturing processes and systems.

Moses Boudourides served as a Professor of Practice at the Arizona State University School of Public Affairs and is currently a member of the faculty of the Northwestern University School of Professional Studies Data Science Online Graduate Program. Previously, he held the position of Professor of Computational Mathematics at the University of Patras in Greece and the Department of Electrical and Computer Engineering at the Democritus University of Thrace, also in Greece. His expertise lies in applied and computational mathematics, network science, and computational social science.

Maria Hedlund is an Associate Professor at the Department of Political Science, Lund University, Sweden. Her research focuses on theories on democracy and the role of experts in democratic processes and in public administration, in particular regarding questions on emerging technologies, ethics, governance, responsibility, and legitimacy. Her recent publications include 'AI and epigenetic responsibility" (in *Epigenetics and Responsibility: Ethical Perspectives*, Anna Smajdor, Daniela Cutas, Emma Moormann & Kristien Hens (eds.), Bristol University Press, 2024), 'Ethicisation and reliance on ethics expertise" (*Res Publica*, April 2023), with Erik Persson 'Expert responsibility in AI development" (*AI & Society*, June 2022), and 'När maskiner fattar beslut – vem är ansvarig?" (When machines make decisions – who is responsible?) (in *Statsvetenskaplig tidskrift* 122, 2020).

Rahulrajan Karthikeyan is a graduate student in the Computer Systems Engineering (CSE) program at the School of Computing and Augmented Intelligence, Arizona State University. He has worked as a Machine Learning Research Assistant in the Cooperative Robotics Systems Lab (CRS), collaborating with PhD students on research involving multi-modal robot communication, temporal-spatial inverse semantics, and various projects leveraging Inverse Reinforcement Learning, ROS, and Computer Vision. In addition, he co-founded the Google Developer Student Club (DSC) at ASU, where he has taught Flutter, TensorFlow, Machine Learning, and Computer Vision to over 200 Bachelor's and Master's students at each DSC event. His accomplishments at ASU include winning more than 20 hackathons and coding challenges. He has also collaborated with Professor Boudourides on several machine learning projects.

Ivica Kelam, PhD, Head of the Department of Philosophy and History at the Faculty of Education, teaches the philosophy of education, ethics of the teaching profession and bioethics. Since 2018, he has been the Head of the Osijek Unit of International Bioethics Chair. In 2014, he successfully defended his doctoral thesis entitled Genetically modified crops as a bioethical problem. Since 2016, he has been the Head of the Center for Integrative Bioethics at J.J. Strossmayer University of Osijek. Since 2020, he has taught the bioethics of sports and sociology of sports at the Faculty of Kinesiology, teaches ethics in biosciences at the doctoral study in molecular biology at the University of Osijek, and teaches bioethics at the doctoral study at the Faculty of Education. He is the President of the Organization Committee of the Osijek Days of Bioethics, an international bioethical conference held in Osijek. He has published the book Genetically Modified Crops as a Bioethical Issue, over 40 scientific papers in Croatian and foreign scientific journals, and participated in more than 80 scientific conferences in Croatia and abroad. In 2020, he was elected President of the Croatian Bioethical Society.

Evie Kendal is a Bioethicist and Public Health Scientist whose work focuses on emerging reproductive technologies. She is the Head of the Ethical, Legal, and Social Implications of Emerging Technologies (ELSIET) research group of the Iverson Health Innovation Research Institute at Swinburne University of Technology and a Senior Lecturer of health promotion in the School of Health Sciences. She is the author of 'Ectogenesis and the Ethics of New Reproductive Technologies for Space Exploration" (in *Transhumanism*, Springer 2022), 'Biological Modification as Prophylaxis: How Extreme Environments Challenge the Treatment/Enhancement Divide" (in *Human Enhancements for Space Exploration*, Springer 2020), and 'Desire, Duty and Discrimination: Is There an Ethical Way to Select Humans for Noah's Ark?" (in *Reclaiming Space*, Oxford University Press 2023).

Tony Milligan is a Research Fellow in Ethics with the Department of Theology and Religious Studies at King's College London. His publications include *The Ethics of Political Dissent* (2023), *Nobody Owns the Moon* (2015), and the coedited volume *The Ethics of Space Exploration* (2016). He is currently working on a short introduction to societal issues concerning space: *What is Space Exploration For?* with Koji Tachibana, and a SpringerBrief on *Indigenous Cosmological Visions of the Pleiades*.

Amir Muzur is a Full Professor (since 2013) and the Head of Department of Social Sciences and Medical Humanities (since 2008) at University of Rijeka – Faculty of Medicine. His major fields of research/teaching interest are history of medicine and bioethics and theoretical neuroscience. He authored/coauthored more than 30 books (local history, history of medicine, popularization of neuroscience, essays, travelogues, poetry) and about 700 articles in scientific and other periodicals and participated in more than 200 conferences (more than 40 invited lectures). Amir Muzur was the President of Croatian Bioethics Society (2012–2016) and now is the Director of the Fritz Jahr Documentary and Research Centre for European Bioethics at University of Rijeka (since 2013).

