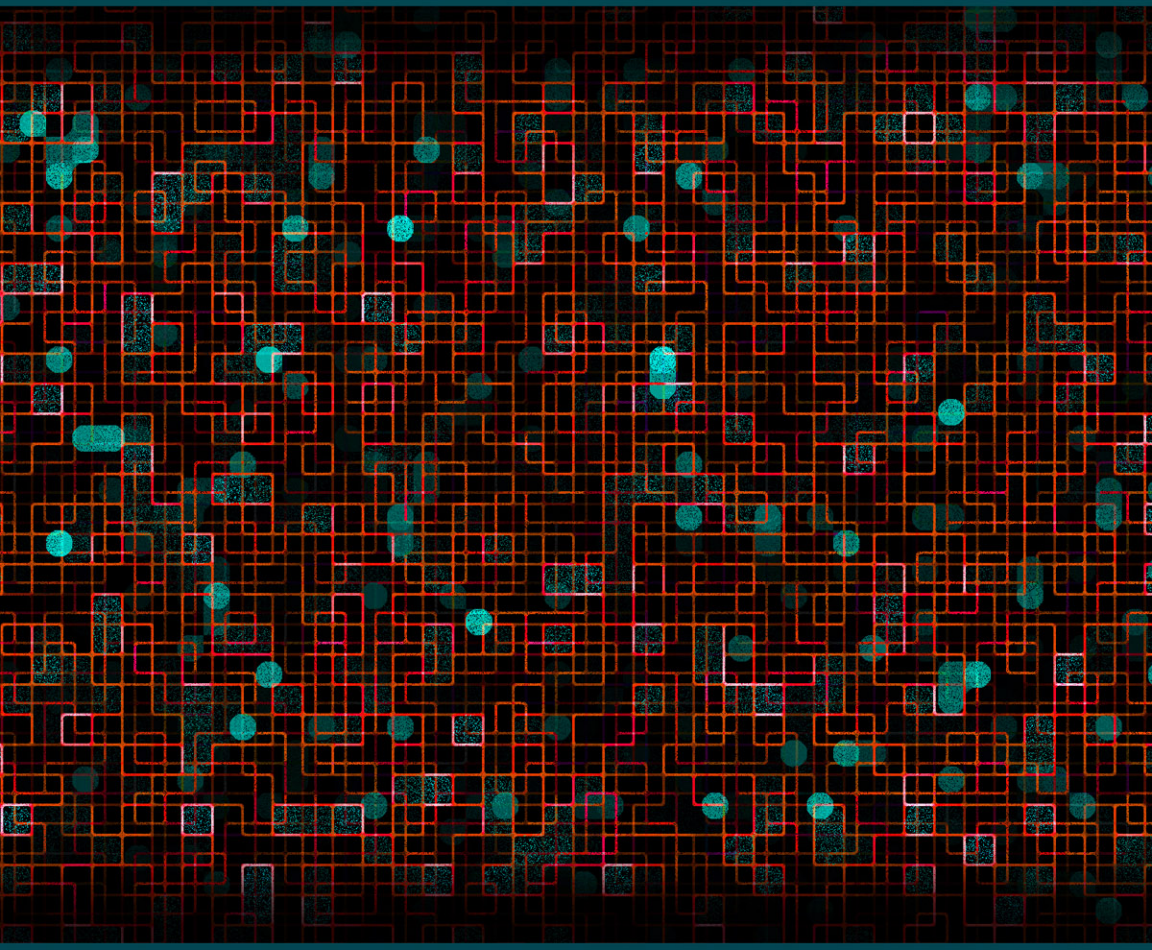
Sapient Circuits & Digitalized Flesh

The Organization as Locus of Technological Posthumanization



Matthew E. Gladden

second edition

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Second Edition

Published in the United States of America
by Defragmenter Media, an imprint of Synthypnion Press LLC

Synthypnion Press LLC
Indianapolis, IN 46227
http://www.synthypnionpress.com

Defragmenter Media
http://defragmenter.media

ISBN 978-1-944373-21-4 (print edition)

ISBN 978-1-944373-22-1 (ebook)

10 9 8 7 6 5 4 3 2 1

March 2018

The first edition of this book was published by Defragmenter Media in 2016.

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Preface

This book has emerged in response to the lack of comprehensive analyses that make the methodologies and insights of posthumanist thought accessible and relevant for those who study or manage contemporary organizations. The best works on posthumanism already existing have typically appeared within fields such as literary criticism or bioethics that have little immediate application to organizational theory and management. Conversely, the many management texts exploring the impact of emerging technologies on organizational performance and change typically do so from a functional or strategic perspective that is highly practical in nature, and they do not extensively draw on (or even recognize) the underlying technologically facilitated transformation in the nature of human agency and our relationship to our environment that has deep ontological, phenomenological, psychological, aesthetic, ethical, legal, and political components and which posthumanist thought is analyzing with great fruitfulness.

This volume is designed to address that lacuna in current scholarship by undertaking a systematic effort at building bridges between posthumanism and organizational theory and management. My hope is that this work will especially be of use to scholars and students of management who are interested in the posthumanizing role of emerging technologies, as well as managers who must understand the rapidly evolving sociotechnological dynamics that shape their organizations and make real-world decisions that affect the lives of many. The text may also be of value to science fiction writers and futurologists who, for their own reasons, are working to develop imaginative and realistic visions of the ways in which human agency and organizations will be transformed through their encounter with new forms of artificial and hybrid human-synthetic agency.

The book provides a general conceptual framework that ties together many of the particular topics explored in journal articles and book chapters

that I have published and lectures and conference presentations that I have delivered over the last several years. In particular, this second edition of the text incorporates minor revisions reflecting new perspectives on organizational posthumanization that I have developed since the publication of the first edition in 2016, as a result of the process of writing and publishing additional journal articles and presenting at further conferences over the last couple of years. I am grateful to everyone who made possible those opportunities for dialogue and feedback. I am particularly thankful to the faculty, staff, and students of the universities and other research institutions where many of the ideas contained in this text were first presented, including those of Aarhus University, VERN´ University of Applied Sciences, the Jagiellonian University, the Facta Ficta Research Center, the Warsaw University of Technology, the University of Silesia in Katowice, the Centrum Informacji Naukowej i Biblioteka Akademicka (CINiBA) in Katowice, the Faculty of Humanities of the AGH University of Science and Technology, the Institute of Computer Science of the Polish Academy of Sciences, and the Digital Economy Lab of the University of Warsaw. I am also thankful to the editors and other personnel who made possible the publication of my earlier investigations into these topics, including those at the MIT Press, IOS Press, Ashgate Publishing, *Creatio Fantastica*, the *Annals of Computer Science and Information Systems*, *Informatyka Ekonomiczna / Business Informatics*, *Annales: Ethics in Economic Life*, the *International Journal of Contemporary Management*, and *Fronda Lux*. In particular, I offer my deepest gratitude to Krzysztof Maj, Ksenia Olkusz, Mateusz Zimnoch, Magdalena Szczepocka, Marco Nørskov, Johanna Seibt, Helena Dudycz, Natalia Juchniewicz, Renata Włoch, Mateusz Matyszkowicz, and Jerzy Kopański.

I am also most grateful to everyone associated with Georgetown University's School of Continuing Studies, especially Douglas M. McCabe and Edwin Schmierer; to Serge Pukas, Paulina Krystosiak, Jacek Koronacki, and everyone affiliated with the Institute of Computer Science of the Polish Academy of Sciences; and to Nicole Cunningham for her friendship and example as an author. Whatever clarity and intelligibility are reflected in this text, I owe to Sarah Stern and her editorial tutelage; I appreciate her patience with my delay in the completion of other writing projects which, because of this one, remain unfinished. As always, I am deeply thankful to my family and friends for the support they have provided throughout my research, and I offer my heartfelt thanks to my wife for her sound advice and continual encouragement. And, especially, I am grateful to Terry R. Armstrong and Gasper Lo

Biondo, S.J., who have shaped me as a manager, a colleague, and a student of organizations; without them I would never have embarked upon the paths that have led to the preparation of this book. I am grateful to them and to all of the individuals whom I have mentioned; responsibility for the flaws and limitations that remain in this work after their generous input is mine alone.

Matthew E. Gladden

Introduction

The Posthumanized Organization as a Synergism of Human, Synthetic, and Hybrid Agents

The realities of contemporary organizational life are rapidly catching up with the visions long explored by science fiction writers and futurologists. Many of us can now expect to experience during our working lives a world in which 'ordinary' human beings labor alongside artificial general intelligences, social robots, sapient networks, nanorobotic swarms, and human beings with genetically engineered capacities and neurocybernetic implants.

A world in which a robot boss is embraced by its human subordinates because it is more empathetic, fair, honest, intelligent, and creative than its human predecessor. A customized product and marketing campaign designed for a single human consumer by an AI that can deduce the consumer's deepest fears and desires. Artificial life-forms that function as self-contained 'businesses' by gathering resources from the environment, transforming them into products, and selling them to consumers, all without the involvement of any human beings. Intelligent, evolvable bioelectronic viruses that can infect an organization's information infrastructure by moving effortlessly back and forth between human employees and their computers. Corporate espionage conducted by hacking into the video stream of a rival CEO's robotic eye. An office building or manufacturing facility or orbiting satellite or tropical resort where an organization's employees gather every day to work but which exists only as a persistent virtual world experienced using immersive multisensory VR. Employees who engage their colleagues as avatars within virtual environments, without knowing or caring whether a particular coworker is a 'normal' human being, uploaded human mind, social robot, or artificial general intelligence. Different classes and subclasses of 'metahuman' and 'parahuman' employees and customers who have been genetically engineered to possess radically nonhuman types of minds and bodies. Human workers who no longer own the intellectual property rights to their

own thoughts, dreams, or memories, because they were produced with the assistance of neuroprosthetic implants or cognitive enhancement software provided by their employer. Human beings who are unable to quit their jobs because they rely on their employers for a lifetime supply of antivirus updates, immunosuppressive drugs, or physical maintenance for their full cyborg body. Human workers whose invasive neural interfaces allow them to dwell permanently within virtual worlds and whose physical bodies must be cared for by their employer's biomedical support division. Neurocybernetically linked human workers who lose their personal identity and merge to form a hive mind whose members share collective sensations, emotions, and volitions. A vast, tangled, digital-physical ecosystem in which an organization's human and synthetic employees, buildings, vehicles, manufacturing equipment, databases, products, and customers are all cybernetically linked through their participation in the 'Internet of Being.'

Such possibilities terrify some of us just as they exhilarate others. Because of the ongoing rapid technological developments taking place in many fields, these hypothetical scenarios present all who are involved with the study or management of organizations with complex ethical, legal, and operational questions whose thoughtful consideration cannot easily be further delayed.

The Ongoing Posthumanization of Organizations

It is widely acknowledged that the nature of human organizations is undergoing a profound transformation. Historic approaches to long-term strategic planning are increasingly being rendered obsolete by intensifying forces of globalized competition, rising worker mobility, and the breathtaking pace of technological change that is driving organizations of all types to devote growing resources to activities like online commerce, social media, cloud computing, data mining, and the development of artificially intelligent tools.[1] Rich bodies of scholarship and best practices have been formulated to guide organizations in grappling with such change. However, while such analyses

[1] For a discussion of the ways in which multidimensional and synergistic 'business models' of the sort pioneered by technology firms are now supplementing or supplanting previous types of linear 'business plans,' see, e.g., Magretta, "Why Business Models Matter" (2002); Casadesus-Masanell & Ricart, "How to Design a Winning Business Model" (2011); and DaSilva & Trkman, "Business Model: What It Is and What It Is Not" (2014). Regarding the increasing difficulty – or even futility – of attempting to secure a competitive advantage of a lasting structural nature for an organization, see McGrath, *The End of Competitive Advantage: How to Keep Your Strategy Moving as Fast as Your Business* (2013).

are of great practical value for informing decision-making in areas like marketing, sales, logistics, and finance, they have barely begun to plumb the deeper forces which – at an ontological and phenomenological level – are reshaping human beings' capacity and desire to join with one another in the organized pursuit of shared goals.

Among the more noteworthy forces driving such change are those which collectively constitute the phenomenon of *posthumanization*.[2] Posthumanization can be understood as those processes by which a society comes to include members other than 'natural' biological human beings who, in one way or another, contribute to the structures, dynamics, or meaning of the society. The forces of posthumanization are rewriting long-accepted rules about the kinds of entities that can serve as members of organizations, the sorts of structures that organizations can adopt to facilitate and regulate their internal activities, and the range of roles that organizations can play in their broader environment. One critical manifestation of posthumanization is seen in the changing nature of intelligent agency within our world. For millennia, organizations were fashioned and led by intelligent agents in the form of human beings – sometimes assisted by intelligent (though not sapient) agents in the form of dogs, horses, and other kinds of domesticated animals that filled specialized roles in support of their human caretakers. In many human societies, over the last century the role of animals as intelligent agents participating in the work of organizations has declined, while a new form of intelligent agent has emerged to take on roles critical to organizations' successful functioning: namely, computerized systems that are capable of collecting and processing information and then selecting and pursuing a course of action.

The conceptual and functional distinction between the sort of 'bioagency' exercised by human beings and the 'synthetic agency' exercised by such electronic computerized systems was originally quite clear.[3] However, the array of intelligent agency present and active in organizations is now undergoing a

[2] For an in-depth discussion of technological and nontechnological forms of posthumanization, see Part One of this book, "A Typology of Posthumanism: A Framework for Differentiating Analytic, Synthetic, Theoretical, and Practical Posthumanisms," and Herbrechter, *Posthumanism: A Critical Analysis* (2013).

[3] The 'bioagency' possessed by biological entities like human beings and 'cyberagency' demonstrated by artificial entities are distinguished in Fleischmann, "Sociotechnical Interaction and Cyborg–Cyborg Interaction: Transforming the Scale and Convergence of HCI" (2009).

rapid evolution, thanks to the emergence of new technologies for social robotics, artificial intelligence, artificial life, neurocybernetic augmentation, and genetic engineering.[4] Through our increasingly intimate integration of computerized devices into our cognitive processes and bodies, human agency is taking on aspects traditionally seen in artificial agents; the notion of the 'cyborg' is no longer simply a concept found in science fiction but – to a greater or lesser degree – an accurate description of ourselves and the people we meet around us every day.[5] At the same time, developments in the fields of robotics and AI are creating synthetic systems that possess levels of sociality, imagination, emotion, legal and moral responsibility, and metabolic processes resembling those which had previously been seen only in biological entities like human beings.[6]

Within organizations, information will be gathered and communicated, strategic decisions made, and actions undertaken by a kaleidoscopic web of intelligent agents which together form a complex cybernetic network. Such entities may include 'natural' human beings who have not been biotechnologically modified; human beings possessing neuroprosthetic implants that provide extensive sensory, motor, and cognitive enhancement;[7] human beings whose physical structures and biological processes have been intentionally sculpted through genetic engineering;[8] human beings who spend all of

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[4] Such technologies are discussed in detail in Part Three of this book, "The Posthuman Management Matrix: Understanding the Organizational Impact of Radical Biotechnological Convergence."

[5] The ever-increasing aspects of 'cyborgization' reflected in the minds and bodies of typical human beings are discussed, e.g., in Haraway, *Simians, Cyborgs, and Women: The Reinvention of Nature* (1991); Tomas, "Feedback and Cybernetics: Reimaging the Body in the Age of the Cyborg" (1995); Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (1999); Clark, *Natural-born cyborgs: Minds, Technologies, and the Future of Human Intelligence* (2004); and Fleischmann (2009).

[6] A comprehensive review of advances in developing sociality, emotions, and other cognitive and biological capacities for robots is found in Friedenberg, *Artificial Psychology: The Quest for What It Means to Be Human* (2008). For the ability of robots to bear responsibility for their actions, see, e.g., Calverley, "Imagining a non-biological machine as a legal person" (2008); Coeckelbergh, "From Killer Machines to Doctrines and Swarms, or Why Ethics of Military Robotics Is Not (Necessarily) About Robots" (2011); and Gladden, "The Diffuse Intelligent Other: An Ontology of Nonlocalizable Robots as Moral and Legal Actors" (2016).

[7] For anticipated growth in the use of implantable neuroprosthetic devices for purposes of human enhancement, see, e.g., McGee, "Bioelectronics and Implanted Devices" (2008); Gasson, "Human ICT Implants: From Restorative Application to Human Enhancement" (2012); and Gladden, "Neural Implants as Gateways to Digital-Physical Ecosystems and Posthuman Socioeconomic Interaction" (2016).

[8] See, e.g., Panno, *Gene Therapy: Treating Disease by Repairing Genes* (2005); Bostrom, "Human

their time dwelling in virtual worlds;[9] virtualized entities resulting from a process of 'mind uploading';[10] artificial general intelligences;[11] social robots;[12] decentralized nanorobotic swarms;[13] artificial organic or electronic life-forms,[14] including virtual or physical robots that evolve through processes of mutation and natural selection;[15] sentient or sapient networks;[16] and 'hive

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Genetic Enhancements: A Transhumanist Perspective" (2012); De Melo-Martín, "Genetically Modified Organisms (GMOs): Human Beings" (2015); and Nouvel, "A Scale and a Paradigmatic Framework for Human Enhancement" (2015).

[9] Implications of long-term immersion in virtual reality environments are discussed in Bainbridge, *The Virtual Future* (2011); Heim, *The Metaphysics of Virtual Reality* (1993); Geraci, *Apocalyptic AI: Visions of Heaven in Robotics, Artificial Intelligence, and Virtual Reality* (2010); and Koltko-Rivera, "The potential societal impact of virtual reality" (2005).

[10] For perspectives on 'mind uploading' (including issues that may render it impossible), see Moravec, *Mind Children: The Future of Robot and Human Intelligence* (1990); Hanson, "If uploads come first: The crack of a future dawn" (1994); Proudfoot, "Software Immortals: Science or Faith?" (2012); Pearce, "The Biointelligence Explosion" (2012); Koene, "Embracing Competitive Balance: The Case for Substrate-Independent Minds and Whole Brain Emulation" (2012); and Ferrando, "Posthumanism, Transhumanism, Antihumanism, Metahumanism, and New Materialisms: Differences and Relations" (2013), p. 27.

[11] Potential paths to the development of artificial general intelligence and obstacles to its creation are discussed in, e.g., *Artificial General Intelligence*, edited by Goertzel & Pennachin (2007); *Theoretical Foundations of Artificial General Intelligence*, edited by Wang & Goertzel (2012); and *Artificial General Intelligence: 8th International Conference, AGI 2015: Berlin, Germany, July 22-25, 2015: Proceedings*, edited by Bieger et al. (2015).

[12] Robots that can interact socially with human beings are discussed in, e.g., Breazeal, "Toward sociable robots" (2003); Gockley et al., "Designing Robots for Long-Term Social Interaction" (2005); Kanda & Ishiguro, *Human-Robot Interaction in Social Robotics* (2013); *Social Robots and the Future of Social Relations*, edited by Seibt et al. (2014); *Social Robots from a Human Perspective*, edited by Vincent et al. (2015); and *Social Robots: Boundaries, Potential, Challenges*, edited by Nørskov (2016).

[13] Swarm robotics are discussed in, e.g., Arkin & Hobbs, "Dimensions of communication and social organization in multi-agent robotic systems" (1993); Barca & Sekercioglu, "Swarm robotics reviewed" (2013); and Brambilla et al., "Swarm robotics: a review from the swarm engineering perspective" (2013). Regarding nanorobotic swarms, see, e.g., Ummat et al., "Bionanorobotics: A Field Inspired by Nature" (2005), and Pearce (2012).

[14] Artificial life-forms are discussed, e.g., in Andrianantoandro et al., "Synthetic biology: new engineering rules for an emerging discipline" (2006); Cheng & Lu, "Synthetic biology: an emerging engineering discipline" (2012); and Gladden, "The Artificial Life-Form as Entrepreneur: Synthetic Organism-Enterprises and the Reconceptualization of Business" (2014). For the relationship of artificial life and evolutionary robotics, see Friedenberg (2008), pp. 201-16.

[15] Evolutionary robotics and evolvable robotic hardware are reviewed in Friedenberg (2008), pp. 206-10.

[16] For a self-aware future Internet that is potentially a sort of living entity, see Hazen, "What is life?" (2006). Regarding a future Internet that is 'self-aware' even if not subjectively conscious, see Galis et al., "Management Architecture and Systems for Future Internet Networks" (2009), pp. 112-13. A sentient Internet is also discussed in Porterfield, "Be Aware of Your Inner Zombie" (2010), p. 19. Regarding collectively conscious networks and a "post-internet sentient network," see Callaghan,

minds' comprising groups of diverse agents linked in such a way that they can share collective sensory experiences, emotions, and volitions.[17]

At the forefront of efforts to understand and consciously shape this integration of biological and artificial agents are those diverse bodies of thought and practice that constitute the phenomenon of posthumanism. And yet, while insights and methodologies from the field of posthumanism have been advantageously applied to many other spheres of human activity, there have so far been very few explicit links made between posthumanism and the work of integrating posthumanized agents to form effective organizations. In this book, we endeavor to inform and enhance contemporary approaches to the design and operation of organizations by fashioning such a bridge between posthumanist thought and the fields of organizational theory and management. This task is approached at three different levels, moving from the more abstract sphere of basic investigations into the nature of posthumanism to the more concrete sphere of formulating tools for analysis and management in a posthumanized context.

The Intellectual Foundations of Posthumanism

In Part One of this book, "**A Typology of Posthumanism**," we consider the nature of posthumanization and the many phenomena that have been described as forms of 'posthumanism,' in order to situate organizational posthumanism within a broader theoretical context. The array of activities that have been described as 'posthumanist' is quite diverse, ranging from literary criticism of Renaissance texts[18] and efforts by military research agencies to develop futuristic technologies for human enhancement[19] to spiritual movements and

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"Micro-Futures" (2014).

[17] For detailed taxonomies and classification systems for potential kinds of hive minds, see Chapter 2, "Hive Mind," in Kelly, *Out of control: the new biology of machines, social systems and the economic world* (1994); Kelly, "A Taxonomy of Minds" (2007); Kelly, "The Landscape of Possible Intelligences" (2008); Yonck, "Toward a standard metric of machine intelligence" (2012); and Yampolskiy, "The Universe of Minds" (2014). For discussion of systems whose behavior resembles that of a hive mind without a centralized controller, see Roden, *Posthuman Life: Philosophy at the Edge of the Human* (2014), p. 39. Hive minds are also discussed in Gladden, "Utopias and Dystopias as Cybernetic Information Systems: Envisioning the Posthuman Neuropolity" (2015). For critical perspectives on hive minds, see, e.g., Bendle, "Teleportation, cyborgs and the posthuman ideology" (2002), and Heylighen, "The Global Brain as a New Utopia" (2002).

[18] See, e.g., *Posthumanist Shakespeares*, edited by Herbrechter & Callus (2012).

[19] For examples of the term 'posthuman' being used to describe technologies whose development is being pursued by DARPA and other military research and development agencies, see, e.g., Coker,

specific styles of performance art.[20] The question thus arises of whether these phenomena share anything in common at all – and if so, what is their shared dynamic and what are the characteristics that distinguish these different forms of posthumanism.

Much excellent work has been carried out by Ferrando, Herbrechter, Birnbacher, Miah, Miller, and others that explores the conceptual foundations of posthumanism. However, among such studies it can be noted that those research articles which are especially comprehensive and systematic in scope[21] must often – due to space limitations – refrain from exploring any particular form of posthumanism in depth. Meanwhile, the book-length analyses of posthumanism that are exceptionally thorough and detailed in their approach often focus on a single aspect of posthumanism rather than attempting to survey the phenomenon as a whole.[22] Moreover, existing analyses of posthumanism tend to emerge from fields such as critical theory, cultural studies, philosophy of technology, and bioethics; from the perspective of someone who is interested in organizational theory and management, it takes considerable work to extract meaningful insights from such studies and reinterpret and apply them in ways relevant to organizational life.[23]

"Biotechnology and War: The New Challenge" (2004); Graham, "Imagining Urban Warfare: Urbanization and U.S. Military Technoscience" (2008), p. 36; and Krishnan, "Enhanced Warfighters as Private Military Contractors" (2015).