Erik Persson received his PhD in Philosophy from Lund University in 2009. He is currently an Associate Professor in Practical Philosophy at the Department of Philosophy, Lund University and Researcher at RISE – Research Institutes of Sweden. His previous employers include Umeå University, the Nordic Genetic Resource Centre and the Institute for Theological Inquiry in Princeton. His research and teaching are primarily focused on applied ethics, value theory, environmental ethics, space humanities, and the philosophy of AI and other emerging technologies. His recent publications include 'The future of AI in our hands? To what extent are we as individuals morally responsible for guiding the development of AI in a desirable direction?" (*AI & Ethics* 2: 683 – 695), co-authored with Maria Hedlund.

George Profitiliotis is a Research Scientist affiliate at Blue Marble Space Institute of Science and a speculative fiction author serving the New Weird. He is an electrical and computer engineer, further trained in interdisciplinary environmental studies, biomimetics, and strategic innovation management, and holds a PhD on the application of environmental economics to planetary protection policy. He has worked extensively in the fields of strategic foresight, futures literacy, and futures studies. During his first PostDoc, he studied the pertinence of anticipation to the search for extraterrestrial life from the viewpoints of particular subfields of the humanities, social sciences, and policy, with a focus on the proactive management of a future discovery. His second PostDoc focused on anticipating the future ethical, legal, and societal implications of quantum technologies.

Iva Rinčić graduated in 2000 in Sociology and Croatian Culture from the Department of Croatian Studies at the University of Zagreb and defended her Master's thesis in 2005 at the Faculty of Political Sciences. She defended her PhD thesis 'Theoretical Strongholds, Achievements and Perspectives of Bioethical Institutionalisation in the European Union' in 2010 at the Faculty of Philosophy in Zagreb. Since 2001, she has been working at the Department of Social Sciences and Medical Humanities of the Rijeka University Faculty of Medicine (since 2022 as Full Professor), and since 2014, also at the Department of Public Health of the University of Rijeka Faculty of Health Studies. She has participated at more than 60 Croatian and international conferences, published approximately 70 scientific and professional articles, and five books. From 2013 till 2021, she was the Director of the University of Rijeka Foundation.

Goran Rujević is an Assistant Professor at the Department of Philosophy of the Faculty of Philosophy in Novi Sad. He earned his Bachelor's and Master's degrees in Philosophy from the Faculty of Philosophy in Novi Sad, where he also defended his PhD thesis on Kant's philosophy of science in 2019. His main areas of interest are philosophy of natural sciences and argumentation theory, but he also has interest in issues regarding teaching and popularizing philosophy. Apart from scholarly work, he often translates works from English and German into Serbian; of note is his work on translating Nick Bostrom's seminal book *Superintelligence* into Serbian.

Emmanouil Stathatos is a Mechanical Engineer who graduated from the National Technical University of Athens (NTUA) in 2006. He earned his PhD in 2020, focusing on the optimization of the Selective Laser Melting (SLM) process through numerical modeling and machine learning techniques. Since 2009, he has served as a Technical Consultant to Greek industrial firms. Currently, he is a Postdoctoral Researcher at the Manufacturing Technology Lab, NTUA, where he contributes to Horizon Europe and Erasmus+ projects. His teaching roles have included Laboratory Teaching Assistant for Computer Aided Manufacturing, Additive Manufacturing, and Discrete Event Simulation for manufacturing systems, as well as Instructor for the Advanced Manufacturing Systems course in the Interdepartmental Master's Program on Automation Systems. He has published 11 papers in international scientific journals and conferences. His research is dedicated to integrating AI into manufacturing to redefine the paradigms of smart production.

Konrad Szocik, University of Information Technology and Management in Rzeszow, Poland. From 2021 to 2022, he was a Visiting Fellow at the Yale Interdisciplinary Center for Bioethics. His interests include ethics, philosophy and bioethics of space exploration, feminism, antinatalism, procreative ethics, and population ethics. He is the author of *The Bioethics of Space Exploration* (Oxford University Press, 2023) and *Feminist Bioethics in Space* (Oxford University Press, 2024).

George-Christopher Vosniakos studied Mechanical Engineering at the National Technical University of Athens and obtained an MSc in Advanced Manufacturing Technology in 1987 and a PhD in Intelligent CAD-CAM interfaces in 1991 from UMIST-Britain. He has worked in the software industry in Germany and as a Lecturer at UMIST. In 1999 he joined NTUA, where he is currently Professor of Manufacturing Systems and director of the Manufacturing Technology Laboratory. He has authored 110 Journal and over 108 Conference papers obtaining 2,850 Scopus citations. He is editorial board member of six major International Journals. His recent research interests include AI in Manufacturing.

Chieh Yi is a graduate student in the Computer Systems Engineering (CSE) program at the School of Computing and Augmented Intelligence at Arizona State University. He has collaborated with Professor Boudourides on several machine learning projects and is actively involved in the ASU EPICS program, where he contributes to innovative technical projects.

Acknowledgments

Special thanks to Katy Mathers, Lauren Kammerdiener, and Brindha Thirunavukkarasu from Emerald for their help, encouragement, and support as well as to the anonymous reviewers for their insightful comments.