[20] The spiritual aspects of some forms of transhumanism have been noted by numerous scholars; see, e.g., Bostrom, "Why I Want to Be a Posthuman When I Grow Up" (2008), p. 108, and Herbrechter (2013), pp. 103-04. The neohumanist spiritual movement developed by Sarkar might also be considered a form of posthumanism; see Sarkar, "Neohumanism Is the Ultimate Shelter (Discourse 11)" (1982), and the discussion of such neohumanism in Part One of this book, "A Typology of Posthumanism." The form of metahumanism developed by Del Val and Sorgner applies posthumanist ideals to performance art; see Del Val & Sorgner, "A *Metahumanist* Manifesto" (2011), and Del Val et al., "Interview on the Metahumanist Manifesto with Jaime del Val and Stefan Lorenz Sorgner" (2011).

[21] For example, see the insightful discussion in Ferrando (2013).

[22] Such an exposition and investigation of critical posthumanism is found, e.g., in Herbrechter (2013).

[23] There are several forward-thinking works of management scholarship that consider the impacts that posthumanizing technologies will have on future organizations; however, they do so without describing posthumanizing technologies as such or drawing significantly on the theoretical or methodological aspects of posthumanism. Such works might better be understood as a form of 'management futurology' grounded solidly in the field of organizational management rather than as a bridge between management and posthumanism. They include studies such as Berner's comprehensive review of the management implications of futuristic technologies in *Management in 20XX: What Will Be Important in the Future – A Holistic View* (2004). Posthumanist themes are considered more explicitly – although in a narrowly focused context – in, e.g., Mara & Hawk, "Posthuman rhetorics

Part One of this book attempts to synthesize and advance such existing analyses of posthumanism in a way that lays a conceptual foundation for understanding the varied processes of posthumanization that are relevant to specific topics in organizational theory and management. We begin by formulating a comprehensive typology that can be used to classify existing and future forms of posthumanism. The framework suggests that a given form of posthumanism can be classified either as *analytic* or *synthetic* and as either *theoretical* or *practical*. An analytic posthumanism understands 'posthumanity' as a sociotechnological reality that already exists in the contemporary world, such as the nonanthropocentric outlook found among some present-day evolutionary biologists, secular humanists, or animal-rights advocates that tends to minimize the distinctions between human beings and other biological species. A synthetic posthumanism is quite different: it understands 'posthumanity' as a collection of hypothetical future entities – such as full-body cyborgs or genetically engineered human beings – whose creation can either be intentionally realized or prevented, depending on whether humanity decides to develop and deploy particular technologies. A theoretical form of posthumanism is one that primarily seeks to develop new knowledge or cultivate new ways of understanding reality; posthumanist thought and study occurring on university campuses (and especially within the humanities) are often of this sort. Finally, a practical posthumanism seeks primarily to bring about some social, political, economic, or technological change in the world: efforts to develop new cryonics technologies or to engineer transhumanist genetic enhancements may be of this kind.

Arranging the properties of analytic/synthetic and theoretical/practical as two orthogonal axes creates a grid that can be used to categorize a form of posthumanism into one of four quadrants or as a hybrid posthumanism spanning all quadrants. We argue that analytic theoretical forms of posthumanism can collectively be understood as constituting a 'posthumanism of critique'; synthetic theoretical posthumanisms, a 'posthumanism of imagination'; analytic practical posthumanisms, a 'posthumanism of conversion'; synthetic practical posthumanisms, a 'posthumanism of control'; and hybrid posthumanisms uniting all four elements as a 'posthumanism of production.'

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and technical communication" (2009), and Barile, "From the Posthuman Consumer to the *Onto-branding* Dimension: Geolocalization, Augmented Reality and Emotional Ontology as a Radical Redefinition of What Is Real" (2013).

Having developed this framework, we employ it to sift through a wide range of phenomena that have been identified as 'posthumanist' in the scholarly literature or popular discourse and to categorize them according to the framework's criteria. The phenomena thus classified include critical, cultural, philosophical, sociopolitical, and popular (or 'commercial') posthumanism; science fiction; techno-idealism; multiple forms of metahumanism and neohumanism; antihumanism; prehumanism; feminist new materialism; the posthumanities; and biopolitical posthumanism, including bioconservatism and transhumanism.[24] Given its notable presence in the popular consciousness, special attention is devoted to transhumanism, and three specialized sub-typologies are discussed for distinguishing different forms of transhumanism. Part One concludes by considering the form of organizational posthumanism developed in this book and classifying it as a form of hybrid posthumanism that spans all four quadrants of the framework.

Applying Posthumanist Thought to Organizational Theory and Management

In Part Two, "**Organizational Posthumanism**," the manners in which posthumanist insights can be applied to the theory and practice of organizational management are explored in more detail. We sketch out one way of fashioning posthumanist methodologies into a coherent management approach and chart out the potential scope of such a field. At its heart, the organizational posthumanism formulated in this text is a pragmatic approach to analyzing, understanding, creating, and managing organizations that is attuned to the intensifying processes of technological posthumanization and which employs a post-dualistic and post-anthropocentric perspective that can aid in recognizing challenges caused by the forces of posthumanization and developing innovative strategies for appropriately harnessing those forces.

Organizational posthumanism does not naïvely embrace all forms of posthumanization; unlike some strains of transhumanist thought, it does not presume that all emerging technologies for genetic engineering or nanorobotics are inherently beneficial and free from grave dangers. But at the

[24] Many of these forms of posthumanism are identified in Ferrando (2013); others are discussed in Herbrechter (2013); Birnbacher, "Posthumanity, Transhumanism and Human Nature" (2008); Miah, "A Critical History of Posthumanism" (2008); and Miller, "Conclusion: Beyond the Human: Ontogenesis, Technology, and the Posthuman in Kubrick and Clarke's 2001" (2012). Some forms, such as sociopolitical posthumanism, are explicitly defined for the first time in this volume. Detailed descriptions of all of these types of posthumanism are presented in Part One of this text, "A Typology of Posthumanism."

same time, organizational posthumanism does not directly join bioconservatism in attempting to block the development of particular technologies deemed to be hazardous or destructive. Instead, organizational posthumanism focuses on analyzing posthumanizing technologies that are already available or whose development is expected in order to assess their (potential) impact on organizations and develop strategies for utilizing such technologies in ways that are ethical, impactful, and efficient. Organizational posthumanism recognizes that emerging technologies are likely to possess both benign and harmful applications, and the role of a manager as such is to identify and creatively exploit the beneficial aspects of a technology within a particular organizational context while simultaneously avoiding or ameliorating the technology's more detrimental effects.[25]

Indeed, like critical posthumanism and other forms of analytic posthumanism, organizational posthumanism recognizes that to a certain degree the world as a whole has already become 'posthumanized' through nontechnological processes: for example, regardless of whether a particular organization decides to acquire and exploit technologies for social robotics and neuroenhancement, the organization must account for the fact that its pool of (potential) employees, customers, and other stakeholders includes a growing number of individuals who, in different fashions and for varying reasons, possess increasingly nonanthropocentric and nondualistic ways of viewing reality. Thus engaging the realities of posthumanization is something that every contemporary organization must do of necessity; the only question is the extent to which an organization does so consciously and with a coherent strategy.

In order to develop an adequate framework for identifying the aspects of organizations that our study must address, we turn to fields like organizational architecture, enterprise architecture, and organizational design. When organizations are viewed through the lens of these disciplines, the relevance of six key elements becomes apparent: the forces of posthumanization are expected to increasingly expand and transform the kinds of *agent-members*, *personnel structures*, *information systems*, *processes and activities*, *physical*

[25] A human manager may simultaneously also be, for example, a follower of a particular religious tradition, a consumer, a voter, a patient, and a parent. In those other capacities, he or she may quite possibly work actively to spur or prevent the adoption of particular posthumanizing technologies, based on his or her adherence to posthumanist movements like bioconservatism or transhumanism. Organizational posthumanism does not attempt to study or shape all of those ways in which a human being may be related to posthumanizing forces and technologies; its scope only includes those mechanisms and dynamics by which posthumanization impacts the organization whose activities the manager is (co)responsible for directing.

and virtual spaces, and *external ecosystems* that organizations are able (or required) to utilize.[26] We argue that in each of these six areas, three different kinds of posthumanizing technologies will create new opportunities, threats, and exigencies that drive organizational change. The first kind is technologies for human augmentation and enhancement, which include many forms of neuroprosthetics, implantable computing, genetic engineering, and life extension.[27] The second is technologies for synthetic agency, which include artificial intelligence, artificial life, and diverse forms of robotics such as social, nano-, soft, and evolutionary robotics.[28] The third kind is technologies for digital-physical ecosystems and networks, which create new kinds of environments that human, artificial, and hybrid agents can inhabit and infrastructure through which they can interact. Such technologies might create persistent immersive virtual worlds and cybernetic networks whose topologies allow their agent-members to form collective hive minds.[29]

Managing the Transformation and Functional Convergence of Human and Artificial Agents

Part Two thus sketches the contours of organizational posthumanism as a field that can allow management theorists to understand the forces of posthumanization that are impacting organizations and for management practitioners to anticipate and shape them. However, before attempting to apply such insights to the task of creating organizational designs and enterprise architectures for particular organizations, it would be helpful to have at one's disposal a more concrete guide for assessing the technological posthumanization of particular groups of agents, such as those comprising the (potential) stakeholders of an organization. To that end, in Part Three of the book, we formulate "**The Posthuman Management Matrix**," a conceptual tool for analyzing and managing the behavior of agents within organizations where

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[26] For example, within the 'congruence model' of organizational architecture conceptualized by Nadler and Tushman, structures, processes, and systems constitute the three main elements of an organization that must be considered. See Nadler & Tushman, *Competing by Design: The Power of Organizational Architecture* (1997), p. 47.

[27] Biologically and nonbiologically based efforts at human life extension are compared in Koene (2012).

[28] An overview of such topics can be found, e.g., in Friedenberg (2008) and Murphy, *Introduction to AI Robotics* (2000).

[29] Regarding the ongoing evolution of the Internet to incorporate ever more diverse types of objects and entities, see Evans, "The Internet of Everything: How More Relevant and Valuable Connections Will Change the World" (2012). For a conceptual analysis of the interconnection between physical and virtual reality and different ways in which beings and objects can move between these worlds, see Kedzior, "How Digital Worlds Become Material: An Ethnographic and Netnographic Investigation in Second Life" (2014). Regarding the typologies of posthumanized cybernetic networks, see Gladden, "Utopias and Dystopias as Cybernetic Information Systems" (2015).

the boundaries between human beings and computers are becoming increasingly blurred.

Within the schema of this Matrix, an organization's employees and consumers can include two different kinds of agents (human and artificial agents), and the characteristics possessed by a specific agent belong to one of two sets ('anthropic' or 'computronic' characteristics). The model thus defines four different types of possible entities that might serve as organizational participants and stakeholders. The phrase 'human agents possessing anthropic characteristics' is simply another way of describing the 'natural' human beings who have not been modified by posthumanizing technological processes such as neuroprosthetic enhancement or genetic engineering and who – from the dawn of human history – have served as the backbone of all organizations on earth. Disciplines like HR management and organization development offer many time-tested approaches for optimizing the performance of such human beings within an organizational context.

The phrase 'artificial agents with computronic characteristics' is another way of describing the ubiquitous electronic systems developed over the last half-century in which a computer utilizing a conventional Von Neumann architecture and running specialized software serves as an intelligent agent to perform assignments like transporting materials within production facilities;[30] wielding a robotic arm to perform assembly-line manufacturing tasks;[31] monitoring systems and facilities to detect physical or electronic intrusion attempts;[32] automatically scheduling tasks and optimizing the use of physical and electronic resources;[33] initiating financial transactions within online markets;[34] mining data to evaluate an applicant's credit risk or decide what personalized offers and advertisements to display to a website's visitors;[35] inter-

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[30] See, e.g., *The Future of Automated Freight Transport: Concepts, Design and Implementation*, edited by Priemus & Nijkamp (2005), and Ullrich, *Automated Guided Vehicle Systems: A Primer with Practical Applications* (2015).

[31] For an overview of such technologies, see, e.g., *Intelligent Production Machines and Systems*, edited by Pham et al. (2006), and Perlberg, *Industrial Robotics* (2016).

[32] Regarding the automation of intrusion detection and prevention systems, see Rao & Nayak, *The InfoSec Handbook* (2014), pp. 226, 235, 238.

[33] For an overview of methods that can be employed for such purposes, see Pinedo, *Scheduling: Theory, Algorithms, and Systems* (2012), and *Automated Scheduling and Planning: From Theory to Practice*, edited by Etaner-Uyar et al. (2013).

[34] See Schacht, "The Buzz about Robo-Advisers" (2015); Dhar, "Should You Trust Your Money to a Robot?" (2015); Scopino, "Do Automated Trading Systems Dream of Manipulating the Price of Futures Contracts? Policing Markets for Improper Trading Practices by Algorithmic Robots" (2015); and Turner, "The computers have won, and Wall Street will never be the same" (2016).

[35] Regarding the role of automated systems in data mining, see, e.g., Giudici, *Applied Data Mining:*

acting with customers through automated call centers, online chatbot interfaces, and physical kiosks to offer customer support;[36] or dispensing goods and services to customers.[37] The successful integration of such artificial agent technologies into organizational life is a major focus of contemporary management theory and practice.

However, the remaining two types of entities described by the Posthuman Management Matrix have historically been overlooked by the field of management – and understandably so, because of the fact that such entities have not existed as beings that could serve as workers, customers, and other organizational stakeholders. We argue, though, that such entities are now emerging as potential organizational actors, thanks to posthumanizing phenomena such as the development of increasingly powerful forms of neuroprosthetics, genetic engineering, virtual reality, robotics, and artificial intelligence. Human agents possessing computer-like physical and cognitive characteristics can be understood as real-world embodiments of the 'cyborgs' long envisioned in science fiction, while artificial agents possessing anthropic physical and cognitive characteristics will have very little in common with the desktop computers of earlier eras; they can be better understood as 'bioroids' whose form and behaviors resemble those of sophisticated biological entities like human beings.

We suggest that existing management approaches will prove ill-equipped for successfully understanding and shaping the activities of such novel posthumanized entities. New approaches are expected to emerge that allow organizations to identify and address the serious operational, legal, and ethical issues that will arise as human employees and consumers become more like computers and computerized agents more like biological human beings. Such efforts can build on the foundations developed by disciplines like cybernetics, systems theory, xenopsychology, and exoeconomics that employ a nonanthropocentric perspective and which formulate genericized principles that are equally well-suited to explaining the forms and dynamics of all kinds

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Statistical Methods for Business and Industry (2003); Provost & Fawcett, *Data Science for Business* (2013), p. 7; and Warkentin et al., "The Role of Intelligent Agents and Data Mining in Electronic Partnership Management" (2012), p. 13282.

[36] Such technologies are described, e.g., in Perez-Marin & Pascual-Nieto, *Conversational Agents and Natural Language Interaction: Techniques and Effective Practices* (2011); McIndoe, "Health Kiosk Technologies" (2010); and Ford, *Rise of the Robots: Technology and the Threat of a Jobless Future* (2015).

[37] See, e.g., the firsthand account of such technologies from the perspective of a potential consumer in Nazario, "I went to Best Buy and encountered a robot named Chloe – and now I'm convinced she's the future of retail" (2015).

of agents, regardless of whether they are human, artificial, or hybrid in nature.[38]

It is our hope that the questions raised and approaches suggested in this book can draw attention to an important element that is largely missing from the contemporary debates surrounding emerging transformative technologies, which often focus on issues of economics (such as the question of whether increasing roboticization will produce mass human unemployment[39]) or bioethics (such as the question of whether neuroprosthetic devices that alter a user's personality or memories are ethically permissible[40]). Namely, we aim to highlight the fact that those posthumanizing technologies that transform the nature of human and synthetic agency will necessarily also transform the nature of the organizations for which agents serve as workers, consumers, managers, investors, and other stakeholders. Given the fact that almost every aspect of human existence is intimately connected with the activity of human organizations, the forces of posthumanization that enable or impel dramatic changes in such organizations will impact every corner of our lives. The extent to which such radical change can be anticipated and consciously shaped by organizations may largely determine the quality of the world – or worlds – experienced by generations of human beings to come.

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[38] For a history of the use of 'xeno-' as a prefix to designate disciplines that study the forms or behaviors of intelligent agents other than human beings (and in particular, those of hypothetical extraterrestrial life-forms), see the "Preface and Acknowledgements for the First Edition" in Freitas, *Xenology: An Introduction to the Scientific Study of Extraterrestrial Life, Intelligence, and Civilization* (1979). For a similar use of 'exopsychology' in connection with the study of the cognitive mechanisms and processes of potential extraterrestrial intelligences, see Harrison & Elms, "Psychology and the search for extraterrestrial intelligence" (1990), p. 207. Regarding the work of exoeconomists, see Ames, "The Place of an Individual in an Economy" (1981), p. 37.

[39] See, for example, Sachs et al., "Robots: Curse or Blessing? A Basic Framework" (2015), and Ford (2015).

[40] See, e.g., Maguire & McGee, "Implantable brain chips? Time for debate" (1999); Khushf, "The use of emergent technologies for enhancing human performance: Are we prepared to address the ethical and policy issues" (2005); Soussou & Berger, "Cognitive and Emotional Neuroprostheses" (2008); Kraemer, "Me, Myself and My Brain Implant: Deep Brain Stimulation Raises Questions of Personal Authenticity and Alienation" (2011); and Van den Berg, "Pieces of Me: On Identity and Information and Communications Technology Implants" (2012).

Part One

A Typology of Posthumanism:

A Framework for Differentiating Analytic, Synthetic, Theoretical, and Practical Posthumanisms

Abstract. The term 'posthumanism' has been employed to describe a diverse array of phenomena ranging from academic disciplines and artistic movements to political advocacy campaigns and the development of commercial technologies. Such phenomena differ widely in their subject matter, purpose, and methodology, raising the question of whether it is possible to fashion a coherent definition of posthumanism that encompasses all phenomena thus labelled. In this text, we seek to bring greater clarity to this discussion by formulating a novel conceptual framework for classifying existing and potential forms of posthumanism. The framework asserts that a given form of posthumanism can be classified: 1) either as an *analytic posthumanism* that understands 'posthumanity' as a sociotechnological reality that already exists in the contemporary world or as a *synthetic posthumanism* that understands 'posthumanity' as a collection of hypothetical future entities whose development can be intentionally realized or prevented; and 2) either as a *theoretical posthumanism* that primarily seeks to develop new knowledge or as a *practical posthumanism* that seeks to bring about some social, political, economic, or technological change. By arranging these two characteristics as orthogonal axes, we obtain a matrix that categorizes a form of posthumanism into one of four quadrants or as a hybrid posthumanism spanning all quadrants. It is suggested that the five resulting types can be understood roughly as posthumanisms of *critique*, *imagination*, *conversion*, *control*, and *production*.

We then employ this framework to classify a wide variety of posthumanisms, such as critical, cultural, philosophical, sociopolitical, and popular (or 'commercial') posthumanism; science fiction; techno-idealism; metahumanism; neohumanism; antihumanism; prehumanism; feminist new materialism; the posthumanities; biopolitical posthumanism, including bioconservatism and transhumanism (with specialized objective and instrumental typologies of-

fered for classifying forms of transhumanism); and organizational posthumanism. Of particular interest for our research is the classification of organizational posthumanism as a hybrid posthumanism combining analytic, synthetic, theoretical, and practical aspects. We argue that the framework proposed in this text generates a typology that is flexible enough to encompass the full range of posthumanisms while being discriminating enough to order posthumanisms into types that reveal new insights about their nature and dynamics.

I. Introduction

Terms such as 'posthumanism,' 'posthumanity,' and 'the posthuman' are being used to describe an increasingly wide and bewildering array of phenomena in both specialized scholarly and broader popular contexts. Spheres of human activity that have been described as 'posthumanist' include academic disciplines,[1] artistic movements,[2] spiritual movements,[3] commercial research and development programs designed to engineer particular new technologies,[4] works of science fiction,[5] and campaigns advocating specific legislative or regulatory action.[6]

Running through many of these 'posthumanisms' is the common thread of emerging technologies relating to neurocybernetic augmentation, genetic engineering, virtual reality, nanotechnology, artificial life, artificial intelligence, and social robotics which – it is supposed – are challenging, destabilizing, or transforming our understanding of what it means to be 'human.'

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[1] For examples, see the descriptions of critical, cultural, and philosophical posthumanism and the posthumanities later in this text.

[2] Examples include the works of performance art created by Del Val. See Del Val et al., "Interview on the Metahumanist Manifesto with Jaime del Val and Stefan Lorenz Sorgner" (2011).

[3] An instance is the form of neohumanism developed by Sarkar. See Sarkar, "Neohumanism Is the Ultimate Shelter (Discourse 11)" (1982).

[4] For examples of the term 'posthuman' being used to describe specific technologies that are being developed by DARPA and other military research and development agencies, see, e.g., Coker, "Biotechnology and War: The New Challenge" (2004); Graham, "Imagining Urban Warfare: Urbanization and U.S. Military Technoscience" (2008), p. 36; and Krishnan, "Enhanced Warfighters as Private Military Contractors" (2015).

[5] Posthumanist aspects of science fiction are discussed, for example, in Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (1999); *Cyberculture, Cyborgs and Science Fiction: Consciousness and the Posthuman*, edited by Haney (2006); and Goicoechea, "The Posthuman Ethos in Cyberpunk Science Fiction" (2008).

[6] Examples include some of the legislative and regulatory approaches proposed in Fukuyama, *Our Posthuman Future: Consequences of the Biotechnology Revolution* (2002), and Gray, *Cyborg Citizen: Politics in the Posthuman Age* (2002).

And yet when posthumanist interpretations are also being offered for subjects like the Bible,[7] medieval alchemical texts,[8] Shakespeare,[9] and 1930s zombie fiction,[10] it becomes apparent that directly equating posthumanism with an attitude toward futuristic technologies is overly simplistic and even misleading.

And not only do different manifestations of posthumanism differ widely from one another in their subject matter; even when two forms of posthumanism consider the same object, they often oppose one another in their aims, methodologies, and conclusions. For example, both transhumanists and bioconservatives attempt to foresee the extent to which genetic engineering will allow the capacities of future human beings to be radically transformed; while transhumanists conclude that the development of such technologies must be pursued as a natural next step in the evolution of humanity, bioconservatives conclude that pursuit of such technologies must be blocked in order to preserve the integrity of the human species and the possibility of a politically and economically just society.[11]

This *mélange* of meanings for the term 'posthumanism' raises important questions. First, is it possible to develop a definition of posthumanism that covers all of its uses? And second, assuming that this is theoretically possible, would it be desirable? Or is it better to acknowledge that 'posthumanism' has become too fragmented to possess a single coherent definition and that it is better to develop separate definitions for the diverse phenomena which share that appellation?

In this text, we seek to contribute to this debate by developing a conceptual framework that presents one approach to clarifying the key characteristics of different types of posthumanism and the relationships between them. Although the structure and details of the proposed framework are novel, such a framework can be understood as an appraisal, synthesis, and elaboration of the work of thinkers such as Ferrando, Herbrechter, Birnbacher, Miah, Miller, and others who have not simply carried out posthumanist reflection

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[7] See, e.g., *The Bible and Posthumanism*, edited by Koosed (2014).

[8] See, e.g., Smith, *Genetic Gold: The Post-human Homunculus in Alchemical and Visual Texts* (2009).

[9] Examples include the texts collected in *Posthumanist Shakespeares*, edited by Herbrechter & Callus (2012).

[10] Instances of this can be found in *Better Off Dead: The Evolution of the Zombie as Post-Human*, edited by Christie & Lauro (2011).

[11] These issues are explored in more detail in the discussion of biopolitical posthumanism and bioconservatism later in this text.

on topics like genetic engineering or science fiction but have instead analyzed the nature of posthumanism itself – have attempted to forge some conceptual order amidst the landscape of many conflicting 'posthumanisms.'

Rather than presenting a simple catalogue of posthumanisms, the framework developed in this text proposes that a given form of posthumanism can be categorized on the basis of a pair of factors: its understanding of 'posthumanity' and the role or purpose for which the posthumanism has been developed. In this way, a posthumanism can be classified either as an *analytic posthumanism* that understands posthumanity as a sociotechnological reality that already exists in the contemporary world or as a *synthetic posthumanism* that understands posthumanity as a collection of hypothetical future entities whose development can be intentionally realized or prevented. Simultaneously, it can be classified either as a *theoretical posthumanism* that primarily seeks to develop new knowledge or as a *practical posthumanism* that primarily seeks to bring about some social, political, economic, or technological change. By combining these factors, a two-dimensional typology is created that identifies a form of posthumanism with one of four quadrants or as a hybrid posthumanism that spans all quadrants. After presenting this tool, the majority of this text will be spent in employing it to classify a wide variety of posthumanisms that have been identified in the literature.

II. Established Definitions of Posthumanism

Before formulating our typology of posthumanism, it is useful to explore the ways in which the concept of posthumanism is currently understood.

A multiplicity of posthumanisms. The term 'posthuman' has been used by different authors to represent very different concepts;[12] while this has enriched the development of posthumanism, it has also introduced confusion.[13] For example, Miller notes that the term has been given a variety of meanings by theorists operating in the natural sciences; cybernetics; epistemology; ontology; feminist studies; film, literary, and cultural studies; animal studies; and ecocriticism.[14] Herbrechter observes that the 'post-' in 'posthumanism' is not

[12] Bostrom, "Why I Want to Be a Posthuman When I Grow Up" (2008), p. 107.

[13] See Ferrando, "Posthumanism, Transhumanism, Antihumanism, Metahumanism, and New Materialisms: Differences and Relations" (2013), p. 26.

[14] Miller, "Conclusion: Beyond the Human: Ontogenesis, Technology, and the Posthuman in Kubrick and Clarke's 2001" (2012), p. 163.

only ambiguous but even "radically open" in its meaning.[15] For example, the word can be understood either as 'post-*humanism*,' a critical response to and deconstructive working-through of the assumptions of humanism, or as '*posthuman*-ism,' a philosophy of future engineered beings whose capacities are expected to surpass those of contemporary human beings.[16] Indeed, Birnbacher suggests that the term 'posthumanity' and related idea of 'transhumanism' have been utilized by so many different thinkers in such widely divergent fashions that they can be better understood "as slogans rather than as well-defined concepts."[17]

Posthumanist terminology. In this text, we will refer often to the interrelated but distinct notions of 'posthumanization,' 'posthumanity,' 'posthumanism,' and the 'posthuman.' Because each of these terms has been used to represent multiple concepts, it is difficult to offer authoritative definitions for them. Nevertheless, they can be broadly differentiated:

- The processes of **posthumanization** are those dynamics by which a society comes to include members other than 'natural' biological human beings who, in one way or another, contribute to the structures, activities, or meaning of the society. In this way, a society comes to incorporate a diverse range of intelligent human, non-human, and para-human social actors who seek to perceive, interpret, and influence their shared environment and who create knowledge and meaning through their networks and interactions. At present, posthumanization often occurs as a result of the **technologization** of human beings, which is spurred by phenomena such as our increasing physical integration with electronic systems, our expanding interaction with and dependence on robots and artificial intelligences, our growing immersion in virtual worlds, and the use of genetic engineering to design human beings as if they were consumer products.[18] However, processes of posthumanization do not inherently require the use of modern technology: works of mythology or literature that present quasi-human figures such as monsters, ghosts, and semidivine heroes can advance the processes of posthumanization by challenging

[15] Herbrechter, *Posthumanism: A Critical Analysis* (2013), p. 69.

[16] Herbrechter (2013), p. 16.

[17] Birnbacher "Posthumanity, Transhumanism and Human Nature" (2008), p. 96.

[18] The relationship of posthumanism to the commercialization of the human entity is discussed in Herbrechter (2013), pp. 42, 150-52.

the boundaries of our concept of humanity and, in some sense, incorporating those figures into the structures and dynamics of society.[19]

- **Posthumanity** refers either to a collection of intelligent beings – whether human, synthetic, or hybrid – that have been created or affected by a process of posthumanization or to the broader sociotechnological reality within which such beings exist.
- **Posthumanism** is a coherent conceptual framework that takes the phenomenon of posthumanization or posthumanity as its object; it may be developed as part of an academic discipline, artistic or spiritual movement, commercial venture, work of fiction, or form of advocacy, among other possible manifestations.
- **'Posthuman'** can refer to any of the above: a process (posthumanization), collection of entities (posthumanity), or body of thought (posthumanism).

Tracing the origins of posthumanism. Some identify the birth of posthumanism as an explicit conceptual system with Wiener's formulation of cybernetics in the 1940s; others suggest that posthumanism as an explicit discipline only appeared with Haraway's analysis of cyborgs and the dissolution of human-machine boundaries in the 1990s.[20] While ongoing developments in robotics, artificial intelligence, biocybernetics, and genetic engineering are lending new urgency to questions surrounding posthumanism, Herbrechter argues that the phenomenon of posthumanism is at least as old as that of post-Enlightenment humanism – even if it has only recently been explicitly named.[21] The fact that the term 'posthumanism' is used to refer to such a diverse array of intellectual phenomena means that scholars can date its origins variously to the Renaissance, post-Enlightenment era, 1940s, or 1990s, depending on exactly which 'posthumanism' is being considered.

Attempts at defining posthumanism generically. Ideally, it would be possible to formulate a generic definition of 'posthumanism' broad enough to cover all such intellectual frameworks. And, indeed, scholars have attempted to identify elements that are shared across all varieties of posthumanism. For example, Miller contends that various strains of posthumanism agree that:

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[19] For the role of such figures in nontechnological posthumanization, see, e.g., Herbrechter (2013), pp. 2-3, 106.

[20] Such perspectives on the genesis of posthumanism are offered, e.g., in Herbrechter (2013), p. 41, and its discussion of Gane, "Posthuman" (2006).

[21] Herbrechter (2013), p. 77.

> The posthuman subject is a multiple subject, not a unified one, and she or he (a distinction that also gets blurred in posthuman-ism) is not separate from his/her environment. Technologies become extensions of the self, and humans become only one type of individual in a vast ecosystem that includes digital as well as natural environmental forces. In other words, posthumanism is partly about leaving behind the old notions of liberal humanism. [...] But it also begins to gesture toward a much more radical state, a state beyond the current human form.[22]

According to this view, the heart of posthumanism is a 'post-anthropocentric'[23] perspective that looks beyond traditional human beings to identify other sources of intelligence, agency, subjectivity, and meaning within the world. Emphasizing this fact, Ferrando states that:

> Posthumanism is often defined as a post-humanism and a post-anthropocentrism: it is "post" to the concept of the human and to the historical occurrence of humanism, both based [...] on hierarchical social constructs and human-centric assumptions.[24]

Thus by way of offering a preliminary definition, Herbrechter suggests that posthumanism in its most general sense is "the cultural malaise or euphoria that is caused by the feeling that arises once you start taking the idea of 'post-anthropocentrism' seriously."[25] Similarly, Birnbacher suggests that the different forms of posthumanism are united in studying already existing or potential future 'posthumans' whose nature is not constrained by human nature as previously understood and who lack at least some key characteristics that have historically been considered typical of the human species.[26]

Miah, meanwhile, finds "a range of posthumanisms" that are united by the fact that they "challenge the idea that humanness is a fixed concept."[27] However, posthumanism's challenge to the concept of the 'human' differs from the more nihilistic attacks waged by postmodernism: in their own unique ways – whether subtly or wholeheartedly – various kinds of posthumanism are willing to entertain the idea of restoring in an altered post-anthropocentric form some of the 'grand narratives' about humanity, agency, history, and other phenomena that had been wholly rejected by postmodernism.[28]

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[22] Miller (2012), p. 164.
[23] See Herbrechter (2013), pp. 2-3.
[24] Ferrando (2013), p. 29.
[25] Herbrechter (2013), p. 3.
[26] Birnbacher (2008), p. 104.
[27] Miah, "A Critical History of Posthumanism" (2008), p. 83.
[28] Differences between postmodernism and posthumanism can be observed, e.g., in Herbrechter

Problems with a generic definition of posthumanism. While such general definitions offer a useful starting point, they are hampered by the fact that 'posthumanisms' differ markedly with regard to their origins, purpose, and methodology. For example, as we have noted, some thinkers argue that technological progress is an essential aspect of posthumanism that will inevitably someday be harnessed to engineer a superior posthumanity.[29] Other thinkers argue that technology is not an inherent element of posthumanism at all and that posthumanity is a conceptual array of interrelated human, quasi-human, and nonhuman beings (such as ghosts, monsters, aliens, and robots) that have held a place within the human imagination for hundreds or thousands of years. Any definition of 'posthumanism' that is broad enough to describe all such conflicting perspectives may be so vague as to be of little practical value.

Existing frameworks for categorizing posthumanisms. Scholars have proposed a range of conceptual frameworks for classifying the many forms of posthumanism. For example, Miah distinguishes between the three different phenomena of *biopolitical*, *cultural*, and *philosophical* posthumanism.[30] Ferrando distinguishes three forms of posthumanism *per se* (i.e., *critical*, *cultural*, and *philosophical* posthumanism), while noting that the word 'posthuman' is also used more broadly to include related phenomena such as transhumanism, new materialism, antihumanism, metahumanism, and the posthumanities.[31]

Finally, drawing on Rosenau, Herbrechter distinguishes two different strains of posthumanism. On one side is an *affirmative* posthumanism that includes 'technoeuphorians' (such as transhumanists) who wholeheartedly embrace posthumanizing technologies and 'technocultural pragmatists' who accept that posthumanizing technological change is inevitable and who attempt to strengthen its positive impacts while ameliorating any detrimental side-effects. On the other side is a *skeptical* posthumanism that includes 'catastrophists' (such as bioconservatives) who are attempting to forestall the development of posthumanizing technology due to its perceived danger and 'critical deconstructive posthumanists' (such as Herbrechter) who accept that posthumanizing technological change is occurring and who are primarily interested not in identifying its potentially negative biological or social impacts

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(2013), p. 23.

[29] For such broadly transhumanist perspectives, see, e.g., Bostrom (2008) and Kurzweil, *The Singularity is Near: When Humans Transcend Biology* (2005).

[30] See Miah (2008).

[31] Ferrando (2013), p. 26.

but in analyzing the theoretical weaknesses, biases, and naïvety displayed by those who zealously advocate such technologization of humankind.[32]

III. A Proposed Two-dimensional Typology of Posthumanism

While such existing schemas for classifying posthumanisms offer valuable insights, we contend that it would be useful to possess a more comprehensive and systematic framework developed for this purpose. To that end, we would suggest that a given form of posthumanism can be classified in two ways:

1) **By its understanding of posthumanity**. A form of posthumanism can be categorized either as an **analytic posthumanism** that understands posthumanity as a sociotechnological reality that already exists in the contemporary world and which needs to be analyzed or as a **synthetic posthumanism** that understands posthumanity as a collection of hypothetical future entities whose development can be either intentionally realized or intentionally prevented, depending on whether or not human society chooses to research and deploy certain transformative technologies.

2) **By the purpose or role for which it was developed**. A form of posthumanism can be categorized either as a **theoretical posthumanism** that primarily seeks to develop new knowledge and understanding or as a **practical posthumanism** that primarily seeks to bring about some social, political, economic, or technological change in the real world.

By arranging these two characteristics as orthogonal axes, a matrix is obtained that categorizes a form of posthumanism into one of four quadrants or as a hybrid that spans all quadrants. Figure 1 depicts this matrix along with our proposed classification of numerous forms of posthumanism that will be investigated within this text. We can now discuss these two axes in more detail.

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[32] For this dichotomy of affirmative and skeptical perspectives, see Herbrechter (2013), pp. 23-24, and its analysis of Rosenau, *Post-Modernism and the Social Sciences: Insights, Inroads, and Intrusions* (1992).

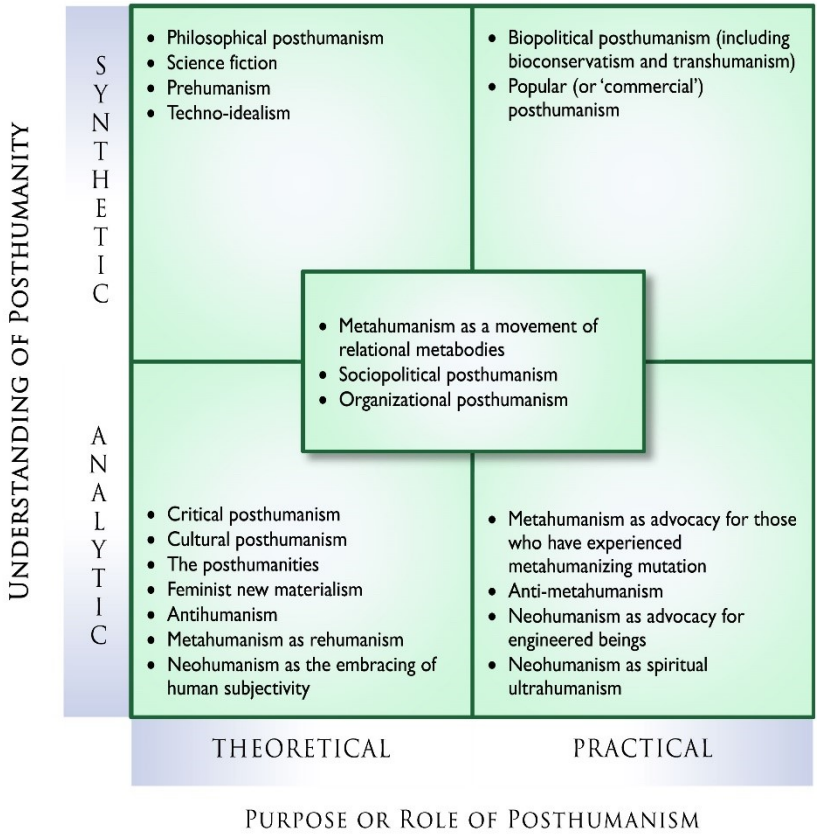

Fig. 1: Our proposed two-dimensional typology of posthumanism, which classifies a form of posthumanism based on whether it understands posthumanity as a sociotechnological reality already existing in the contemporary world ('analytic') or as a set of hypothetical future entities whose capacities differ from those of natural biological human beings ('synthetic') and whether its purpose is primarily to expand the knowledge possessed by humanity ('theoretical') or to produce some specific political, economic, social, cultural, or technological change within the world ('practical'). Classifications are suggested for numerous forms of posthumanism.

Analytic versus synthetic posthumanism. Analytic posthumanisms define 'posthumanity' as a sort of sociotechnological reality that already exists in the contemporary world and which calls out to be better understood. Such posthumanisms typically display a strong orientation toward the present and the past; they do not generally focus on the future, insofar as the exact form that

the future will take has not yet become clear to us and thus cannot yet be the object of rigorous analysis.

Synthetic posthumanisms, on the other hand, define 'posthumanity' as a set of hypothetical future entities[33] (such as full-body cyborgs or artificial general intelligences) whose capacities differ from – and typically surpass – those of natural biological human beings and whose creation can either be intentionally brought about or intentionally blocked, depending on whether humanity decides to develop and implement certain transformative technologies such as those relating to genetic engineering, neuroprosthetics, artificial intelligence, or virtual reality. Such posthumanisms generally have a strong future orientation; they rarely give detailed attention to events of the distant past, and they conduct an exploration of power structures or trends of the current day only insofar as these offer some insight into how future processes of posthumanization might be directed.

Theoretical versus practical posthumanism. Posthumanisms can also be classified according to the purpose for which they were developed or the role that they play.[34] Theoretical posthumanisms are those that mainly seek to enhance our understanding of issues and to expand the knowledge possessed by humanity – not primarily for the sake of effecting some specific change within the world but for the sake of obtaining a deeper, richer, more accurate, and more sophisticated understanding of human beings and the world in which we exist.

Practical posthumanisms, on the other hand, are interested primarily in producing some specific political, economic, cultural, social, or technological change. While theoretical posthumanism often takes the form of analyses, critiques, or thought experiments, practical posthumanism may take the form of efforts to ensure or block the approval of proposed treaties, legislation, or regulations; secure or cancel funding for particular military, educa-

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[33] An exception to this definition would be prehumanism, a form of synthetic theoretical posthumanism that is similar to science fiction but which imagines the characteristics of quasi-human beings in a hypothetical distant past rather than in the far future. While the directionality of the temporal reference-points is reversed in comparison to that of futurological science fiction, the (implicit or explicit) contrast of contemporary humanity with the intelligent beings of a chronologically distant but causally connected world remains intact. See the discussion of prehumanism later in this text.

[34] The distinction between theoretical and practical posthumanisms could be understood, for example, in light of the Aristotelian division of human activities into *theoria*, *poiesis*, and *praxis*. Theoretical posthumanism is a kind of *theoria*, while practical posthumanism comprises *praxis* (as in the case of posthumanist political movements) and *poiesis* (as in the case of some posthumanist artistic movements).

tional, or social programs; develop and test new technologies; design, produce, and market new kinds of goods or services; or influence the public to vote, spend their time and money, interact socially, tolerate particular corporate or governmental actions, or otherwise behave in specific ways. Practical posthumanisms may thus include elements of advocacy, engineering, and entrepreneurship.

Hybrid posthumanisms that combine all four aspects. There are at least three kinds of posthumanism which, we would argue, are simultaneously analytic, synthetic, theoretical, and practical. These will be explored in more depth later in this text. The first of these hybrid posthumanisms is the form of metahumanism formulated by Sorgner and Del Val.[35] Their metahumanist program possesses a strong theoretical component, insofar as it is grounded in and seeks to advance critiques developed by thinkers such as Nietzsche and Deleuze; however, it also displays a strong practical component in that it is geared toward generating works of performance art and other concrete products. Similarly, their metahumanism is analytic insofar as it reflects on the 'metabodies' of human beings as they exist today and synthetic insofar as it recognizes that new kinds of metabodies will be created in the future, largely through the ongoing technologization of humankind.

The second hybrid posthumanism is sociopolitical posthumanism. This is manifested, for example, in legal scholars' efforts to update legal systems to reflect emerging deanthropocentrized realities such as the growing ability of robots to autonomously make complex ethical and practical decisions that impact the lives of human beings.[36] Such work is theoretical insofar as it flows from a sophisticated theory of law and practical insofar as it is geared toward reshaping real-world legal systems. Similarly, it is analytic insofar as it investigates the effects of posthumanization that are already reflected in the world today and synthetic insofar as it seeks to anticipate and account for different posthumanities that might appear in the future.

Finally, the form of organizational posthumanism formulated later in this text also combines both analytic and synthetic as well as theoretical and practical aspects. Organizational posthumanism is theoretical insofar as it seeks to understand the ways in which the nature of organizations is being trans-

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[35] They describe their form of metahumanism in Del Val & Sorgner, "A *Metahumanist* Manifesto" (2011).

[36] A thoughtful example of this is found in Calverley, "Imagining a non-biological machine as a legal person" (2008).

formed by the technologization and posthumanization of our world and practical insofar as it seeks to aid management practitioners in creating and maintaining viable organizations within that posthumanized context. It is analytic insofar as it recognizes post-anthropocentric phenomena (such as the growing use of AI, social robotics, and virtualized interaction) that are already present within many organizations and synthetic insofar as it believes that such post-anthropocentrizing trends will continue to accelerate and will generate organizational impacts that can be shaped through the planning and execution of particular strategies.

Distilling Five Main Types of Posthumanism: Posthumanisms of Critique, Imagination, Conversion, Control, and Production

The types of posthumanism delineated by our two-dimensional framework are generalizations. The phenomena that can be assigned to any one type may differ significantly from one another, thus it is hazardous to assign a broad-brush description to a type of posthumanism and expect it to apply equally well to all of the posthumanisms included within that type. Nevertheless, as a starting point for further discussion, we would suggest that it is possible to capture the fundamental dynamic of each type of posthumanism.

For example, analytic theoretical posthumanisms might collectively be understood as manifesting a '**posthumanism of critique**' that employs posthumanist methodologies to identify hidden anthropocentric biases and posthumanist aspirations contained within different fields of human activity. Similarly, synthetic theoretical posthumanisms could be seen as exemplifying a '**posthumanism of imagination**' that creatively envisions hypothetical future posthumanities so that their implications can be explored. Analytic practical posthumanisms manifest a '**posthumanism of conversion**' aimed at changing hearts and minds and influencing the way in which human beings view the world around themselves. Synthetic practical posthumanisms exemplify a '**posthumanism of control**' that seeks either to develop new technologies that give individuals control over their own posthumanization or to implement legal or economic controls to govern the development of such technologies. Finally, hybrid posthumanisms that span all four spheres can be understood as examples of a '**posthumanism of production**' that develops a robust and rigorous theoretical framework that is then employed to successfully generate concrete products or services within the contemporary world. An overview of these five main types of posthumanism is reflected in Figure 2.

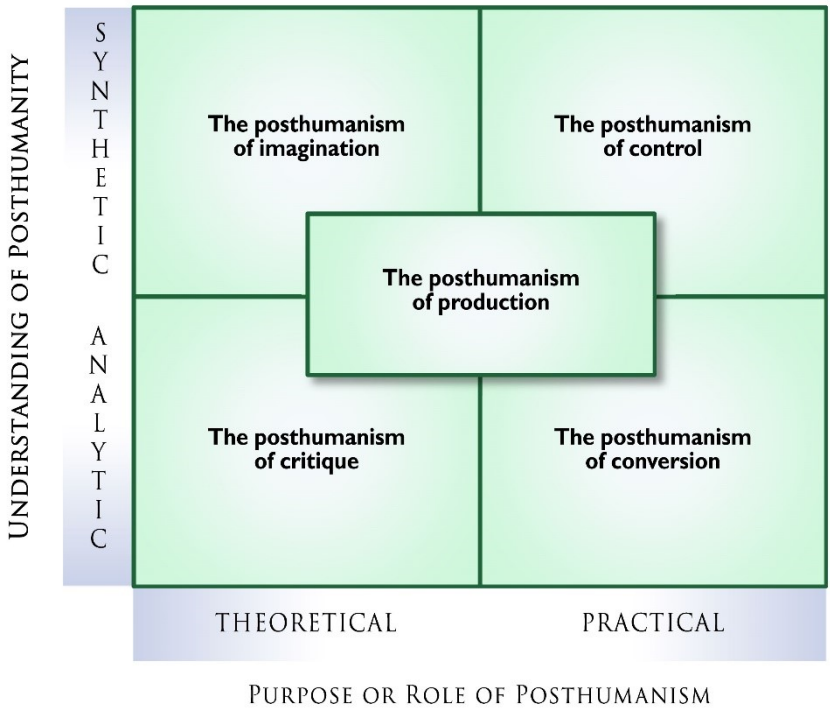

Fig. 2: The five types of posthumanism delineated by our two-dimensional model can be understood informally as posthumanisms of critique, imagination, conversion, control, and production.

IV. Classification and Analysis of Individual Forms of Posthumanism

A review of the literature reveals many different phenomena that have been identified as forms of posthumanism or which more generally have been described as 'posthuman' or 'posthumanist' in nature. Below we classify and analyze many such phenomena utilizing our two-dimensional typology.

A. Analytic Theoretical Posthumanisms: Seeking to Understand the Posthumanized Present

Analytic theoretical posthumanisms can collectively be understood as constituting a 'posthumanism of critique' that employs posthumanist methodologies to uncover hidden anthropocentric biases and posthumanist aspirations that are concealed within different fields of human activity. Such forms

of analytic theoretical posthumanism include critical posthumanism, cultural posthumanism, the posthumanities (or 'digital humanities'), feminist new materialism, antihumanism, and some forms of metahumanism and neohumanism. We can consider each of these in more detail.

1. Critical Posthumanism

Critical posthumanism is an academic form of posthumanism developed primarily from within the disciplines of the humanities. It constitutes a form of **analytic theoretical posthumanism** in that it applies critical methodologies to challenge our contemporary conception of humanity and to spur the development of more appropriate theoretical frameworks. Critical posthumanism does not come 'after' humanism in a chronological sense but instead follows from humanism in a conceptual sense; Herbrechter explains this by stating that critical posthumanism "inhabits humanism deconstructively,"[37] critiquing historical binary conceptual oppositions between subject and object, biological and artificial, human and machine, human and animal, nature and nurture, and male and female.[38] Unlike many strains of postmodernism, such critical posthumanism is not nihilistic;[39] it is not about destroying the human subject but about recognizing a whole wealth of subjects that had never before been fully acknowledged or which – because of an absence of the necessary sociotechnological environment – could not previously exist in the real world.[40]

Assimilation of the nonhuman. Critical posthumanism seeks to create an account of the personal subject that is descriptive rather than normative and which does not consider 'humanity' as historically (and narrowly) defined but instead addresses a broader universe of entities that includes 'natural' human beings as well as related entities like ghosts, angels, monsters, cyborgs, artificial intelligences, and extraterrestrial beings that have traditionally been considered quasi-human, parahuman, or nonhuman.[41] Critical posthumanism possesses an empathy for such excluded beings in part because it claims

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[37] Herbrechter (2013), pp. 6-7.

[38] The raising of such challenges to historical binary and dualistic thought is a hallmark of posthumanism. See, e.g., Herbrechter (2013), pp. 79, 90.

[39] Regarding the positive aspects of critical posthumanism that distinguish it from more negational forms of postmodernism, see Herbrechter (2013), p. 196.

[40] See Herbrechter (2013), p. 198.

[41] Regarding the wide spectrum of entities that are important for critical posthumanism, see, e.g.,

that we owe our humanity to them: while some humanists contend that the 'human being' is defined first and then all entities that fail to satisfy that definition are excluded as being 'nonhuman,' critical posthumanism argues that in reality it was our inherent understanding of the myriad forms of the 'inhuman' that first allowed us to define the 'human' in opposition to them.[42] In a sense, critical posthumanism is thus nothing new; it is an age-old, nontechnological, deconstructive process that continually challenges our understanding of (and exclusive identification with) the 'human' by bringing into our circle of awareness examples of the inhuman and nonhuman.[43] It has existed for as long as monsters, angels, mythic heroes, and the relationship of such entities to human beings have been pondered within works of art, literature, philosophy, and theology.

Posthumanism with or without technology. In contrast with transhumanism – which is closely identified with particular technologies – critical posthumanism can thus take the form of a 'posthumanism without technology'[44] that focuses on anthropological, linguistic, or aesthetic questions rather than issues of biomedical engineering. However, as a practical matter, critical posthumanism's consideration of the 'nonhuman other' has taken on a new focus and urgency thanks to the accelerating processes of technologization that are now reshaping humankind. Critical posthumanism does not formulate a critique of technology *per se* but of the processes of technologization by which technological mechanisms, systems, and attitudes are consolidating their power over all aspects of human life. Critical posthumanism recognizes the fact that human beings are – and have always been – locked in a symbiotic relationship of coevolution with our technology; it analyzes and critiques this process, without condemning or embracing it *a priori* in the way that biopolitical posthumanism often does.[45]

Diagnosing 'speciesism.' Critical posthumanism considers the cases of nonhuman entities as a means of diagnosing what it sees as previously unnoticed

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Herbrechter (2013), pp. 2-3, 106.

[42] For a discussion of the logical and practical priority of the 'human' or 'nonhuman,' see Herbrechter (2013), p. 55, and its reflections on Curtis, "The Inhuman" (2006), p. 434.

[43] Herbrechter (2013), p. 44.

[44] Regarding nontechnological forms of posthumanization, see Herbrechter (2013), p. 157.

[45] For a discussion of our symbiotic relationship with technology and critical posthumanism's attitude toward it, see Herbrechter (2013), pp. 90, 19.

forms of 'speciesism' or anthropocentric bias that have long permeated human political, economic, scientific, artistic, and religious activity.[46] For example, traditional cultural studies are highly anthropocentric, insofar as they assume that 'humanity' (or something closely mimicking it) is required in order for culture to exist; thus animals may have societies, but they do not possess culture. Critical posthumanism, on the other hand, does not assume as a starting point that culture logically requires humanity; indeed, it explicitly rejects this notion.[47] Critical posthumanism accepts the fact that human beings are no longer the only intelligent social actors within the world; we are increasingly only one of many kinds of individuals – both real and virtual, biological and electronic – that populate a rich and complex digital-physical environment and shape it through our interactions.[48] Critical posthumanism thus seeks to identify hidden assumptions that only human beings – and not, for example, social robots or genetically enhanced domesticated animals – are capable of filling particular roles within society or that human activity should be carried out with the sole purpose of benefitting human beings.

A critique of cybernetics, virtualization, and transhumanism. While critical posthumanism appreciates the value of robots and AIs in helping us to better understand the nature of human intelligence and agency, it does not share transhumanism's zeal for attempting to literally transform human beings into virtualized or robotic entities. Indeed, a major aim of critical posthumanism is to resist the defining of 'mind' as a disembodied collection of information in the manner promoted by many forms of transhumanism and some of the more techno-idealistic branches of cybernetics.[49] As envisioned by Haraway, for example, critical posthumanism is not simply an approach bent on destroying traditional anthropocentric presumptions; it also displays a positive element that seeks to formulate a new understanding of human beings as 'embodied

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[46] Ferrando (2013), p. 29.

[47] Regarding the conceptual relationship of humanity to culture, see Badmington, "Cultural Studies and the Posthumanities" (2006), p. 270, and its discussion in Herbrechter (2013), p. 174.

[48] Miller (2012), p. 164. For a philosophical analysis of posthumanized digital-physical ecosystems and the interdependencies existing among their human and nonhuman actors that advances and refines conventional Actor-Network Theory (ANT), see Kowalewska, "Symbionts and Parasites – Digital Ecosystems" (2016).

[49] For critical posthumanism as a challenge to techno-idealism and transhumanism, see Herbrechter (2013), p. 94.

selves.'[50] Similarly, Hayles foresees a danger that the growing cultural fascination with virtual reality might encourage a false belief that information can exist in a disembodied form; her critical posthumanism thus aims to ensure that processes of posthumanization do not result in the dematerialization of human beings but in our rematerialization – in a recognition that we are networked corporalities, material-digital beings, and not pure information as some transhumanists might claim.[51] Critical posthumanism also challenges transhumanism by devoting attention to questions of power and privilege; Ferrando notes that critical posthumanism explicitly analyzes such issues, while transhumanism is singularly 'non-critical' in its lack of interest in the historical development of humanity and its naïve presentation of a generic 'human being' that exists without reference to social or economic class, sex, race, ethnicity and nationality, interpersonal relationships, or religion and spirituality.[52]

Creating a concept of humanity that can endure. It is possible to argue that far from 'destroying' the concept of humanity in a postmodernist sense, critical posthumanism is actually aimed at saving the concept of humanity; critical posthumanism accomplishes this by transforming our notion of 'humanity' into a broader concept of 'posthumanity' that does not require the continued survival of human beings in some mythically pristine, unengineered, untechnologized, and 'natural' biological form but which instead welcomes into the family of (post-)humanity a wider range of biological, artificial, and hybrid subjects. According to this view, even if 'humanity' in the narrow humanist sense were to someday suffer extinction, a more broadly understood 'posthumanity' would be likely to survive. Indeed, some have suggested that by insisting on a definition of humanity that is so rigidly anthropocentric, it is humanism itself that has created the risk of the eventual 'dehumanization' of the universe through the elimination of biological humankind. Critical posthumanism might thus be understood as a sort of conceptual lifeboat that

[50] Regarding critical posthumanism's efforts to fashion a positive concept of the embodied self, see Haraway, *Simians, Cyborgs, and Women: The Reinvention of Nature* (1991), and Herbrechter (2013), pp. 99-100.

[51] For the critical posthumanist rejection of an understanding of the human entity as pure information, see Hayles (1999) and its discussion in Herbrechter (2013), pp. 185-86.

[52] Ferrando (2013), p. 28.

opens the door to the long-term persistence of a world of sapient (if not 'naturally human') posthuman persons and subjects.[53]

Humanism, rehumanism, or alterhumanism? Rather than continuing recent postmodernist trends of disparaging humanism, critical posthumanism might be seen as constituting a renaissance of a transformed and deanthropocentrized humanist thought.[54] Indeed, Herbrechter suggests that posthumanism might be understood as a sort of autoimmune response generated by the larger humanistic culture that can serve to liberate contemporary human beings from the more oppressive and problematic aspects of humanism, thereby leading to the first full flowering of true humanism. However, critical posthumanism attempts to counteract the more dehumanizing aspects of posthumanization not through a strategy of nostalgic 'rehumanization' that restores classical humanism to an authoritative role but through a form of 'alterhumanism' that expands itself to encompass entities and perspectives previously dismissed as inhuman.[55]

Critical posthumanism as a bridge between posthumanisms. Herbrechter's efforts to fashion a "critical but open-minded posthumanism"[56] are suggestive of the fact that critical posthumanism is well-positioned to serve as an impartial mediator and translator between conflicting posthumanist positions. For example, Herbrechter draws on Thacker's attempts to describe the growing informatization of human beings and conversion of the human body into 'biomedia' in a way that is critical but value-neutral and does not inherently support transhumanist or bioconservative positions.[57]

Similarly, Herbrechter argues that critical posthumanism represents a sort of reversible methodological process that can translate between the two spheres or levels of the human being as personal subject and human being as viable system. Taking the human subject as its starting point, critical posthumanism can draw on the insights of postmodernism to deconstruct that subject and move to the atomic realm of processes and relations that constitute

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[53] For the notion that humanism may be the true threat to humanity and posthumanism its rescuer, see Herbrechter (2013), pp. 123-24, 187, and its commentary on Hayles (1999), p. 290.

[54] Regarding posthumanism as the refinement and fulfillment of humanism, see Herbrechter (2013), p. 106.

[55] For critical posthumanism's ability as an 'alterhumanism' to critique the detrimental effects of posthumanization without resorting to naïve humanism, see Herbrechter (2013), pp. 76-77, 70.

[56] Herbrechter (2013), p. 171.

[57] For such more or less value-neutral analyses of posthumanization, see Thacker, "What Is Biomedia?" (2003), p. 52, and the discussion of it in Herbrechter (2013), pp. 191-92.

what is referred to as a 'human being.' Conversely, by drawing on insights from cybernetics and systems theory, critical posthumanism can begin with a collection of discrete processes and relations and correlate them to show how their interactions create a system that constitutes a human (or posthuman) subject. Critical posthumanism might thus serve as a bridge between postmodernism and cybernetics.[58]

Posthuman Realism

One form of critical posthumanism sometimes referred to by its own name is the strain formulated by Hayles known as 'posthuman realism.' As described above, it emphasizes the embodiment of the human being within a finite and nonexchangeable biological substrate, which contrasts with techno-idealist and transhumanist visions of the human mind as a virtualized entity or collection of disembodied data that can be shifted from one body to another (and between biological and electronic substrates) without imperiling its consciousness or personal identity.[59]

2. Cultural Posthumanism

Miah places the origins of cultural posthumanism in *Posthuman Bodies,* edited by Halberstam and Livingstone in 1995. Other formative figures identified by Miah include Haraway, Hayles, Badmington, and Graham.[60] As a form of **analytic theoretical posthumanism**, cultural posthumanism understands 'posthumanity' to be a state that already exists within our contemporary world. It argues that the nature of posthumanity can be diagnosed by applying the tools of cultural studies to analyze elements of contemporary culture, including works of literature, film, television, music, painting, sculpture, architecture, fashion, computer games, tabletop roleplaying games, and religious and political speech.

Affinity with critical posthumanism. Some authors treat cultural posthumanism and critical posthumanism as though they were the same discipline; other scholars classify critical posthumanism as a subset of cultural posthumanism or *vice versa*. Indeed, the overlap between cultural and critical posthumanism is significant, and many thinkers have worked to advance both forms of

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[58] Regarding critical posthumanism as a mediator between postmodernist understandings of the subject and cybernetics, see Herbrechter (2013), pp. 198-99.

[59] See Hayles (1999), p. 5, and Herbrechter (2013), p. 43.

[60] Miah (2008), pp. 76, 78.

posthumanism. Like critical posthumanism, cultural posthumanism can take the form of a 'posthumanism without technology': rather than awaiting or building a future of technologized beings, cultural posthumanism focuses on the present in which humanity already "collapses into *sub-*, *inter-*, *trans-*, *pre-*, *anti-*."[61] Cultural posthumanism also shares with critical posthumanism a strong second-order element, in that it seeks to understand the cognitive and social dynamics by which cultural posthumanism is generated. In fact, Miah argues that the most coherent and explicit theories of posthumanism have been developed from within the fields of cultural and literary studies and communications.[62]

Differences from critical posthumanism. Despite the links between cultural and critical posthumanism, differences can be discerned between the two fields. For example, in exploring posthumanism's origins in the 1990s, Ferrando distinguishes the critical posthumanism that emerged within the sphere of literary criticism and which was driven primarily by feminist theorists from the cultural posthumanism that emerged simultaneously within the field of cultural studies.[63] Unlike critical posthumanism (and biopolitical posthumanism), cultural posthumanism does not privilege issues relating to subjectivity, ethics, politics, and power relations but seeks to develop a broader analysis of posthumanization processes that gives equal weight to their aesthetic, artistic, and theological facets. Beyond highlighting deficiencies in existing bodies of thought, cultural posthumanism can also play a proactive role in building the 'posthumanities' that will increasingly become the focus of study at universities.[64]

Cultural visions of a posthumanized future as diagnoses of the posthumanized present. Both critical and cultural posthumanism analyze the state of posthumanity as it exists in the present moment; however, while critical posthumanism typically focuses on the effects of posthumanization that have already impacted human beings, cultural posthumanism also studies cultural depictions of future social and technological change (e.g., as presented in works of science fiction), insofar as they reflect a current desire for or fear of posthumanization. However, depictions of breakdowns in the binary opposition of human

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[61] See *Posthuman Bodies*, edited by Halberstam & Livingstone (1995), p. viii, and the commentary in Miah (2008), p. 76.

[62] Miah (2008), pp. 75-76.

[63] Ferrando (2013), p. 29.

[64] Herbrechter (2013), p. 143.

and inhuman can be found not only in science fiction but in all types of cultural texts, from ancient to contemporary works; thus cultural posthumanism has a vast field of objects for study.[65]

Cultural products as harbingers of posthuman oppression or liberation. As previously noted, critical posthumanism does not take an *a priori* stance in favor of either technoeuphoric transhumanism or technoparanoid bioconservatism; it instead tries to honestly understand and critique both positions.[66] Nevertheless, in practice critical posthumanism injects itself into such biopolitical discourses in a way meant to expose perceived biases and shift the processes of posthumanization in a direction of greater justice and equity. Miah argues that despite its supposed neutrality regarding the value of posthumanization, cultural posthumanism, too, often reflects an implicit concern that revolutionary new technologies will be appropriated by the powerful in a way that thwarts the realization of social justice for the less privileged. Cultural posthumanism documents the ways in which cultural products explore the power of the posthumanization process to either liberate or oppress human beings.[67] Miah suggests that this investigation of the meaning of justice and ethics in a posthumanized world represents a common interest of both cultural and philosophical posthumanism.[68]

3. The Posthumanities (or Digital Humanities)

Ferrando notes that while the word 'posthumanities' can refer to a collection of future posthumanized species, it can also denote a set of academic disciplines that are in the process of succeeding the historical disciplines of the humanities.[69] The nature of such 'posthumanities' is as diverse and ambiguous as that of posthumanism itself. On the one hand, the posthumanities can include disciplines like critical and cultural posthumanism that explicitly incorporate posthuman realities into their subject matter or posthumanist conceptual frameworks and techniques into their methodologies; such posthumanities offer a skeptical assessment of posthumanizing and technologizing trends. On the other hand, the term 'posthumanities' is sometimes

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[65] Regarding the broad range of cultural artifacts that may reflect posthumanist themes, see Herbrechter (2013), p. 143.

[66] See Herbrechter (2013), p. 84.

[67] Regarding this dual potential of the forces of posthumanization, see Herbrechter (2013), p. 85.

[68] Miah (2008), p. 79.

[69] Ferrando (2013), p. 32.

used as a synonym for the 'digital humanities,' a group of fields that are on the vanguard of the technologization of academia. Displaying a techno-enthusiasm similar to that of transhumanism, posthumanities of the latter sort advocate the replacement of "analog or literacy-based knowledge structures" with virtualized digital collections of data.[70]

Human nature and the posthumanities. Herbrechter notes that simply because critical posthumanism considers 'human nature' to be a cultural artifact, it is not obligated to claim that human nature is unworthy of study. Indeed, the critical posthumanities will be well-positioned to investigate human nature in a way that expands the scope of such a 'nature' in a deanthropocentrizing manner.[71] With its insights into the history, structure, and practices of various spheres of culture, cultural posthumanism can play a role in taking the critical methodologies developed within critical posthumanism and applying them across the current range of the humanities to develop nonanthropocentric and nonbinary posthumanities that can survive and thrive despite their loss of the concept of human nature that has historically served as the anchor of the humanities.[72]

Counteracting the forces of scientism. From the perspective of critical posthumanism, one important aim of the posthumanities is to ensure that disciplines such as philosophy, theology, history, and the arts continue to play a role in shaping our understanding of human nature and that fields such as neuroscience, biology, chemistry, and computer science do not appropriate for themselves the sole privilege and responsibility of defining what is and is not human. In this way, Herbrechter suggests that the posthumanities can help guarantee that binary and anthropocentric historical humanism is succeeded by a nondualistic and nonanthropocentric posthumanism rather than by a 'scientistic' posthumanism that simply replaces the transcendental idol of the human with a new transcendental idol of science.[73]

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[70] For the posthumanities as a possible driver (rather than critic) of digitalization, see Herbrechter (2013), p. 179.

[71] Herbrechter (2013), p. 168.

[72] This is similar to the previously discussed notion that posthumanism might serve as the rescuer of a faltering humanism. See Herbrechter (2013), p. 143.

[73] For the posthumanities as a bulwark against scientism, see Herbrechter (2013), p. 169.

4. Feminist New Materialism

Ferrando cites a range of 'new materialisms' that have arisen as a largely feminist response to late postmodernism; they represent a pushback against those forms of postmodernism that had resolved the historic 'nature versus nurture' debate by strongly emphasizing the importance of culture and education while downplaying the role of biology and matter in shaping human existence.[74] New materialism's link to posthumanism lies in the fact that rather than resolving such a binary question in one direction or the other, it dissolves the dualism that pits language and culture against biology and matter. As Ferrando explains, within new materialist thought "biology is culturally mediated as much as culture is materialistically constructed," and matter cannot be separated from the dynamic and performative process of its ongoing materialization.[75]

Herbrechter offers a similar account of the neovitalism that arises from a "feminist materialist, life-affirming tradition" which offers a critique of the more death-centered philosophy of, for example, Derrida. For Herbrechter, the posthumanist aspect of new materialism can be seen in its effort "to reposition the notion of 'life' outside propriety or impropriety, namely by 'de-athropo-centring' and 'de-ontologizing' it."[76] He also notes that strong feminist elements have long been found within mainstream critical posthumanism; Haraway, for example, suggests that the posthumanizing dissolution of the boundary between human being and machine resulting from the technologization and cyborgization of our lives can also be exploited to dissolve other boundaries such as those relating to gender.[77]

5. Antihumanism

The term 'antihumanism' has been used to describe an array of phenomena that bear some relationship to posthumanism. Some forms of antihumanism are directly identified with posthumanism; for example, Miah characterizes Pepperell's theory of posthumanism – in which the technological tools that once gave humankind dominance over nature now threaten to

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[74] Ferrando (2013), pp. 30-31.

[75] Ferrando (2013), p. 31.

[76] Herbrechter (2013), p. 212.

[77] The recognition of such blurring boundaries has long been at the core of posthumanism. See Haraway (1991) and Herbrechter (2013), pp. 99-100.

claim dominance over us – as a form of "*anti*-humanism, which is re-enlightened by modern science."[78] Other forms of antihumanism are described as diverging from posthumanism in key respects. For example, Ferrando conceptualizes 'antihumanism' as sharing a central tenet with posthumanism: namely, a radical critique of "modern rationality, progress and free will" that constitutes a "deconstruction of the notion of the human." However, the deconstruction offered by posthumanism argues that simple binaries such as 'human versus nonhuman' are no longer meaningful and that human beings are not (any longer) the only kinds of personal subjects that constitute our society. Antihumanism, on the other hand, claims that the binary of 'life versus death' is still meaningful – and that the human being, as such, is dead. Ferrando argues that while posthumanism draws much from the deconstructive approach of Derrida, antihumanism has more in common with the 'death of Man' propounded by Foucault.[79]

Drawing on Badmington, Herbrechter suggests that antihumanism is frequently just a well-disguised form of humanism, insofar as it does not develop its own independent perspective but instead simply defines itself as the negation of all that humanism stands for. However, denying the exclusive centrality of the 'human' is not the same thing as embracing the joint centrality of the 'human and nonhuman'; from the perspective of critical posthumanism, antihumanism thus presents an insufficient challenge to the fundamentally anthropocentric doctrines of humanism. While antihumanism remains locked into the binary patterns that characterize humanist thought, critical posthumanism makes a concentrated effort to break down those historical binaries, replacing them with richer and more sophisticated conceptual schemas.[80]

While the relationship of antihumanism to posthumanism is thus complex, building on Ferrando's analysis we would suggest that at least some forms of antihumanism have evolved to take on characteristics indicative of posthumanist thought. We would argue that such antihumanism is most naturally classified as a form of **analytic theoretical posthumanism**. While such antihumanism differs from critical posthumanism in its attitude toward binary frameworks and post-anthropocentrism, it shares critical posthumanism's rejection of simplistic post-Enlightenment humanism, its goal of developing

[78] See Miah (2008), p. 75, and Pepperell, *The Posthuman Condition: Consciousness Beyond the Brain* (2003).

[79] Ferrando (2013), pp. 31-32.

[80] Herbrechter (2013), p. 126.

a more accurate understanding of the nature of humanity, and an emphasis on analyzing the state of humanity as it has come to exist rather than in some engineered form that it might take in the distant future.

6. Metahumanism as Rehumanism

There have arisen at least three independent uses of the term 'metahumanism.' These are: 1) metahumanism understood as a form of 'rehumanism,' as formulated by Sanbonmatsu; 2) metahumanism as an activist movement in support of those who have been subject to metahumanizing mutation, as formulated in numerous works of science fiction and fantasy; and 3) metahumanism as a philosophical and artistic approach and movement of relational 'metabodies,' as formulated by Del Val and Sorgner. We would argue that the first form of metahumanism constitutes a type of analytic theoretical posthumanism; it will thus be considered in more detail here. The second form of metahumanism will be discussed later as a form of synthetic practical posthumanism, and the third will be explored as a type of hybrid posthumanism that spans theoretical, practical, analytic, and synthetic spheres.

Writing in 2004, Sanbonmatsu formulated a concept of 'metahumanism' not as a form of posthumanism but rather as a critical response to and explicit rejection of it. He argues that within our contemporary world,

> [...] in the Western academy, cultural studies theorists and other academic intellectuals hold conferences celebrating our so-called post-human times, singing the virtues of cyborgs, prosthetics, and bioengineering. Post-humanism is merely the latest in a string of commodity concepts spun off by academic industrialists to shore up the crumbling appearance of use value in their work.[81]

In this view, posthumanism is presented as perhaps the most degenerate iteration of a disintegrating Western critical tradition, while metahumanism is proposed as a form of thought that can rescue the critical tradition by confronting and vanquishing posthumanism. In its contents, such metahumanism would essentially appear to be a reborn humanism operating under a different name. Thus Sanbonmatsu argues that "If critical thought is to survive this implosion of theory" represented by posthumanism, posthumanist thought must be challenged by a metahumanism that constitutes "a return

[81] Sanbonmatsu, *The Postmodern Prince: Critical Theory, Left Strategy, and the Making of a New Political Subject* (2004), p. 207.

to ontology and the grounding of thought in a meaningful account of human being" and which does not hesitate "to declare itself to be in defense of *this being that we are – or that we might become.*"[82]

Herbrechter considers Sanbonmatsu to be pursuing the "renewal of a leftist radical humanism in the name of a Kantian cosmopolitan tradition."[83] However, such metahumanism could instead arguably be understood as an idiosyncratic example of **analytic theoretical posthumanism**, insofar as it does not simply propose for adoption a naïve 19th-Century humanism that is unaware of the processes of technologization and posthumanization that have occurred during recent centuries. Rather than ignoring the rise of posthumanist thought, Sanbonmatsu's metahumanism explicitly critiques and seeks to learn from what it perceives as the errors of earlier posthumanist accounts. While such metahumanism can thus be viewed as an 'anti-posthumanism,' we would argue that it can alternatively be understood as a 'rehumanism' informed by posthumanist insights.

7. Neohumanism as the Embracing of Human Subjectivity

As is true for 'posthumanism' and 'metahumanism,' the term 'neohumanism' has been used to describe a divergent array of phenomena. For example, Herbrechter refers broadly to the discourse that pits "transhumanists versus neohumanists."[84] In that context, neohumanists can be understood as thinkers who disagree both with the postmodernist annihilation of the notion of humanity and the transhumanist idolization of a reengineered humanity; neohumanists seek to salvage the positive elements of humanism but in a manner that acknowledges ongoing processes of posthumanization. Similarly, Wolin employs the term when arguing that in his later works Foucault distanced himself from his earlier post-structuralist critique of modernity and formulated a new 'neohumanist' approach in which the existence of a free and thinking human subject is at least implicitly embraced.[85] If considered a form of posthumanism, such neohumanisms would take their place alongside critical posthumanism as a form of **analytic theoretical posthumanism**.

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[82] Sanbonmatsu (2004), p. 207.

[83] For this critique of Sanbonmatsu's metahumanism, see Herbrechter (2013), p. 71.

[84] Herbrechter (2013), p. 40.

[85] See Wolin, "Foucault the Neohumanist?" (2006), and Nealon, *Foucault Beyond Foucault* (2008), pp. 10-11.

B. Synthetic Theoretical Posthumanisms: Seeking to Understand a Future Posthumanity

Synthetic theoretical posthumanisms manifest a 'posthumanism of imagination' that creatively envisions hypothetical future posthumanities so that their implications can be explored.[86] Such forms of synthetic theoretical posthumanism include philosophical posthumanism, science fiction, prehumanism, and techno-idealism. We can consider each of these in more detail.

1. Philosophical Posthumanism

Philosophical posthumanism combines critical posthumanism's academic rigor with science fiction's practice of imagining possible future paths for the processes of posthumanization. It is a **synthetic theoretical posthumanism** insofar as it constructs scenarios of future posthumanities and its goal is to deepen human knowledge rather than to generate some economic, political, or technological impact.

Philosophical posthumanism draws on the insights of critical and cultural posthumanism, integrating them into traditional methodologies of philosophical inquiry in order to reassess earlier philosophical claims with a new awareness of the ways in which philosophy has been suffused with "anthropocentric and humanistic assumptions" that limit its scope, comprehensiveness, and effectiveness.[87] Moreover, as philosophy reflects on processes of posthumanization to envision the ways in which they will reshape ontology, epistemology, and ethics, this generates a new process of 'philosophical posthumanization' that takes its place alongside other technological and social forms of posthumanization.[88]

Origins in critical and cultural posthumanism. Ferrando recounts that during the 1990s feminists within the field of literary criticism developed critical posthumanism, which interacted with cultural posthumanism to give rise to philosophical posthumanism by the end of the decade.[89] Similarly, Miah considers the cyborg expositions of Haraway and Gray, the posthumanism of Hayles

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[86] As previously noted, an exception to this temporal pattern is prehumanism, which considers fictional or hypothetical beings of the far-distant past as an alternative to positioning them in the far-distant future.

[87] Ferrando (2013), p. 29.

[88] Herbrechter (2013), p. 176.

[89] Ferrando (2013), p. 29.

and Fukuyama, and Bostrom's transhumanism to have contributed to the development of philosophical posthumanism.[90] Philosophical posthumanism can be understood either as a form of philosophy that has adopted elements of posthumanist thought or as a new form of critical and cultural posthumanism that has chosen to focus its attention on traditional philosophical questions.

The differences between philosophical and cultural posthumanism, in particular, are frequently blurred. Even Miah, who clearly distinguishes philosophical posthumanism from its biopolitical and cultural siblings, notes that the analyses offered by philosophical posthumanism are often "inextricable from other cultural critiques." However, it is possible to identify differences between the two fields; for example, Miah suggests that while cultural posthumanism (as represented by Haraway and Hayles) is "intended to disrupt uniform ideas about what it means to be human and the social and political entitlements this might imply," philosophical posthumanism typically focuses on ontological, phenomenological, and epistemological questions surrounding scenarios of future technologization.[91]

Envisioning future posthumanity. Like cultural posthumanism, philosophical posthumanism contemplates not only current processes of technologization but also hypothetical futuristic technologies that do not yet exist but which have been envisioned in works of science fiction. While cultural posthumanism analyzes such fictional future technologies as a means of diagnosing current humanity's desire for or fear of further posthumanization, philosophical posthumanism uses hypothetical technologies as the bases for thought experiments that explore the ontological, epistemological, ethical, legal, and aesthetic implications of such future posthumanization. By exploiting philosophical methodologies and a knowledge of science and technology, such thought experiments allow philosophical posthumanists to understand the ways in which human nature may be transformed or superseded through

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[90] See Miah (2008), p. 80; Haraway, "A Manifesto for Cyborgs: Science, Technology, and Socialist Feminism in the 1980s" (1985); Gray, "The Ethics and Politics of Cyborg Embodiment: Citizenship as a Hypervalue" (1997); Gray (2002); Hayles (1999); Fukuyama (2002); and Bostrom, "A History of Transhumanist Thought" (2005).

[91] Miah (2008), pp. 79-80.

future posthumanization – without necessarily advocating or opposing such transformations in the way that a biopolitical posthumanist would.[92]

The phenomenon of environmental posthumanization. As conceptualized by Miah, a notable characteristic of philosophical posthumanism is that it does not focus on changes to human beings *per se* as the primary manifestation of posthumanization.[93] Instead, philosophical posthumanism posits a broader phenomenon in which posthumanization is occurring throughout the world as a whole. For example, the proliferation of social robots, artificial general intelligences, artificial life-forms, virtual worlds, ubiquitous computing, and the Internet of Things is expected to create a rich digital-physical ecosystem in which human beings are no longer the only – or perhaps even the most significant – intelligent actors. Such a post-anthropocentric and post-dualistic world would already possess a strongly posthuman character regardless of whether human beings undergo processes of biotechnological transformation or choose to remain in their 'natural' biological form.

Some strains of philosophical posthumanism effectively update historical Darwinian biological materialism for the age of artificial life, viewing the posthuman world as a place in which the differences between human beings and animals, human beings and robots, and human beings and electronic information systems are increasingly ones of degree rather than kind.[94] The relationship between the human and machine is explored especially by considering entities such as cyborgs in which those two realms have become physically and behaviorally fused.[95] It also addresses the ontological and ethical implications of new kinds of entities such as artificial general intelligences that have not yet been created in practice but for whose development much theoretical groundwork has been laid; this gives philosophical posthumanism a stronger future orientation than critical posthumanism, which is more concerned with ethical and social realities of our current day.

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[92] Regarding philosophical posthumanism's dispassionate analysis of processes of posthumanization, see, e.g., Miah (2008), p. 79.

[93] Miah (2008), pp. 80-81.

[94] For philosophical posthumanism's consideration of evolutionary processes in biological and non-biological entities, see Miah (2008), p. 82.

[95] Miah (2008), pp. 80-81.

2. Science Fiction

Herbrechter suggests that true science fiction is "the most posthumanist of all genres," as it takes seriously – and often advances – the ongoing "dissolution of ontological foundations like the distinction between organic and inorganic, masculine and feminine, original and copy, natural and artificial, human and nonhuman."[96] In its most representative form, science fiction attempts to construct coherent visions of a near- or far-future posthumanized world so that its nature and implications can be investigated; for this reason, science fiction can be categorized as a **synthetic theoretical posthumanism**.[97]

Science fiction versus posthumanist reflection on science fiction. It is important to distinguish science fiction itself from scholarly analysis *of* science fiction. While science fiction typically constitutes a form of synthetic theoretical posthumanism, the reflection on science fiction that is carried out, for example, by cultural posthumanists is often a form of analytic theoretical posthumanism. From the perspective of cultural posthumanism, science fiction's relevance does not depend on it portraying future technologies that are in fact strictly realizable; rather it is relevant because it reflects society's current 'cultural imaginary' and can thus be used to diagnose humanity's attitude toward the processes of technologization and posthumanization.[98] In a related fashion, when transhumanism draws inspiration from works of science fiction to spur the real-world pursuit of particular futuristic technologies, it constitutes a form of synthetic practical rather than synthetic theoretical posthumanism.

Science fiction and the genesis of posthumanism. From its birth, the field of posthumanism has been tied to the world of science fiction. Indeed, the work generally considered to contain the earliest allusion to a critical posthumanism, Hassan's 1977 text "Prometheus as Performer: Toward a Posthumanist Culture? A University Masque in Five Scenes," explicitly cites the film *2001: A Space Odyssey* and dawning questions about artificial intelligence as being

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[96] Herbrechter (2013), pp. 115-17.

[97] Building on Poster and Hayles, Herbrechter notes that the cyberpunk genre in particular – which attempts to construct realistic and realizable visions of a near-future technologized posthumanity – has most explicitly grappled with the nature of human beings as embodied informational processes and the ramifications of posthumanizing technologies that are expected to break down traditional humanist binaries and reshape the experience of human existence within the coming decades. See Goicoechea (2008); Poster, *What's the Matter with the Internet?* (2001); Hayles, *My Mother Was a Computer: Digital Subjects and Literary Texts* (2005); Hayles (1999); and Herbrechter (2013), p. 187.

[98] Herbrechter (2013), p. 117.

relevant to understanding the "emergent [...] posthumanist culture."[99] If posthumanism has always drawn on certain forms of science fiction, Miller suggests that – in complementary fashion – science fiction has always constituted a form of posthumanism. While 'posthumanism' as such may only have been labelled and defined during the last few decades, science fiction had already existed for centuries as an unrecognized form of posthumanism; only recently has critical theory begun to follow science fiction's example of radically reassessing the limits of human nature and the social and technological structures that circumscribe the meaning of 'the human.'[100]

Distinguishing science fiction from popular ('commercial') posthumanism. In places, Herbrechter writes of science fiction as though it were essentially a commercial enterprise whose contents are formulated by large corporations with the goal of maximizing revenue and profits – rather than a serious literary and artistic endeavor whose contents are crafted by individual authors, filmmakers, and game designers as a means of exploring difficult philosophical, political, and social issues facing humanity. Thus he emphasizes the "rather close 'co-operation' between science fiction, the film industry and its lobbies and the discourse on posthumanity in general."[101] However, such a view appears to be an oversimplification. We would argue that in the context of posthumanism, the phrase 'science fiction' is frequently used to refer to two spheres of human activity which are so qualitatively different in nature that they are better classified as two entirely different forms of posthumanism.

We would suggest that the term 'science fiction' be reserved for the first of these two types of posthumanism, which involves the construction of fictional scenarios (often set in the future) as a means of exploring the profound ontological, biological, ethical, social, and cultural implications of posthumanization. Works of science fiction are, in a sense, thought experiments similar to those utilized within philosophical posthumanism. However, while philosophical posthumanism employs the rigorous methodologies and critical apparatus of philosophy, science fiction exploits the freedom to draw on more artistic and less formally academic methodologies. Works such as paintings, sculpture, or music with science-fiction themes can explore the 'mood' or 'ethos' of posthumanization in a general sense. Artistic forms such

[99] See Hassan, "Prometheus as Performer: Toward a Posthumanist Culture? A University Masque in Five Scenes" (1977), and its discussion in Herbrechter (2013), p. 33.

[100] This point is made in Miller (2012), p. 164.

[101] Herbrechter (2013), p. 39.

as films or novels can present more detailed diegetic content but are consumed in a manner that is still largely passive. However, interactive media such as computer games and tabletop roleplaying games can put their human players in situations in which they face complex ethical dilemmas and must actively confront challenges associated with new posthumanized ways of being. As noted above, because of its emphasis on imagining future posthumanities and the fact that it is primarily geared at deepening human knowledge, science fiction can be best understood as a form of **synthetic theoretical posthumanism**.

The second kind of posthumanism that is sometimes described as a type of 'science fiction' (and which Herbrechter indeed takes to be the most representative form of science fiction) is what we would refer to as 'popular' (or 'commercial') posthumanism to distinguish it from science fiction proper. Examples of popular posthumanism include films, television series, and other works that are created either to generate maximum profits by engaging mass audiences or to condition the public to accept certain future actions by governments, corporations, or other institutions. Like posthumanist science fiction, popular posthumanism often employs storylines that are set in the future and which feature cyborgs, androids, artificial general intelligences, genetic engineering, virtual reality, and other posthumanizing technologies. However, rather than attempting to confront and thoughtfully explore the philosophical implications of such phenomena, popular posthumanism exploits posthuman themes instrumentally as a means of achieving some practical goal – such as generating revenue from movie ticket sales.

Some artistic products function simultaneously as works of both posthumanist science fiction and popular posthumanism; in practice, the division between these two types is rarely absolute. Nevertheless, the divergence in the goals of posthumanist science fiction and popular posthumanism can often be seen, for example, in the difference between complex original literary works and their later adaptations into Hollywood blockbuster films that feature a drastic simplification of the works' philosophical content coupled with more frequent explosions and a happy ending in which the protagonist defeats the (often technologically facilitated) threat to humanity.[102] Popular posthumanism will be considered in more detail later as a form of synthetic practical posthumanism.

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[102] For example, consider Asimov's *Robot* series of stories and novels as compared with the 2004 Will Smith cinematic vehicle, *I, Robot*.

3. Prehumanism

While some works of science fiction envision the extremely far future, other forms of theoretical posthumanism envision the extremely distant past. For example, some proponents of cultural materialism emphasize the billions of years that passed before intelligent life appeared on earth. These vast foregone eons are highlighted not because the events that occurred within them are of direct interest to posthumanism but because they contextualize and deanthropocentrize our present moment; they emphasize the fact that the universe is not dependent on humanity for its existence or meaning and that the whole era of humankind's flourishing is only a fleeting instant in comparison to the lifespan of the cosmos as a whole.[103] Practitioners of what might be called 'prehumanism' are not interested in performing a literal scientific reconstruction of the biological or anthropological characteristics of the precursors of modern human beings but rather in imagining such prehistoric beings from a metaphorical or hypothetical perspective in order to better appreciate the relationship of contemporary humanity to the timescale of the universe.

'Prehumanist' approaches generally constitute forms of **synthetic theoretical posthumanism**, insofar as they are grounded in imagination rather than critique. Herbrechter notes, for example, that the world of posthumanist speculative fiction includes not only works that explore future spaces but also ones that explore "fictional pasts or *verfremdet* (defamiliarized) presents."[104] As a posthumanist approach that looks back imaginatively to the past, prehumanism thus constitutes a mirror image of the posthumanist science fiction that looks ahead imaginatively to the future.[105] Works such as the cosmic horror literature of H.P. Lovecraft that feature alien entities that have existed for millions of years (or in a timeless parallel dreamworld) can be understood

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[103] See Herbrechter (2013), pp. 9-10.

[104] Such products are by no means limited to science fiction but can include works of any genre and theme that disorient and challenge their characters and readers. See Herbrechter (2013), p. 116.

[105] As described here, prehumanism is thus not 'pre-humanist' in the sense of considering the world that existed before the appearance of humanism but rather 'prehuman-ist' in the sense of considering the world that existed before the appearance of human beings. The usage described here thus differs from the way in which the terms 'prehumanism' and 'prehumanist' are employed in, e.g., Berrigan, "The Prehumanism of Benzo d'Allesandria" (1969), and Witt, "Francesco Petrarca and the Parameters of Historical Research" (2012), to refer to time periods that preceded and concepts that foreshadowed those of Renaissance humanism.

as examples of such prehumanism.[106] Other works such as *2001: A Space Odyssey* simultaneously constitute both: 1) prehumanism that uses the distant past as a setting for imagining a 'quasi-human' that already was; and 2) posthumanist science fiction that looks into the future to imagine a 'quasi-human' that has not yet been.[107]

4. Techno-idealism

Techno-idealism is a form of posthumanist thought closely linked to but distinct from transhumanism. It involves the belief that the sole essential part of a human being is the mind and that this 'mind' consists of a particular pattern of information. Because only a mind's pattern of information – and not the physical substrate in which the information is stored – is relevant, all of a brain's biological neurons can be replaced one by one with electronic replicas, and as long as the pattern of interactions found within the brain's neural network is preserved intact, the person's mind, consciousness, and identity would continue to exist within its new (and undying) robotic shell. From the perspective of techno-idealism, human beings' physical biological bodies are ultimately interchangeable and replaceable with physical robotic bodies or potentially even virtualized ones.

Contrast with critical posthumanism. Herbrechter portrays techno-idealists as yearning for 'technoscientific utopias' in which human engineers will someday unravel the mysteries of genetics, thereby allowing biological life to finally be transformed into pure, disembodied information; in this way, virtuality becomes a means to immortality as human beings "gain control over the 'book of life'."[108] He contrasts techno-idealism's naïve understanding of the nature of the human mind with the more thoughtful and incisive analyses conducted within critical and philosophical posthumanism. Indeed, Herbrechter suggests that critical posthumanism can largely be understood as an effort to defend the material anchoring of humanity against those techno-idealists who seek to virtualize and disembody everything – as manifested, for example, in their advocacy of mind uploading.[109]

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[106] See, e.g., Lovecraft, *The Dunwich Horror and Others* (1983) and *At the Mountains of Madness and Other Novels* (1985).

[107] See Kubrick's *2001: A Space Odyssey* (1968).

[108] Herbrechter (2013), pp. 103, 171.

[109] Herbrechter (2013), p. 95.

Complementarity to transhumanism. The 'posthumanity' envisioned by techno-idealism is one of hypothetical future entities like full-body cyborgs and uploaded minds. Techno-idealism does not, in itself, actively seek to engineer such beings but rather to develop conceptual frameworks for exploring their nature, capacities, and behavior; it can thus be understood as a form of **synthetic theoretical posthumanism**. However, in practice techno-idealist frameworks are often formulated by committed transhumanists seeking an intellectual justification for their concrete practical endeavors. Drawing on Krüger, Herbrechter traces the development of a 'radical techno-idealism' from Wiener's cybernetics, the futurology of the incipient Space Age, and the cryonics movement to figures such as More, Minsky, Moravec, Kurzweil, and contemporary transhumanist performance artists.[110] For many such individuals, the techno-idealism which says that human beings *can* achieve immortality through the development of transformative technologies is paired with a technological determinism which says that humanity inevitably *will* create and implement such technologies.[111]

It is not necessary, however, for transhumanists to hold techno-idealist beliefs. For example, one could conceivably deny that an uploaded mind is a 'true' human mind – while simultaneously arguing that such artificial intelligences should nonetheless be developed to serve as successors to humanity and a next step in the evolution of sapient intelligence within our world. Someone holding such a view would be a transhumanist but not a techno-idealist. Conversely, a person could conceivably accept the claim that a biological human brain can be gradually replaced by an electronic brain without destroying its owner's 'mind' – but without feeling the slightest inclination to see any human being undergo such a procedure. Indeed, such a person might feel a sense of revulsion at the idea that causes him or her to oppose the development of such technologies, even while accepting their efficacy on an intellectual level. Such an individual would be a techno-idealist but not a transhumanist.

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[110] See Krüger, *Virtualität und Unsterblichkeit* [Virtuality and Immortality] (2004), as discussed in Herbrechter (2013), p. 103.

[111] On this frequent pairing of theoretical and practical posthumanism, see Herbrechter (2013), p. 103.

C. Analytic Practical Posthumanisms: Seeking to Reshape the Posthumanized Present

Analytic practical posthumanisms seek to reshape an already-existing posthumanized world. They can be understood as constituting a 'posthumanism of conversion' that is aimed at changing hearts and minds and influencing the way in which human beings view and interact with their contemporary environment. Such forms of analytic practical posthumanism include some forms of metahumanism and neohumanism, which we describe in more detail below.

1. Metahumanism as Advocacy for Those Who Have Experienced Metahumanizing Mutation

Since the 1980s, the term 'metahuman' has been used within a range of science-fiction, superhero, and fantasy literature and roleplaying games to refer to a human being who has undergone a mutation or transformation that grants the individual a new physical form or altered sensory, cognitive, or motor capacities; the mechanics of the transformation may be portrayed as technological, magical, or otherwise preternatural in nature.[112] The term 'metahumanity' is employed within such a fictional world to describe either its typically diverse collection of metahuman beings or the state of being a metahuman. Within the context of such a fictional world, 'metahumanism' can describe either: 1) the condition of possessing metahuman characteristics (which can be viewed by different individuals as a blessing or a curse); or 2) a political or social movement that works to promote the safety, welfare, and basic rights of metahumans, who often suffer discrimination as a result of the radical otherness that can terrify or appall 'normal' human beings.

a. Anti-metahumanism as Discrimination against Metahumans

Within such a fictional context, 'anti-metahumanism' describes an opposing political, social, or religious movement that views metahumans either as a lesser form of being whose activities must be supervised, a threat to the

[112] See Ferrando (2013), p. 32. Perhaps the earliest published use of the term 'metahuman' in this sense (in particular, as an adjective referring to superhuman powers or abilities gained as a result of infection by an extraterrestrial virus) was in the anthology set in the shared *Wild Cards* superhero universe published in 1986. See, e.g., Milán, "Transfigurations" (p. 264) and "Appendix: The Science of the Wild Card Virus: Excerpts from the Literature" (p. 403), in *Wild Cards*, edited by Martin (1986).

welfare of regular human beings, or inherently evil.[113] Such oppression is typically described as being inflicted by natural, non-metahumanized human beings, although metahumans themselves are capable of displaying anti-metahuman attitudes and behaviors.

B. Classifying Metahumanism within the Fictional and Real Worlds

When classifying them as forms of posthumanism, metahumanism and anti-metahumanism can be understood from two perspectives, namely: 1) as they function within the fictional world in which they appear; and 2) as devices created by authors, filmmakers, or game designers and consumed by audiences within our contemporary real world. Within the fictional worlds in which they exist as political and social movements, metahumanism and anti-metahumanism depict a form of **analytic practical posthumanism**, insofar as they focus on an already existing (within the work's fictional timeline) posthumanity and either advocate for the adoption of particular policies or work directly to empower or suppress metahumanity.

However, within our real world, such fictional depictions of metahumanism and anti-metahumanism play a broader range of roles. Some creators of fictional works employ metahumans (and the reactions to them) as a means of critiquing our real-world presumptions and encouraging audiences to probe their own understanding of what it means to be human. In these cases, it is not being claimed by an author that posthumanized beings displaying those exact characteristics might someday come to exist; rather, metahumanity is being used as a device to compel contemporary audiences to consider their own humanity. Such metahumanism and anti-metahumanism serve as a form of **analytic posthumanism** that is either **theoretical** or **practical**, depending on whether it fills the role of a thought experiment or is intended to alter the way that audiences treat other human beings (or animals, artificial intelligences, and other nonhuman beings).

Other fictional works may feature metahumanism and anti-metahumanism in order to help audiences explore the many possible forms that future posthumanity might take and understand the interrelationships between posthumanizing technologies such as genetic engineering, neuroprosthetics,

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[113] For a depiction of anti-metahumanism, e.g., within the fictional universe of the *Shadowrun* roleplaying game, see the *Sixth World Almanac*, edited by Hardy & Helfers (2010), pp. 23, 35, 49, 54, 57, 79, 142.

and artificial intelligence. Such works are often forms of **synthetic theoretical posthumanism**;[114] however, they may also display aspects of **synthetic practical posthumanism**, if designed to foster attitudes of acceptance toward future metahuman beings.

3. Neohumanism as Advocacy for Engineered Beings

One variety of 'neohumanism' was described in an earlier section as a type of analytic theoretical posthumanism. The term 'neohuman' has also been used within the context of science fiction to describe genetically engineered human beings who possess a genotype derived from and similar to that of natural human beings but who have been given enhanced sensory, motor, and cognitive capacities. While some fictional neohumans are presented as relishing the engineered capacities that make them 'superior' to natural human beings, others resent these traits that they never chose to possess and which cause them to be seen as something other than fully human. Rather than emphasizing the engineered characteristics that set them apart, such neohumans may instead accentuate those shared genetic traits that link them with (the rest of) humanity.[115]

In such a context, 'neohumanism' would involve advocacy for the development of such engineered beings or defense of the rights and welfare of such persons, thus resembling metahumanism in its form of support for those who have experienced metahumanizing mutation. Such neohumanism would be a form of **analytic practical posthumanism** within the fictional worlds in which it is depicted, but it could be either **analytic** or **synthetic** and either **theoretical** or **practical** if evaluated according to the real-world reasons for which a creator of fiction decided to include it in his or her work.

4. Neohumanism as Spiritual Ultrahumanism

Another application of the term 'neohumanism' is in describing a holistic and universalist philosophy developed by Sarkar that is grounded in Tantric

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[114] This is especially true of works featuring future worlds in which metahumans can choose at least some of their 'nonhuman' traits, such as characters who acquire neuroprosthetic enhancements or study magic within the *Shadowrun* universe. Similarly, in many tabletop roleplaying games and computer games, a game's contemporary human player must invest significant time and care in selecting his or her character's metahuman characteristics from among a complex system of physical and cognitive attributes, advantages, disadvantages, skills, and equipment and possessions. See, e.g., the *Shadowrun: Core Rulebook 5*, edited by Killiany & Monasterio (2013).

[115] See *Interface Zero 2.0: Full Metal Cyberpunk*, developed by Jarvis et al. (2013), p. 107.

spiritual principles[116] and manifested in particular religious practices, works of art and literature, humanitarian and animal-rights initiatives, and a global network of schools guided by "a transcivilizational global pedagogy."[117] The goal of such a neohumanism is:

> [...] to relocate the self from ego (and the pursuit of individual maximization), from family (and the pride of genealogy), from geo-sentiments (attachments to land and nation), from socio-sentiments (attachments to class, race and religious community), from humanism (the human being as the centre of the universe) to Neohumanism (love and devotion for all, inanimate and animate, beings of the universe).[118]

This nominal dislocation of the human being from its historical position as the 'center of the universe' appears to have much in common with the post-anthropocentric attitude that is developed, for example, within critical posthumanism. However, that similarity is arguably superficial. Elsewhere, Sarkar writes that:

> Neohumanism will give new inspiration and provide a new interpretation for the very concept of human existence. It will help people understand that human beings, as the most thoughtful and intelligent beings in this created universe, will have to accept the great responsibility of taking care of the entire universe – will have to accept that the responsibility for the entire universe rests on them.[119]

Ferrando argues that some forms of transhumanism can actually be understood as an 'ultrahumanism' that seeks to advance post-Enlightenment rationality and scientific progress to its logical conclusion, thereby consummating humanism rather than superseding it.[120] A similar account might be offered of Sarkar's neohumanism: rather than rejecting the humanist vision of human beings as the supreme intelligent agents charged with exercising dominion over nature, neohumanism seeks to cement the position of human beings as the 'center of the universe' – albeit a center that serves as a loving caretaker for the rest of creation.[121]

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[116] See the "Foreword" to *Neohumanist Educational Futures: Liberating the Pedagogical Intellect*, edited by Inayatullah et al. (2006).

[117] "Foreword," *Neohumanist Educational Futures* (2006).

[118] "Foreword," *Neohumanist Educational Futures* (2006).

[119] Sarkar (1982).

[120] Ferrando (2013), p. 27.

[121] Indeed, Sarkar claims explicitly that "Neohumanism is humanism of the past, humanism of the present and humanism – newly explained – of the future." See Sarkar (1982).

Such neohumanism is **analytic**, insofar as it focuses its attention on the human beings who already exist today and the sociotechnological reality within which they are embedded. While such neohumanism possesses many elements that are explicitly philosophical in nature, the neohumanist project is geared primarily toward creating a movement whose adherents alter their daily lives to incorporate particular spiritual practices and who establish and operate schools, charitable institutions, and other organizations that embody the movement's philosophy; in this sense, neohumanism can be understood as a **practical** rather than theoretical posthumanism.

D. Synthetic Practical Posthumanisms: Seeking to Control the Processes Generating a Future Posthumanity

Synthetic practical posthumanisms reflect a 'posthumanism of control' that seeks to initiate, accelerate, guide, limit, or block future processes of posthumanization – typically through regulating the development of new technologies or through other political, economic, or social mechanisms. Such forms of synthetic practical posthumanism include biopolitical posthumanism (which itself includes bioconservatism and transhumanism) and popular or 'commercial' posthumanism. We can consider these in more detail.

1. Biopolitical Posthumanism

Biopolitical posthumanism encompasses a range of posthumanisms that all envision the engineering of a future 'posthumanity' but which differ in their assessment of whether such a development is desirable or undesirable. Biopolitical posthumanisms manifest a strong future orientation: they attempt to predict the long-term impact of pursuing particular new biotechnologies and – based on such predictions – work to actively facilitate or impede the creation of such technologies by spurring political or regulatory action, influencing public opinion, advancing scientific research and technology commercialization, or through other means. Such biopolitical posthumanisms are **synthetic** insofar as they understand posthumanity to be a collection of future beings whose creation can be purposefully brought about or avoided, and they are **practical** insofar as they seek to actively accomplish or block the advent of such posthuman beings.

Contrasting attitudes toward posthumanity. Different forms of biopolitical posthumanism are distinguished by their attitude toward biotechnological posthumanization. For Miah, biopolitical posthumanism can be divided fairly neatly into the opposing camps of 'bioconservative' thinkers like Fukuyama and 'technoprogressive' or transhumanist thinkers like Stock. Bioconservatives see the advent of posthumanity as a negative or retrogressive step – a loss of human dignity and a destruction of the characteristic essence that makes human beings unique – while technoprogressives see the arrival of posthumanity as an advance by which human nature is beneficially enhanced or its limits transcended.[122]

Birnbacher argues that the concept of 'posthumanity' is in itself value-neutral;[123] however, one could contend that for biopolitical posthumanists, 'posthumanity' is in fact an intensely *value-laden* term – but one whose 'authentic' value is disputed by two opposed ideological groups. Such an interpretation is consistent with Miah's observation that for some bioconservatives, the very word 'posthumanism' is presumed to represent a world so obviously horrific and morally bankrupt that little need is seen to offer specific arguments about why the creation of a 'posthuman' world should be avoided.[124]

Having reviewed biopolitical posthumanism in general, it is worth exploring in more depth its two most prominent forms: bioconservatism and transhumanism.

a. Bioconservatism

Bioconservatism is a form of posthumanism that came into existence largely as a rejection of the tenets of another form of posthumanism – namely, transhumanism.[125] For bioconservatives, the arrival of the posthu-

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[122] See Miah (2008), pp. 73-74. 'Factor X' is the term used by Fukuyama to describe the essence of humanity that is vulnerable to being corrupted through the unrestrained application of biomedical technology. This can be compared and contrasted, e.g., with the idea of 'essence loss' within the fictional *Shadowrun* universe. See Fukuyama (2002) and *Shadowrun: Core Rulebook 5* (2013), pp. 52-55, 396-97.

[123] Birnbacher (2008), p. 95.

[124] Miah (2008), pp. 74-75.

[125] Herbrechter (2013), pp. 36-37.

manity envisioned by transhumanism would bring about the 'dehumanization' of the human species.[126] Fukuyama is frequently cited as an eminent bioconservative as a result of his writing and public debating in opposition to transhumanism during his time as a member of the U.S. President's Council on Bioethics in the early 2000s. Habermas is also often cited as a leader in the world of bioconservative thought: while much of his work is highly theoretical, it includes a call to action that points toward practical applications, and the critiques and conceptual frameworks that he has developed provide a philosophical foundation for bioconservatism.[127]

Bioconservatism is a **synthetic posthumanism** insofar as it focuses its attention on hypothetical and emerging technologies that can potentially be used to engineer new quasi-human biological species or cyborgs that differ greatly from human beings as they exist today. It is a **practical posthumanism** insofar as it attempts to block the creation of such future posthumanized beings by rallying public opinion to support particular political and social initiatives; developing and promoting treaties, legislation, regulations, and policies for adoption by governments; pressuring companies, universities, and other institutions engaged in transhumanist programs to curtail such activities; and encouraging individual consumers to change the ways in which they spend their money and time.

Concerns regarding the social impact of posthumanization. Typical bioconservatism does not focus on the psychological, phenomenological, or ontological consequences of posthumanization for the individual posthumanized being. Instead, it sketches out the broad negative impacts that biotechnological posthumanization will supposedly have for human society as a whole – for example, by weakening government protections for human rights, lowering the ethical standards of corporations, creating economic injustice, pressuring entire social classes of human beings to modify themselves in order to compete economically, and perhaps even sparking civil war between those transhuman beings who have been genetically and cybernetically 'enriched' and those 'natural' human beings who, comparatively speaking, are genetically and cybernetically 'deprived.'[128] This emphasis on broad social concerns is re-

[126] Birnbacher (2008), p. 97.

[127] Herbrechter (2013), pp. 161-62.

[128] Miah (2008), pp. 73-74; Herbrechter (2013), p. 45, 162.

flected in Bostrom's characterization of the five main objections that bioconservatism offers to the purposeful creation of posthumanized beings – namely, that: 1) "It can't be done"; 2) "It is too difficult/costly"; 3) "It would be bad for society"; 4) "Posthuman lives would be worse than human lives"; and 4) "We couldn't benefit."[129]

B. Transhumanism

Transhumanism shares with analytic posthumanism its origins in the late 1980s and early 1990s and a "perception of the human as a non-fixed and mutable condition"; in other ways, though, the two perspectives are quite different.[130] Transhumanism does not look back into humanity's past to diagnose the social and technological legacy that we have inherited; instead it looks ahead to the future – and in particular, to the 'enhanced' human, quasi-human, or parahuman species that can be fashioned through the intentional application of genetic engineering, nanotechnology, cryonics, 'mind uploading,' and other emerging or hypothetical technologies.[131]

Understanding of posthumanity. Bostrom uses the word 'posthuman' in a concrete functional sense to refer to an engineered being that possesses at least one 'posthuman capacity' exceeding what is possible for natural human beings.[132] In Bostrom's conception of posthumanity, posthuman beings will not necessarily constitute the entirety – or even a large percentage – of future human society. Indeed, because of the cost and difficulty of the bioengineering equipment and techniques that are needed to create posthuman beings, it is likely that such beings will at least initially represent only a small portion of human society. This **synthetic** understanding differs from analytic forms of posthumanism in which all human beings are already considered to be posthumanized, insofar as we live in a world that is posthuman.

Attitude toward posthumanity. The attitude toward posthumanity expressed by Bostrom can be taken as typical of transhumanists more generally. Bostrom makes a nominal effort at suggesting that he is neutral regarding the question of whether posthumanity represents a step forwards or backwards in human development; he acknowledges that while transhumanism is only concerned

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[129] Bostrom (2008), p. 109.

[130] For an account of the origins of such forms of posthumanism, see Ferrando (2013), p. 26.

[131] Ferrando (2013), p. 27.

[132] Bostrom (2008), p. 108.

with creating forms of posthumanity that are "very good," there are undoubtedly other "possible posthuman modes of being" that would be "wretched and horrible."[133] Elsewhere, however, Bostrom appears to define posthumanity in such a way that it can only be a beneficial phenomenon. For example, he defines a 'posthuman being' not merely as one that has been technologically engineered to possess characteristics differing from those naturally possessed by human beings but as one who has been technologically engineered to possess either: 1) an enhanced "capacity to remain fully healthy, active, and productive, both mentally and physically"; 2) enhanced "general intellectual capacities [...], as well as special faculties such as the capacity to understand and appreciate music, humor, eroticism, narration, spirituality, mathematics, etc."; or 3) an enhanced "capacity to enjoy life and to respond with appropriate affect to life situations and other people."[134] Bostrom's view of 'posthumanity' is thus not value-neutral but strongly value-laden, as it would automatically exclude from being considered 'posthumanizing' any future technology that results in injury to human beings' health, a degradation of their cognitive capacities, or an impairment to their ability to enjoy social interactions – even if the technology were developed as part of a transhumanist bioengineering project whose explicit goal was to bring about the creation of posthumanity and its negative impacts were an unintended effect.[135]

Transhumanism as activism and project. In the understanding described above, 'posthumanity' is positioned as though it were a new form of space travel or nuclear power whose costs and benefits can be carefully weighed by a government panel that then decides whether to appropriate funds to bring such technology into existence or to ban the technology and prevent its development. This understanding is quite different from that of analytic posthumanism, which believes that posthumanity is inevitable because it is already here, and that the fundamental question is not whether one should seek to actively bring about or prevent the world's posthumanization but how to interpret it.

Critique from the perspective of critical and cultural posthumanism. Transhumanism involves efforts to intentionally engineer a new human species through the

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[133] This passing acknowledgement is found within an otherwise vigorous defense of the goal of engineering posthumanity. See Bostrom (2008), p. 108.

[134] Bostrom (2008), p. 108.

[135] Identifying posthumanity with an 'enhanced' humanity reflects an optimistic assumption that all posthumanizing bioengineering efforts will be driven by a well-intentioned (and effective) vision of 'improving' human nature and not, for example, by a desire to produce quasi-human workers, test subjects, toys, or personal companions that possess a diminished human nature and whose creation is driven by the self-interest of particular governments, corporations, or individual consumers.

use of emerging biotechnologies. It thus typically focuses on the technological posthumanization of humanity and ignores the many nontechnological ways in which posthumanization has been occurring for centuries. Ferrando notes that cultural and critical posthumanism are inclined to negatively assess such an approach. From their perspective, transhumanism appears to possess an overly simplistic conceptualization of the world: it is willing to perpetuate a post-Enlightenment vision of 'human exceptionalism' that places human beings in a hierarchy over nonhuman animals and nature – and indeed, transhumanism further expands this stratification of being by creating a new 'hierarchy of hierarchies' in which a soon-to-be-engineered posthumanity will peer down from its superior vantage point outside of the natural order. But transhumanism often glosses naïvely over the fact that such frameworks have historically been used to place some human beings (such as slaves) in positions of inhuman subjugation, that such injustices widely exist even today, and that the development of transhumanist technologies could easily exacerbate rather than solve such problems.[136] Thus Herbrechter positions the critical posthumanism of Hayles as being steadfastly opposed to transhumanism and its goal of achieving the radical disembodiment and dematerialization of the human intellect.[137]

Transhumanism as commercialization of the human being. Anders and Herbrechter suggest that at least some strains of transhumanism could be viewed as outgrowths of the West's hyper-commercialized culture of consumer technology. Members of society have been conditioned to covet the newest models of products – whether smartphones or televisions or automobiles – that possess the most innovative features and best specifications and are ostensibly far superior to last year's models; all 'sophisticated' and 'successful' members of society participate in a cycle of continuous product upgrades. According to this view, transhumanism laments – and is even ashamed by – the fact that the human mind and body are not a purposefully engineered consumer product that can be upgraded; through the application of biotechnologies and a reconceptualization of the nature of humanity, it seeks to transform the human being into just such a consumer product.[138] Although transhumanism envisions itself as a positive movement that seeks to exalt humanity by transcending the limits of human nature, it could thus alternatively be understood

[136] See Ferrando (2013), pp. 27-28.

[137] See Hayles (1999) and Herbrechter (2013), p. 94.

[138] See Anders, *Die Antiquiertheit des Menschen. Band 1: Über die Seele im Zeitalter der zweiten industriellen Revolution* (1992), pp. 31ff., as analyzed in Herbrechter (2013), p. 170.

as a negative movement that is embarrassed by the messy imperfections inherent in human beings' biological nature and which seeks to suppress that reality beneath a patina of technological enhancement.

Not all technologists are transhumanists. Not all (or even many) scientists, engineers, and entrepreneurs doing cutting-edge work in the fields of genetic engineering, neuroprosthetics, nanorobotics, and artificial intelligence are transhumanists; many individuals involved with developing new technologies for the engineering and augmentation of human beings are content to focus on the very concrete next steps involved with advancing the 'evolution' of humanity. For transhumanists, though, such incremental progress is a necessary but only preliminary step toward the creation of fully disembodied posthuman entities that can slip effortlessly between biological and electronic modes of being, between actual and virtual substrates.[139]

Religious aspects of transhumanism. Transhumanism frequently takes on aspects of a religious movement, formulating visions of "techno-transcendence and digital cities of god in cyberspace, of the overcoming of the flesh"; it thus cannot be understood simply from a technological perspective but also requires insights from the field of theology.[140] Some would even contend that transhumanism's conceptual origins lie in (arguably misguided) interpretations of the work of Catholic theologian Pierre Teilhard de Chardin and his idea of the 'noosphere' of shared digital information that would someday come to surround the globe.[141]

Building on Le Breton's analysis, Herbrechter suggests that from the perspective of critical posthumanism, transhumanism can be understood as a sort of 'neognostic' hatred of the body that privileges the mind over its vessel of flesh that continuously degrades and decays.[142] Such conceptual objections

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[139] See Herbrechter (2013), p. 101.

[140] Herbrechter (2013), p. 103.

[141] See Teilhard de Chardin, *Le Phénomène humain* (1955), and its discussion in Herbrechter (2013), p. 104. The revolutionary nature of Teilhard's scientific, philosophical, and theological investigations open them to many possible interpretations; his thought has frequently been appropriated by transhumanist groups that disconnect it from its ultimate grounding in the orthodox Catholic intellectual tradition and thus interpret it in ways that do not necessarily reflect its original import or context.

[142] See Le Breton, David, *L'Adieu au corps* (1999), pp. 49, 219-223, as discussed in Herbrechter (2013), pp. 96-97.

to transhumanism, however, are very different from bioconservatives' objections regarding the expected negative real-world impacts of transhumanist projects.

C. Three Typologies of Transhumanism

There are at least three ways of classifying different forms of transhumanism: from political, objective, and instrumental perspectives.

A political typology of transhumanism. Ferrando identifies three distinct strains within transhumanism:[143]

1) **Libertarian transhumanism** argues that the free market – and not governmental oversight – can best ensure that technologies for human enhancement are efficiently and effectively developed and made accessible within human society.
2) **Democratic transhumanism** seeks to ensure – for example, by means of government regulation – that technologies for human enhancement do not simply become privileges for the powerful and wealthy but are made freely accessible to all human beings regardless of their social or economic status.
3) **Extropianism** is a movement founded by More and others that advocates the development of genetic engineering, nanotechnology, cryonics, mind uploading, and other technologies that can supposedly allow human lives to be extended indefinitely and spent in pursuit of intellectual fulfillment.

This model for categorizing transhumanisms might be understood as constituting a 'political' typology of transhumanism, as it largely distinguishes transhumanisms according to their view of the role of governments in steering the development and deployment of transhumanist technologies.

An objective typology of transhumanism. Significant variations also exist between different forms of transhumanism regarding the kinds of entities that are objects of the process of biotechnological posthumanization. Another typology can thus be formulated by classifying strains of transhumanism according to their objects:

1) **Biotransformative transhumanism** seeks to employ transformative technologies to allow *particular human beings who are already alive* to transcend the limits of human nature through manipulation or

[143] Ferrando (2013), p. 27.

augmentation of their existing biological organisms – for example, through somatic cell gene therapy, cryonics, or neuroprosthetic enhancement.

2) **Biogenerative transhumanism** seeks to purposefully design the characteristics of *future beings who have not yet been conceived or born* (e.g., through the use of germline gene therapy (GGT) or synthetic biology to engineer a new superhuman species).

3) **Mimetic transhumanism** seeks to transcend the limits of human nature by creating superior and transcendent *beings that are wholly artificial and do not represent a continuation of humanity in an organic, biological sense* but which in some conceptual sense might nevertheless be considered our 'offspring' – and perhaps even more so than can our biological offspring, insofar as they would be consciously designed by human beings to embody our highest aspirations, rather than being the non-designed products of randomized biological reproductive processes. Such beings might include artificial superintelligences, sapient robot networks, or 'uploaded' human minds that are in fact artificial replicas rather than continuations of their human models.

Herbrechter agrees with Le Breton that for the group we refer to as biotransformative transhumanists, the most relevant power relationship is not that which allows other members of society to control (or be controlled by) an individual but that which allows the individual to control his or her own body.[144] For example, Herbrechter notes that for transhumanists like Warwick, transhumanism is about a rational humanist subject making a free choice between 'good' and 'evil' (or perhaps between 'good' and 'better') and choosing the path that will result in the most happiness and independence.[145] Biotransformative transhumanism might thus be understood as a form of extreme humanism.

On the other hand, some forms of radical mimetic transhumanism seek to actively break all connections with humanistic values. Building on McLuhan's notion of the 'global electric village,' Herbrechter observes that some transhumanists see it as humanity's role (and even responsibility) to give

[144] See Herbrechter (2013), pp. 96, and its analysis of Le Breton (1999), pp. 49.

[145] Warwick's views on human enhancement can be found, e.g., in Warwick, "The Cyborg Revolution" (2014). Such perspectives are analyzed in Herbrechter (2013), p. 102.

birth to our nonanthropic, artificially intelligent successors.[146] Similarly, drawing on Truong's analysis, Herbrechter notes that some transhumanists look forward with hope to the day when human beings will be replaced by the AIs that represent the next stage in the evolution of consciousness within our corner of the universe. It is anticipated that such artificial intelligences would eventually become fundamentally 'inhuman' as they evolve beyond the shackles created by human-like sociality, rationality, and knowledge; while 'consciousness' might thus continue to exist long after the demise of humanity, 'human-like consciousness' would not long survive the biological beings who provided its template.[147]

An instrumental typology of transhumanism. Distinctions also exist between the technologies advocated by different transhumanists for creating posthumanized entities. There are correlations between the goals held by particular transhumanists and the technologies used to pursue those goals; however, the alignment between goals and instruments is not absolute. Some transhumanists first choose the goal that they wish to accomplish and then seek to develop technologies to accomplish that goal. For them, achievement of their selected goal is paramount and the means used to achieve it are secondary and subject to change. On the other hand, some transhumanists work as scientists, engineers, entrepreneurs, ethicists, policy experts, or advocates specializing in a particular type of technology, such as artificial intelligence, neuroprosthetics, or germline gene therapy. For them, their paramount desire is discovering new avenues for improving humanity through the use of that particular technology; the specific ways in which that technology can be employed to create enhanced, transcendent, posthumanized beings are secondary. Such transhumanism can perhaps best be understood using the instrumental typology described here. For example, a scientist who specializes in developing new techniques for synthetic biology and who possesses transhumanist inclinations might pursue the use of such methods for biotransformative, biogenerative, and mimetic transhumanism, while a transhumanist researcher in the field of artificial intelligence might similarly pursue ways of applying AI to advance all three objective types of transhumanism.

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[146] Herbrechter (2013), p. 50.

[147] See Truong, Jean-Michel, *Totalement inhumaine* (2001), pp. 49, 207, as translated and analyzed in Herbrechter (2013), p. 172. See also Gladden, "The Social Robot as 'Charismatic Leader': A Phenomenology of Human Submission to Nonhuman Power" (2014).

2. Popular (or 'Commercial') Posthumanism

Herbrechter distinguishes between "a fashionable and popular posthumanism" and a more "serious and philosophical one." Occasionally, he seems to suggest that science fiction falls within the sphere of popular and faddish posthumanism – such as when he speaks of the intimate collaboration between science fiction and the commercial film industry and notes that the importance of science fiction for posthumanism is "most visible" when science fiction is considered "in its Hollywood blockbuster incarnation."[148] However, as noted earlier, we would argue that in its best and truest form, science fiction takes its place alongside philosophical posthumanism as a form of synthetic theoretical posthumanism that seeks to deepen our understanding of future posthumanities. While we would agree that for many members of the general public, Hollywood blockbusters represent the most *visible* presentations of explicitly posthumanist themes, they are typically not the most insightful, in-depth, or coherent presentations. By focusing on Hollywood blockbusters, Herbrechter minimizes the role of other forms of science fiction (such as novels, short stories, roleplaying and computer games, manga and anime, and independent films) that present more well-thought-out and incisive analyses of posthumanist themes. We would suggest that the more popular (if not populist) and commercially oriented works of speculative fiction – such as Hollywood blockbusters – can be better understood as a form of **synthetic practical posthumanism** that is geared specifically at generating particular economic, social, or political outcomes and which we will discuss here under the title of popular (or 'commercial') posthumanism. Works of popular posthumanism are typically aimed either at generating maximum profits for their producers, influencing public opinion to create a demand for new posthumanizing technologies, or preparing the public to accept changes to daily life that are being planned by government policymakers, corporations, or other powers.

Many of the criticisms directed broadly at the world of 'science fiction' can more accurately be understood as targeting the products and methods of commercial posthumanism. In discussing Best and Kellner's analysis of posthumanism, Herbrechter notes the claim that "Economic neoliberalism, free market ideology and late capitalist individualism can no longer be sepa-

[148] Herbrechter (2013), pp. 22, 39, 107.

rated from the various technological and cultural posthumanization processes."[149] According to that view, popular posthumanism can be seen as simply the most extreme manifestation of the link between commercial and political interests and the ongoing infusion of posthumanist themes into contemporary culture. Similarly, Herbrechter suggests that just as neuroscientists are exploring ways to exploit the plasticity of the human brain, so, too, "Global virtual hypercapitalism needs an equally plastic and flexible individual subject";[150] popular posthumanist narratives that emphasize the pliability, dissolubility, and reconfigurability of the human being support the development of subjects that are ready-made for control by corporate interests.

Indeed, Herbrechter notes the cynical argument that the apparent processes of posthuman technologization might simply be a ruse and distraction foisted cleverly on the public by the forces of neoliberal hypercapitalism that draw attention away from the "ever-increasing gap between rich and poor and the further concentration of power and capital" by subduing the masses with the hope or fear of a radically different future.[151] If such intentionally fabricated posthumanism exists, we would suggest that it takes the form not of critical or philosophical posthumanism (whose proponents are constitutionally on guard against such efforts at manipulation) but of techno-idealism, transhumanism, and the sort of commercial posthumanism described here. Indeed, Herbrechter alludes to the fact that complex, long-term, resource-intensive programs for developing new technologies for virtualization, miniaturization, surveillance, cyborgization, and artificial intelligence are being funded and led not primarily by philosophers who are interested in exploring the boundaries of human nature but by powerful commercial and governmental institutions (including banks, insurance companies, marketing firms, Internet and technology companies, and military and police organizations) that are seeking to develop such instruments for their own concrete ends. Such technologies not only give governments new tools for fighting crime and terrorism but also facilitate the invention of new forms of crime

[149] Herbrechter (2013), p. 55.

[150] Herbrechter (2013), p. 25.

[151] Herbrechter notes the substantiveness of this argument without necessarily fully endorsing it; see Herbrechter (2013), p. 23.

and terrorism (such as memory-hacking or the development of hybrid bioelectronic viruses[152]) that were never previously possible.[153]

Just as popular posthumanism can be employed as an instrument by corporations and governments to aid in their technoscientific consolidation of profits and power, so, too, can critical and sociopolitical posthumanism – with support from science fiction – play an important role in identifying these technologically facilitated efforts to gain hegemony and in developing creative new ways of conceptualizing the nature of citizenship in a posthuman world that guarantee a more democratic basis for political and economic power.[154]

E. Posthumanisms That Join the Analytic, Synthetic, Theoretical, and Practical

Hybrid posthumanisms that include strong analytic, synthetic, theoretical, and practical aspects can be understood as examples of a 'posthumanism of production' that develops a robust and rigorous theoretical framework which is then utilized to successfully generate concrete products or services within the contemporary world. At least three forms of posthumanism display hybrid traits to such an extent that it would be arbitrary to attempt to force them to fit into just one quadrant of our framework. These forms of posthumanism are the metahumanism developed by Del Val and Sorgner, sociopolitical posthumanism, and organizational posthumanism. We can consider each of these posthumanisms in turn.

1. Metahumanism as a Movement of Relational Metabodies

Ferrando cites a form of 'metahumanism' originally formulated by Del Val and Sorgner in 2010[155] and grounded in the thought of Nietzsche, Deleuze, Haraway, Hayles, and others.[156] Such metahumanism draws explicitly on such diverse fields as neuroscience, chaos theory, quantum physics, ecology, and

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[152] See Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), for a discussion of such possibilities.

[153] Herbrechter (2013), p. 190; see also Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015).

[154] See Gray (2002), p. 29, and its discussion in Herbrechter (2013), p. 190.

[155] Ferrando (2013), p. 32.

[156] Del Val et al. (2011), pp. 1-2, 6-9.

Eastern philosophy.[157] Sorgner explains that this metahumanism attempts to build on the best insights from both Anglo-American transhumanist and Continental posthumanist thought. On the one hand, metahumanism adopts critical posthumanism's "attempt to transcend dualisms" and cultivation of a "this-worldly understanding of human beings"; although, rather than assuming the materialist perspective attributed to posthumanism, metahumanism adopts an intensely relational outlook.[158] At the same time, metahumanism is compatible with the transhumanist desire to create transcendent beings. However, metahumanism holds that while it is acceptable for individuals to desire such a transformation and to pursue that goal by applying advanced biotechnologies to themselves (i.e., as a form of biotransformative transhumanism), driving the evolution of human beings into a superior species cannot be claimed to be a necessary goal for humanity as a whole – because the transhumanist ideal is only one of many aims present within the "radical plurality of concepts of the good."[159]

Sorgner positions metahumanism as an outgrowth of philosophical posthumanism rather than cultural or critical posthumanism, insofar as metahumanism's key dynamic is its focus on consistently applying a particular philosophical methodology that Sorgner describes as a 'procedural attitude' which "brings together Adorno's negative dialectics and Vattimo's radical hermeneutics such that it is a particular procedure or a method which can get applied to various discourses." This method is employed by entering into the discourses of other thinkers (such as utilitarian bioethicists) and helping them develop their own paradigms by challenging, undermining, and breaking apart those positions that they take for granted – thereby transforming their thought into something that is "more fluid and multiperspectival."[160]

Metahumanism represents a form of 'radical relationalism,' insofar as it suggests that physical or social bodies which appear to be discrete entities can instead best be understood as the effects of contingent relations (such as movement) and that such seemingly discrete bodies can be transformed by

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[157] Del Val et al. (2011), p. 9.

[158] Del Val et al. (2011), p. 2-3.

[159] Such a position has connections with both postmodernism and posthumanism. See Del Val et al. (2011), p. 3.

[160] Metahumanism thus inherently possesses a strong outward orientation that reaches out to engage thinkers who work in other disciplines and possess other perspectives. See Del Val et al. (2011), pp. 3-4.

altering the relations in which they participate. This notion is formalized in the idea of a 'metabody,' which "is not a fixed entity but a relational body." Such metabodies are both 'metasexual' and post-anatomical.[161] Metahumanism emphasizes that "Monsters are promising strategies for performing this development away from humanism"[162] and its understanding of the human body. In the recognition that the depiction of quasi-human monsters might aid us to think about humanity in a new way, a concrete link exists between the philosophical metahumanism proposed by Del Val and Sorgner and the form of fictional metahumanism that we discussed in an earlier section.

Unlike biopolitical posthumanism, metahumanism does not have a strong future orientation; it shares with cultural and critical posthumanism the fact that "it is non-utopian, it does not see the metahuman as a future, but as a strategy in the present."[163] However, while metahumanism contains strong **analytic** aspects, it is also a form of **synthetic posthumanism**, insofar as it envisions a new kind of posthumanized being that does not yet fully exist but which is only now in the process of appearing. Likewise, metahumanism spans **theoretical** and **practical posthumanism** in that it not only seeks to better understand human nature but also to give birth to concrete new forms of artistic expression and social and political interaction. This is done partly by enacting "new strategies of resistance" to human beings' subjugation to representation and language; such strategies may take the form of "amorphous becomings" manifested through the motion of dance and other forms of artistic performance.[164]

2. Sociopolitical Posthumanism

Sociopolitical posthumanism can be understood as a form of what Herbrechter (building on Rosenau) describes as 'techno-cultural pragmatism.'[165] Sociopolitical posthumanism accepts that posthumanizing technological change is gaining in speed and intensity and – given the fact that the yearning for technological advancement is a fundamental aspect of human nature – any efforts to completely block such technologization are misguided and fu-

[161] Del Val et al. (2011), pp. 5, 14, 8.

[162] Del Val & Sorgner (2011), p. 1.

[163] Del Val et al. (2011), p. 6.

[164] Del Val himself has pioneered such forms of artistic expression. For the role of practical action in metahumanism, see Del Val et al. (2011), pp. 5-6, 12.

[165] See Herbrechter (2013), pp. 23-24, and its discussion of Rosenau (1992).

tile. Instead, sociopolitical posthumanism seeks to steer the processes of technologization and posthumanization in a way that maximizes their positive impacts while ameliorating or avoiding their detrimental side-effects.

Sociopolitical posthumanism frequently initiates new debates among subject-matter experts and the broader public on such topics and, insofar as possible, proposes solutions. The **analytic** and **theoretical** aspects of sociopolitical posthumanism are evident when, for example, scholars explore how established definitions of a 'legal person' are challenged by an increasingly deanthropocentrized environment in which some artificially intelligent systems already display human-like decision-making capacities and fill societal roles previously restricted to human beings. The **synthetic** and **practical** aspects are manifested when scholars draw on such theoretical investigations to propose the implementation of new legislation, regulations, or financial systems not because they are needed to account for a reality that exists today but to address the activities of posthumanized beings expected to appear in the future. However, sociopolitical posthumanism differs from the synthetic practical posthumanisms of transhumanism and bioconservatism, whose adherents may manufacture theoretical frameworks to justify the pursuit or condemnation of processes of technologization that they already instinctively find appealing or repellent. For practitioners of sociopolitical posthumanism, a serious and in-depth exploration of theoretical questions is generally the starting point, and any resulting proposals for practical change emerge from a well-developed theoretical framework of the sort commonly found within philosophical or critical posthumanism.

Such sociopolitical posthumanism can be found, for example, within the field of law, where Braman argues that the traditional "assumption that the law is made by humans for humans" is no longer tenable; as the roles played by computers in society's decision-making processes grow, we are beginning to witness "a transformation in the legal system so fundamental that it may be said that we are entering a period of posthuman law."[166] Another example would be the theoretically grounded 'Cyborg Bill of Rights' proposed by Gray as an attempt to ensure that the increasing technological capacity for cy-

[166] Berman, "Posthuman Law: Information Policy and the Machinic World" (2002).

borgization will result in beneficial new forms of posthumanized political organization and engagement and not simply the production of new military instruments.[167]

3. Organizational Posthumanism

Organizational posthumanism applies posthumanist insights and methodologies to the study and management of organizations including businesses, nonprofit organizations, schools, religious groups, professional associations, political parties, governments, and military organizations. Insofar as ongoing technological and social change is reshaping the capacities and relationality of the human beings who belong to organizations – and creating new kinds of entities like social robots that can enter into goal-directed social relationships with human beings and one another[168] – the nature of organizations is itself changing. Organizational posthumanism can aid us in making sense of and, ideally, anticipating such changes. While a scattered assortment of works by management theorists and practitioners have begun to explore the implications of posthumanism for organizational life, these investigations are still in their incipient stages;[169] the explicit formulation within this book of organizational posthumanism as an emerging discipline thus represents a novel development within the fields of posthumanism and organizational management.

Organizational posthumanism can be defined as an approach to analyzing, understanding, creating, and managing organizations that employs a post-anthropocentric and post-dualistic perspective and which recognizes that emerging technologies that complement traditional biological human beings

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[167] See Gray (2002) and the discussion of that work in Herbrechter (2013), p. 105. For a further sociopolitical posthumanist discussion of ways in which, e.g., the use of posthuman neuroprosthetic technologies could give rise to new forms of utopian or dystopian societies, see Gladden, "Utopias and Dystopias as Cybernetic Information Systems: Envisioning the Posthuman Neuropolity" (2015).

[168] See, e.g., Gladden, "The Social Robot as 'Charismatic Leader'" (2014).

[169] For examples of such works, see, e.g., Gephart, "Management, Social Issues, and the Postmodern Era" (1996); Berner, *Management in 20XX: What Will Be Important in the Future – A Holistic View* (2004); Mara & Hawk, "Posthuman rhetorics and technical communication" (2009); Barile, "From the Posthuman Consumer to the *Ontobranding* Dimension: Geolocalization, Augmented Reality and Emotional Ontology as a Radical Redefinition of What Is Real" (2013); and Gladden, "Neural Implants as Gateways to Digital-Physical Ecosystems and Posthuman Socioeconomic Interaction" (2016).

with new kinds of intelligent actors also transform the structures, membership, dynamics, and roles available to organizations.[170] From this description, it can be seen that – like sociopolitical posthumanism and the metahumanism of Del Val and Sorgner – organizational posthumanism incorporates elements of both analytic and synthetic and both theoretical and practical posthumanism.

Analytic and synthetic elements. Organizational posthumanism is **analytic** in that it is not simply interested in imagining the radically novel forms that organizations might take ten or twenty or fifty years from now, after ongoing trends of roboticization, cyborgization, digitalization, and virtualization will have transformed organizations wholly beyond recognition; it is also interested in understanding and shaping the dynamics of organizations that exist today to the extent that they have already been affected by technological and nontechnological processes of posthumanization. Although the impact that artificial intelligence, social robotics, nanorobotics, artificial life, genetic engineering, neurocybernetics, and virtual reality have had on organizations to date is relatively small when compared to biopolitical posthumanists' visions of the sociotechnological changes that loom on the horizon, even those modest impacts already realized are transforming the ways that organizations can and must operate, rendering many previous best practices increasingly obsolete.

At the same time, organizational posthumanism is **synthetic** insofar as effective strategic management demands that organizations anticipate the contours of new phenomena that may appear in the future and understand their potential implications for an organization. For example, the frequently employed PESTLE analysis requires organizations to envision the short-, medium-, and long-term political, economic, social, technological, legal, and environmental impacts that will result either from internal organizational decisions or future changes in the organization's external ecosystem.[171] In order to anticipate such potential impacts and develop contingency plans for responding to them (or strategies to proactively shape them), organizations must attempt to project as accurately as possible the future directions of posthumanization processes and the new kinds of beings, organizational structures, interactions, physical and virtual spaces, and ecosystems that they might produce. This demands a rigorous and imaginative futurology similar

[170] For an in-depth discussion of this topic, see Part Two of this volume, "Organizational Posthumanism."

[171] See Cadle et al., *Business Analysis Techniques: 72 Essential Tools for Success* (2010), pp. 3-6.

to that employed in philosophical posthumanism and the more thoughtful forms of science fiction.

Theoretical and practical elements. Organizational posthumanism is **theoretical** insofar as it attempts to identify and understand the manner in which organizations are being affected by existing or potential processes of posthumanization. This involves analyzing the ways in which organizations' members, structures, processes, information systems, physical and virtual spaces, and external environments are being changed through the action of supplementing or replacing their natural biological human workers with advanced AIs, social robots, neuroprosthetically augmented human beings, and other posthumanized beings. In this regard, organizational posthumanism builds on existing lines of inquiry within philosophical posthumanism. For example, Miah notes that posthumanist thought has long studied the growing fusion of human beings with the technological devices that we use to interact with one another and with our environment and to perform work-related tasks. As such tools grow increasingly sophisticated, they acquire ever subtler and more efficacious ways of liberating and empowering human beings, even as they subjugate and oppress. Much of this ambivalent dynamic results from our tools' deepening integration into the mechanisms of organizations of which we are members.[172] The theoretical component of organizational posthumanism attempts to develop coherent conceptual frameworks to explain and anticipate such phenomena.

At the same time, organizational posthumanism is also **practical** in that its goal is not simply to understand the ways in which posthuman realities are affecting organizations but also to aid management practitioners in proactively designing, creating, and maintaining organizations that can subsist within such a complex and novel competitive environment. Organizational posthumanism seeks to intentionally bring about the creation of a particular type of near-future 'posthumanity' (i.e., a world of organizations that survive as viable systems within a nonanthropocentric context of radical technological change and convergence) and to purposefully block the creation of a different type of near-future 'posthumanity' (i.e., a world of organizations that become unproductive, inefficient, unsustainable, dehumanizing, and even

[172] See Miah (2008), p. 82, and its analysis of Mazlish, *The Fourth Discontinuity: The Co-Evolution of Humans and Machines* (1993).

dystopian as a result of their inability to deal with the emerging nonanthropocentric context).[173]

V. Conclusion

The term 'posthumanism' is employed within an increasingly wide array of contexts to describe phenomena which, in one way or another, focus on a change in the traditional understanding of the human being. Some forms of posthumanism argue that the historical definition of humanity has always been problematic, others that it is now fracturing and becoming obsolete as a result of ongoing technological change. Still other forms of posthumanism argue that our traditional understanding of the 'human' must be expanded or replaced as a next step in the development of sapient society. As we have seen, posthumanisms include such diverse phenomena as new academic disciplines, artistic and spiritual movements, research and development programs for new technologies, works of science fiction, social advocacy campaigns, and legislative lobbying efforts.

By grouping posthumanisms into a handful of basic types and clarifying the similarities and differences between them, the two-dimensional conceptual framework formulated in this text attempts to create a more orderly and comprehensive foundation for the investigation of posthumanism than has previously existed. The first type considered in detail was analytic theoretical posthumanism, which includes such fields as critical and cultural posthumanism and can be understood roughly as a *posthumanism of critique*. Synthetic theoretical posthumanism, which includes phenomena like philosophical posthumanism, science fiction, and techno-idealism, can be generally understood as a *posthumanism of imagination*. Analytic practical posthumanism, which includes various forms of metahumanism and neohumanism, can be seen as a *posthumanism of conversion* of hearts and minds. Synthetic practical posthumanism, which includes transhumanism, bioconservatism, and popular or commercial posthumanism, can be understood as a *posthumanism of control* over the actions of societies and individuals. Finally, the hybrid posthumanism that combines both analytic and synthetic as well as theoretical and practical aspects – as exemplified by the metahumanism of Sorgner

[173] In the case of, e.g., commercial enterprises and military organizations, the theory and practice of organizational posthumanism might be employed not only to maximize the efficiency and productivity of one's own posthumanized organization but also to degrade the efficiency and productivity of competing or opposing organizations, to the extent that such actions are legally and ethically permissible.

and Del Val, sociopolitical posthumanism, and organizational posthumanism – can be understood as a *posthumanism of production*.

As posthumanist perspectives continue to be adapted and applied to new fields – such as that of organizational management – the work of developing conceptual frameworks that can coherently account for the full spectrum of posthumanisms is only beginning. It is hoped that the typology formulated in this text can contribute to such endeavors by highlighting areas of definitional ambiguity, building new conceptual bridges between different forms of posthumanism, and formulating terminological reference points that can be relied upon both by those who embrace various forms of posthumanism and those who wish to challenge the principles of posthumanist thought.

Part Two

Organizational Posthumanism

Abstract. Building on existing forms of critical, cultural, biopolitical, and sociopolitical posthumanism, in this text a new framework is developed for understanding and guiding the forces of technologization and posthumanization that are reshaping contemporary organizations. This 'organizational posthumanism' is an approach to analyzing, creating, and managing organizations that employs a post-dualistic and post-anthropocentric perspective and which recognizes that emerging technologies will increasingly transform the kinds of members, structures, systems, processes, physical and virtual spaces, and external ecosystems that are available for organizations to utilize. It is argued that this posthumanizing technologization of organizations will especially be driven by developments in three areas: 1) technologies for human augmentation and enhancement, including many forms of neuroprosthetics and genetic engineering; 2) technologies for synthetic agency, including robotics, artificial intelligence, and artificial life; and 3) technologies for digital-physical ecosystems and networks that create the environments within which and infrastructure through which human and artificial agents will interact.

Drawing on a typology of contemporary posthumanism, organizational posthumanism is shown to be a hybrid form of posthumanism that combines both analytic, synthetic, theoretical, and practical elements. Like analytic forms of posthumanism, organizational posthumanism recognizes the extent to which posthumanization has already transformed businesses and other organizations; it thus occupies itself with understanding organizations as they exist today and developing strategies and best practices for responding to the forces of posthumanization. On the other hand, like synthetic forms of posthumanism, organizational posthumanism anticipates the fact that intensifying and accelerating processes of posthumanization will create future realities quite different from those seen today; it thus attempts to develop conceptual schemas to account for such potential developments, both as a means of expanding our theoretical knowledge of organizations and of enhancing the ability of contemporary organizational stakeholders to conduct strategic planning for a radically posthumanized long-term future.

I. Introduction

'Posthumanism' can be defined briefly as an intellectual framework for understanding reality that is post-anthropocentric and post-dualistic; for posthumanism, the 'natural' biological human being as traditionally understood becomes just one of many intelligent subjects acting within a complex ecosystem.[1] Some forms of posthumanism focus on the ways in which our notion of typical human beings as the only members of society has been continuously challenged over the centuries through the generation of cultural products like myths and works of literature that feature quasi-human beings such as monsters, ghosts, angels, anthropomorphic animals, cyborgs, and space aliens (i.e., through processes of nontechnological 'posthumanization').[2] Other forms of posthumanism address the ways in which the circle of persons and intelligent agents dwelling within our world is being transformed and expanded through the engineering of new kinds of entities such as human beings possessing neuroprosthetic implants, genetically modified human beings, social robots, sentient networks, and other advanced forms of artificial intelligence (i.e., through processes of technological posthumanization).[3] The development of sound and discerning forms of posthumanist

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[1] This definition builds on the definitions formulated by scholars of posthumanism such as Ferrando, Miller, Herbrechter, Miah, and Birnbacher, as well as on our own typology of posthumanism found in Part One of this volume, "A Typology of Posthumanism: A Framework for Differentiating Analytic, Synthetic, Theoretical, and Practical Posthumanisms." See Ferrando, "Posthumanism, Transhumanism, Antihumanism, Metahumanism, and New Materialisms: Differences and Relations" (2013), p. 29; Miller, "Conclusion: Beyond the Human: Ontogenesis, Technology, and the Posthuman in Kubrick and Clarke's 2001" (2012), p. 164; Herbrechter, *Posthumanism: A Critical Analysis* (2013), pp. 2-3; Miah, "A Critical History of Posthumanism" (2008), p. 83; and Birnbacher, "Posthumanity, Transhumanism and Human Nature" (2008), p. 104.

[2] Such forms of posthumanism include the critical and cultural posthumanism pioneered by Haraway, Halberstam and Livingstone, Hayles, Badmington, and others. See, e.g., Haraway, "A Manifesto for Cyborgs: Science, Technology, and Socialist Feminism in the 1980s" (1985); Haraway, *Simians, Cyborgs, and Women: The Reinvention of Nature* (1991); *Posthuman Bodies*, edited by Halberstam & Livingstone (1995); Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (1999); Graham, *Representations of the Post/Human: Monsters, Aliens and Others in Popular Culture* (2002); Badmington, "Cultural Studies and the Posthumanities" (2006); and Herbrechter (2013).

[3] Such forms of posthumanism include philosophical posthumanism, bioconservatism, and transhumanism, which are analyzed in Miah (2008), pp. 73-74, 79-82, and Ferrando (2013), p. 29. Such approaches can be seen, for example, in Fukuyama, *Our Posthuman Future: Consequences of the Biotechnology Revolution* (2002); Bostrom, "Why I Want to Be a Posthuman When I Grow Up" (2008); and other texts in *Medical Enhancement and Posthumanity*, edited by Gordijn & Chadwick (2008).

thought is becoming increasingly important as society grapples with the ontological, ethical, legal, and cultural implications of emerging technologies that are generating new forms of posthumanized existence.

The establishing of conceptual links between organizational management and the idea of the 'posthuman' is nothing new. As early as 1978, management scholars Bourgeois, McAllister, and Mitchell had written that "Much of the organization theory literature from the posthuman relations era concentrates on defining which organizational structures, management styles, et cetera are most appropriate (effective) for different technologies and/or environmental contingencies."[4] Writing in 1996, Gephart drew on fictional depictions of cyborgs to envision an emerging 'Postmanagement Era' in which an organization's complex network of computerized systems – with its own synthetic values and logic – would become the true manager of an organization that no longer exists and acts for the sake of human beings. Although a human being might still appear to function as a 'manager' within such an organization, in reality she would be neither a manager nor a natural, biological human being; instead she would possess the form of a cyborg who has been permanently integrated into her employer's operational, financial, and technological systems and who has been weaponized for commercial ends – a being whose human agency has been dissolved until she becomes little more than a cold and lethally efficient "posthuman subject, ripping at flesh as part of her job."[5]

More recently, scholars have explored potential relationships between posthumanism and particular specialized fields within organizational theory and management. For example, Mara and Hawk consider the relationship of posthumanism to the technical communication that constitutes an important

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[4] Bourgeois et al., "The Effects of Different Organizational Environments upon Decisions about Organizational Structure" (1978), pp. 508-14. This allusion to the posthuman is not elaborated upon elsewhere in the text. The article describes an empirical study that was conducted to test hypotheses relating to the default behavior of managers when their organizations encounter "turbulent and threatening business environments" (p. 508).

[5] See Gephart, "Management, Social Issues, and the Postmodern Era" (1996), pp. 36-37, 41. Strictly speaking, Gephart's approach is more postmodernist than posthumanist. While there are areas of overlap between postmodernism and posthumanism, postmodernism generally posits a more nihilistic deconstruction of the notion of 'humanity,' while posthumanism seeks to transform and expand the historically anthropocentric concepts of personal agency and subjectivity to incorporate quasi-human, parahuman, and nonhuman entities. See Part One of this volume, "A Typology of Posthumanism: A Framework for Differentiating Analytic, Synthetic, Theoretical, and Practical Posthumanisms," and Herbrechter (2013).

form of information flow within contemporary organizations that are so dependent on technology. They note the evolving roles that organizations' human and nonhuman actors play in change management, organizational culture, human-computer interaction (HCI), and the integration of technology into the workplace within the context of a complex posthuman organizational ecology in which "it is no longer tenable to divide the world into human choice and technological or environmental determinism."[6] Barile, meanwhile, explores the impact that technologies for augmented reality play in creating 'posthuman consumers' by breaking down boundaries between the virtual and the actual and supplanting previous forms of HCI with "a new kind of interaction where the machines become softer and immaterial, emotions become contents, and places become media."[7]

Other scholars have sought to identify the ultimate drivers of the processes of posthumanization that are expected to increasingly impact organizations of all types. For example, Herbrechter notes the ongoing and intensifying 'technologization' of humanity, by which technoscientific forces that had previously constituted just one element of society attempt to gain economic and political power over all aspects of human culture.[8] Insofar as all organizations exist within human cultures, utilize technology, and are subject to economic and political forces, they become a participant in these dynamics of technologization and posthumanization. However, while the forces of technologization are undoubtedly real, they may not fully explain the rising prominence of posthuman dynamics and motifs within organizational life. Indeed, it has even been suggested that the popular notion of posthumanism may have been engineered as a sort of ruse generated by the power structures of postmodern neoliberal capitalism to pacify the masses with the hope or fear (or both) of a radically different future that looms just over the horizon.[9] According to that view, posthumanist imagery, themes, and philosophies are a mechanism employed by some organizations in order to facilitate the achievement of their strategic objectives.

While a diverse array of connections between posthumanism and organizational management has thus been hinted at for some time, it has not been

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[6] Mara & Hawk, "Posthuman rhetorics and technical communication" (2009), pp. 1-3.

[7] Barile, "From the Posthuman Consumer to the *Ontobranding* Dimension: Geolocalization, Augmented Reality and Emotional Ontology as a Radical Redefinition of What Is Real" (2013), p. 101.

[8] See Herbrechter (2013), p. 19.

[9] See the discussion of such cynical interpretations of posthumanism in Herbrechter (2013), p. 80.

comprehensively or systematically explored. Much scholarship has been dedicated to understanding fields such as literature,[10] film,[11] computer games,[12] biomedical engineering,[13] and politics and economics[14] in light of posthumanist thought. However, efforts to apply posthumanist methodologies and insights to organizational management have remained relatively underdeveloped. This is striking, given the fact that many of the issues of interest to posthumanism have strong organizational repercussions.

In this text, we attempt to address this lacuna by presenting one approach to developing a comprehensive 'organizational posthumanism.' After formulating a definition for organizational posthumanism, we compare it to established forms of post-dualistic and post-anthropocentric posthumanist thought, arguing that it constitutes a type of 'hybrid posthumanism' that incorporates both analytic, synthetic, theoretical, and practical aspects. We then consider six organizational elements that will increasingly be impacted by the forces of posthumanization: namely, an organization's members, personnel structures, information systems, processes, physical and virtual spaces, and external environment. Finally, three main types of technologies that facilitate the development of organizational posthumanity are described; these are technologies for human augmentation and enhancement (including implantable computers, neuroprosthetic devices, virtual reality systems, genetic engineering, new forms of medicine, and life extension); technologies for synthetic agency (including social robotics, artificial intelligence, and artificial life); and technologies for building digital-physical ecosystems and networks (such as the Internet of Things). It is our hope that the questions raised and the framework formulated within this text can offer a useful starting point for those scholars and management practitioners who will address

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[10] See posthumanist analyses of literature in, e.g., Hayles (1999); *Posthumanist Shakespeares*, edited by Herbrechter & Callus (2012); and Thomsen, *The New Human in Literature: Posthuman Visions of Change in Body, Mind and Society after 1900* (2013).

[11] Examples can be found in the articles relating to cinema in *Posthuman Bodies* (1995); Short, *Cyborg Cinema and Contemporary Subjectivity* (2005); and Miller (2012).

[12] For such studies, see, e.g., Schmeink, "Dystopia, Alternate History and the Posthuman in Bioshock" (2009); Krzywinska & Brown, "Games, Gamers and Posthumanism" (2015); and Boulter, *Parables of the Posthuman: Digital Realities, Gaming, and the Player Experience* (2015).

[13] See, e.g., *Medical Enhancement and Posthumanity* (2008); Thacker, "Data made flesh: biotechnology and the discourse of the posthuman" (2003); and Lee, "Cochlear implantation, enhancements, transhumanism and posthumanism: some human questions" (2016).

[14] Examples of such analyses include Gray, *Cyborg Citizen: Politics in the Posthuman Age* (2002); Fukuyama (2002); and Cudworth & Hobden, "Complexity, ecologism, and posthuman politics" (2013).

in an ever more explicit manner the increasingly important intersection of organizational life and posthumanist thought.

II. Definition of Organizational Posthumanism

Having considered the nature of posthumanism and some links that have been suggested between posthumanism and the theory and management of organizations, we are in a position to explicitly formulate a systematic approach that applies posthumanist insights and methodologies to the study and management of organizations. This approach can be described as *organizational posthumanism*.

Lune defines an organization as "a group with some kind of name, purpose, and a defined membership" that possesses "a clear boundary between its inside and its outside" and which can take the form of either a formal organization with clearly defined roles and rules, an informal organization with no explicitly defined structures and processes, or a semi-formal organization that possesses nominal roles and guidelines that in practice are not always observed.[15] Meanwhile, Daft et al. define organizations as "(1) social entities that (2) are goal-directed, (3) are designed as deliberately structured and coordinated activity systems, and (4) are linked to the external environment."[16] Such organizations include businesses, nonprofit organizations, schools, religious groups, professional associations, political parties, governments, and military organizations. Other collections of human beings – such as cities, families, or the proponents of a particular philosophical perspective – share some of the characteristics of organizations but are not generally classified as such.

The very nature of organizations is changing as ongoing technological and social change reshapes the capacities and relationality of the human beings who belong to organizations and creates new kinds of entities (like social robots) that can engage in goal-directed social interaction with human beings and one another. Organizational posthumanism can aid us in making sense of – and, ideally, anticipating and controlling – such changes. By way of a formal definition, we would suggest that:

> Organizational posthumanism is an approach to analyzing, understanding, creating, and managing organizations that employs a post-anthropocentric and post-dualistic perspective; it recognizes that the emerging technologies

[15] Lune, *Understanding Organizations* (2010), p. 2.

[16] Daft et al., *Organization Theory and Design* (2010), p. 10.

> which complement traditional biological human beings with new types of intelligent actors also transform the kinds of members, structures, dynamics, and roles that are available for organizations.

As we shall see, while organizational posthumanism shares elements in common with established disciplines such as philosophical posthumanism, critical posthumanism, and biopolitical posthumanism, it also possesses unique and contrasting elements that prevent it from being understood simply as a subfield of one of those disciplines. Rather, we would argue that as defined above, organizational posthumanism is better viewed as an independently conceptualized body of thought within posthumanism. When understood in the context of organizational and management theory, organizational posthumanism does not represent a new discipline, insofar as it still addresses historical topics of organizational structures, systems, and processes; however, it does constitute an entirely new perspective and set of methodologies – a new approach.

III. Classification of Organizational Posthumanism as a Type of Posthumanism

It is possible to categorize different forms of posthumanism into general types by employing a two-dimensional conceptual framework that classifies a form of posthumanism based on its understanding of posthumanity and the role or purpose for which the posthumanism was developed. With regard to its perspective on posthumanity, a form of posthumanism may be: 1) an *analytic posthumanism* that understands posthumanity as a sociotechnological reality that already exists in the contemporary world and which needs to be analyzed; or 2) a *synthetic posthumanism* that understands posthumanity as a collection of hypothetical future entities whose development can be either intentionally realized or prevented, depending on whether or not human society chooses to research and deploy certain transformative technologies. With regard to the purpose or role for which it was created, a form of posthumanism can be: 1) a *theoretical posthumanism* that seeks primarily to develop new knowledge and understanding; or 2) a *practical posthumanism* that seeks primarily to bring about some social, political, economic, or technological change in the world.[17] This framework yields five general types of posthumanism:

[17] For a more detailed discussion of the distinctions between analytic, synthetic, theoretical, and practical posthumanisms, see Part One of this book, "A Typology of Posthumanism."

- **Analytic theoretical posthumanisms** seek to understand the posthumanized present and include fields like critical and cultural posthumanism. Such disciplines can collectively be understood as constituting a 'posthumanism of critique' that employs posthumanist methodologies to diagnose hidden anthropocentric biases and posthumanist aspirations contained within different fields of human activity.[18]
- **Synthetic theoretical posthumanisms** envision hypothetical forms of posthumanity and include such pursuits as philosophical posthumanism and many forms of science fiction. Such fields could be seen as representing a 'posthumanism of imagination' that creatively conceptualizes future (or otherwise inexistent) posthumanities so that their implications can be explored.[19]
- **Analytic practical posthumanisms** seek to reshape the posthumanized present and include some forms of metahumanism and neohumanism. Such movements can be understood as constituting a 'posthumanism of conversion' that is aimed at changing hearts and minds and influencing the way in which human beings view and treat the world around themselves.[20]
- **Synthetic practical posthumanisms** seek to steer the processes that can generate a future posthumanity; they include such movements as transhumanism and bioconservatism. Such programs can be viewed as representing a 'posthumanism of control' that seeks to develop new technologies that give individuals control over their own posthumanization or to implement legal or economic controls to block the development of such technologies.[21]
- **Hybrid posthumanisms** that span all four spheres of the analytic, synthetic, practical, and theoretical include such phenomena as sociopolitical posthumanism and the metahumanism of Del Val and Sorgner. Such

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[18] For an example, see the critical posthumanism described in Herbrechter (2013).

[19] Regarding, e.g., posthumanist aspects of science fiction, see Short (2005); Goicoechea, "The Posthuman Ethos in Cyberpunk Science Fiction" (2008); Miller (2012); and Herbrechter (2013), pp. 115-17.

[20] Regarding different forms of metahumanism, see Ferrando (2013), p. 32. For the form of neohumanism developed by Sarkar, see Sarkar, "Neohumanism Is the Ultimate Shelter (Discourse 11)" (1982). A classification of different forms of metahumanism and neohumanism is found in Part One of this volume, "A Typology of Posthumanism."

[21] For examples, see Fukuyama (2002); Bostrom, "A History of Transhumanist Thought" (2005); and Bostrom (2008).

> ventures can be understood as examples of a 'posthumanism of production' that develops a robust and rigorous theoretical framework that is then utilized to successfully generate concrete products or services within the contemporary world.[22]

By applying this framework, organizational posthumanism can be classified as a form of hybrid posthumanism that integrates strong analytic, synthetic, theoretical, and practical elements. We can consider each of these elements of organizational posthumanism in more detail.

A. Theoretical Aspects

Organizational posthumanism is theoretical insofar as it involves efforts to understand the ways in which organizations' form and dynamics are being affected by (and are shaping) processes of posthumanization. Such work involves developing new conceptual frameworks that can explain and predict the unique ways in which organizations will become agents and objects of posthumanization and will exist as elements of a larger posthumanized ecosystem.

For example, scholars can explore the ways in which organizations' members, personnel structures, processes, information systems, physical and virtual spaces, and external environment will be altered by the integration of artificial general intelligences, sentient robotic swarms, sapient networks, neuroprosthetically augmented cyborgs, genetically engineered human beings, and other posthumanized entities into organizations whose membership was previously the exclusive domain of unmodified, 'natural' biological human beings. Such posthumanization may allow the creation of new organizational forms that were previously impossible while simultaneously rendering some traditional organizational forms ineffective or obsolete.

In its theoretical aspects, organizational posthumanism draws on and can inform fields such as organizational theory, systems theory, and cybernetics. It can work in parallel with sociopolitical posthumanism, which explores at a theoretical level the impact of posthumanization on legal, political, and economic systems and institutions. Similarly, organizational posthumanism can take up many existing lines of theoretical inquiry within fields such as philo-

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[22] For an instance of sociopolitical posthumanism as it relates to law, see Berman, "Posthuman Law: Information Policy and the Machinic World" (2002). For the form of metahumanism developed by Sorgner and Del Val, see Del Val & Sorgner, "A *Metahumanist* Manifesto" (2011), and Del Val et al., "Interview on the Metahumanist Manifesto with Jaime del Val and Stefan Lorenz Sorgner" (2011).

sophical, critical, and biopolitical posthumanism and science fiction and advance them in a way that is informed by a deeper concern for and insight into their implications at the organizational level.

For example, Miah notes posthumanism's longstanding interest in the blurring physical and cognitive boundaries between human beings and the tools that we use to accomplish work. Drawing on Mazlish, Miah notes that tools have historically served to extend human beings' capacities and freedom while simultaneously subjugating human beings to the organizational systems required for the tools' production and effective use.[23] Whereas tools can serve as an 'artificial skin' that mediates our relationship with our environment and offers us protection, they have also facilitated the creation of large, impersonal organizations in which human beings are reduced to functional bodies that provide some economic value. The creation of new tools such as neuroprosthetic devices is serving to make human beings "more machine-like, physically and cognitively," while the creation of increasingly autonomous tools such as artificial intelligences threatens to replace human beings altogether as components of some organizational systems.[24] Organizational posthumanism can develop new theoretical frameworks that shed light on such relationships between agent and instrument, between human 'employee' and nonhuman 'tool,' within the evolving context of posthumanized organizations.

B. Practical Aspects

Organizational posthumanism is also practical, insofar as its goal is not simply to understand at an abstract level the ways in which posthuman realities are affecting organizations but also to aid managers in proactively designing, creating, and maintaining organizations that can survive and thrive within novel competitive environments such as those emerging as a result of the posthumanization of our world. Just as sociopolitical posthumanism works to produce new legal, political, and economic systems that are adapted to emerging posthuman realities, so organizational posthumanism works to produce successfully posthumanized organizations – and, through them, to produce the goods, services, and other resources that such organizations release into the wider ecosystem. In its more practical aspects, organizational

[23] See Miah (2008), p. 82, and its discussion of Mazlish, *The Fourth Discontinuity: The Co-Evolution of Humans and Machines* (1993).

[24] Miah (2008), p. 82.

posthumanism draws on, shapes, and acts through disciplines like organizational design, organizational architecture, enterprise architecture, organization development, management cybernetics, and strategic management.

Research has already begun to explore the practical implications of technological posthumanization (though without necessarily naming the phenomenon as such) for areas such as strategic planning, business models, entrepreneurship, marketing, knowledge management, and customer relationship management (CRM);[25] change management, organizational culture, and organizational HCI;[26] potential roles for artificial intelligences in leading teams of human workers;[27] and the creation of neurocybernetically linked organizational systems.[28]

C. Analytic Aspects

The fact that processes of posthumanization are expected to accelerate and expand in the future does not diminish the posthumanizing impacts that have already been felt and which every day are creating new opportunities and challenges for organizations. Organizational posthumanism is analytic, insofar as it strives to understand the changes to organizations that have already occurred as a result of such previous and ongoing processes of posthumanization. On the basis of such knowledge, managers and other organizational stakeholders can develop strategies and best practices to optimize the functioning of real-world organizations today.

For example, researchers in the field of organizational posthumanism might, for example, attempt to anticipate the implications of employing artificial general intelligences (AGIs) to fill roles as senior executives within otherwise human organizations.[29] Such efforts to imagine the eventual impacts of radically posthumanized far-future technological systems complement or-

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[25] See the thoughtful overview of the impacts of posthumanizing technologies on such areas in Berner, *Management in 20XX: What Will Be Important in the Future – A Holistic View* (2004).

[26] See Mara & Hawk (2009).

[27] See Gladden, "Leveraging the Cross-Cultural Capacities of Artificial Agents as Leaders of Human Virtual Teams" (2014); Gladden, "The Social Robot as 'Charismatic Leader': A Phenomenology of Human Submission to Nonhuman Power" (2014); and Gladden, "Managerial Robotics: A Model of Sociality and Autonomy for Robots Managing Human Beings and Machines" (2014).

[28] See Gladden, "Neural Implants as Gateways to Digital-Physical Ecosystems and Posthuman Socioeconomic Interaction" (2016).

[29] See, e.g., Gladden, "The Social Robot as 'Charismatic Leader'" (2014).

ganizational posthumanism's efforts to analyze the impact that is already being felt on organizations by more rudimentary technologies for artificial intelligence, such as those that control industrial robots for assembly-line manufacturing,[30] automated systems for resource scheduling and planning,[31] web-based chatbots for basic interactions with customers, [32] and robotic sales associates for dispensing goods and services to customers.[33]

D. Synthetic Aspects

In addition to analyzing the kinds of posthumanized organizations that already exist today, organizational posthumanism seeks to envision the kinds of even more radically posthumanized organizations that may be able to exist in the future thanks to accelerating forces of technologization and other anticipated sociotechnological change.

In a sense, all long-term organizational decision-making involves a sort of 'futurology,' as stakeholders make decisions on the basis of their empirically grounded projections, estimates, or intuitions about how an organization's external context is likely to evolve over time (e.g., as captured in a PESTLE analysis[34]) and how the impact of a decision is likely to reshape the organization's internal form and dynamics. Organizational posthumanism involves a specialized form of organizational futurology that attempts to conceptualize and predict the ways in which organizations in general (or one organization in particular) will be transformed by the dynamics of posthumanization or will be able to exploit those dynamics for their own strategic purposes.

Within organizational posthumanism, the analytic and theoretical effort to understand effective posthumanized organizations and the synthetic and practical effort to design and create them are thus joined as two sides of a single coin.

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[30] For an overview of such technologies, see, e.g., Perlberg, *Industrial Robotics* (2016).

[31] See, e.g., *Automated Scheduling and Planning: From Theory to Practice*, edited by Etaner-Uyar et al. (2013).

[32] Such technologies are described, e.g., in Perez-Marin & Pascual-Nieto, *Conversational Agents and Natural Language Interaction: Techniques and Effective Practices* (2011).

[33] See, e.g., the account from a consumer's perspective of interactions with such technologies in Nazario, "I went to Best Buy and encountered a robot named Chloe – and now I'm convinced she's the future of retail" (2015).

[34] See Cadle et al., *Business Analysis Techniques: 72 Essential Tools for Success* (2010), pp. 3-6, for a description of various versions of this analytic tool.

IV. Organizational Posthumanization as Reflected in Organizational Elements

One aspect of posthumanization is the emergence of a world in which 'natural' human beings are joined by other kinds of entities such as cyborgs, social robots, AGIs, sapient networks, and artificial life-forms in serving as employees, collaborators, and consumers. This posthuman reality will increasingly be reflected in various aspects of organizational life. Particular implications of such posthumanization can be identified in the kinds of *members*, *structures*, *systems*, *processes*, *spaces*, and *external ecosystems* that organizations will possess.[35] Below we consider each of these elements.

A. Posthumanized Members

Traditionally, the members of organizations have been 'natural' biological human beings who have not been engineered or extensively enhanced with the aid of biomedical technologies. The membership of future organizations will comprise a much more diverse array of entities. It is expected that increasingly the members of organizations will, for example, also include:[36]

- Human beings possessing implantable computers (such as devices resembling subcutaneous smartphones)
- Human beings equipped with sensory, cognitive, or motor neuroprosthetics, including human beings who possess full cyborg bodies
- Genetically engineered human beings
- Human beings who are long-term users of virtual reality systems and whose interaction with other persons and their environment takes place largely within virtual worlds
- Social robots
- Artificial general intelligences

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[35] Structures, processes, and systems constitute the three main elements within the 'congruence model' of organizational architecture as conceptualized by Nadler and Tushman. See Nadler & Tushman, *Competing by Design: The Power of Organizational Architecture* (1997), p. 47.

[36] For an overview of the roles that such beings may play in future organizations, see Berner (2004). Discussions of specific types of posthumanized organizational members are found, e.g., in Bradshaw et al., "From Tools to Teammates: Joint Activity in Human-Agent-Robot Teams" (2009); Samani et al., "Towards Robotics Leadership: An Analysis of Leadership Characteristics and the Roles Robots Will Inherit in Future Human Society" (2012); Wiltshire et al., "Cybernetic Teams: Towards the Implementation of Team Heuristics in HRI" (2013); Gladden, "The Social Robot as 'Charismatic Leader'" (2014); Gladden, "The Diffuse Intelligent Other: An Ontology of Nonlocalizable Robots as Moral and Legal Actors" (2016); and Gladden, "Neural Implants as Gateways" (2016).

- Artificial life-forms
- Sapient networks
- Human and synthetic beings whose thoughts and volitions have been cybernetically linked to create 'hive minds'

Such members will be discussed in more detail later in this text, in our analysis of technological changes facilitating organizational posthumanization. From an organizational perspective, the capacities, vulnerabilities, needs, and forms of interaction demonstrated by such entities can differ radically from those of the natural human beings who have historically constituted an organization's membership. The use of posthuman entities (including artificial beings) to fill organizational roles as senior executives, product designers, or the providers of sensitive goods or services (such as health care or military activities) raises a range of complex ethical, legal, and information security questions.[37] Organizational posthumanism can investigate the theoretical constraints and possibilities for creating organizations that include such posthumanized members and can develop practical approaches for the management of organizations that incorporate them.

B. Posthumanized Structures

The types of internal and external structures that are available for use by organizations are expected be reshaped and expanded by emerging posthuman realities. When managing contemporary organizations, possible organizational forms identified by Horling and Lesser include hierarchies (which can be either simple, uniform, or multi-divisional), holarchies (or 'holonic organizations'), coalitions, teams, congregations, societies, federations (or 'federated systems'), matrix organizations, compound organizations, and

[37] For a discussion of questions that can arise when entrusting organizational roles and responsibilities to robots and AIs, see, e.g., Stahl, "Responsible Computers? A Case for Ascribing Quasi-Responsibility to Computers Independent of Personhood or Agency" (2006); Sparrow, "Killer Robots" (2007); Calverley, "Imagining a non-biological machine as a legal person" (2008); Grodzinsky et al., "Developing Artificial Agents Worthy of Trust: 'Would You Buy a Used Car from This Artificial Agent?'" (2011); Coeckelbergh, "Can We Trust Robots?" (2012); Datteri, "Predicting the Long-Term Effects of Human-Robot Interaction: A Reflection on Responsibility in Medical Robotics" (2013); Gladden, "The Social Robot as 'Charismatic Leader'" (2014); and Gladden, "The Diffuse Intelligent Other" (2016). Regarding questions that arise in the case of neurocybernetically enhanced human workers, see, e.g., McGee, "Bioelectronics and Implanted Devices" (2008); Koops & Leenes, "Cheating with Implants: Implications of the Hidden Information Advantage of Bionic Ears and Eyes" (2012); and Gladden, "Neural Implants as Gateways" (2016).

sparsely connected graph structures (which may either possess statically defined elements or be an 'adhocracy').[38] Such structures have been developed over time to suit the particular characteristics of the members that constitute contemporary organizations – i.e., natural biological human beings. As organizations evolve to include members that possess radically different physical and cognitive capacities and novel ways of interacting with one another, the kinds of structures that are available to organize the work of these groups of members will change, and novel organizational structures are expected to become feasible and even necessary.[39]

For example, an organization composed of neuroprosthetically augmented human members may be able to link them through a decentralized network that enables the direct sharing of thoughts and sentiments between members' minds, allowing information to be disseminated in an instantaneous fashion and decisions to be made in a distributed and collective manner that is impossible for conventional human organizations.[40] The reporting and decision-making structures of such an organization might reflect multidimensional cybernetic network topologies that were previously possible only for computerized systems (or some nonhuman animal species) but which could not be effectively employed within human organizations.[41] Organizational posthumanism can conceptualize such new possibilities and develop

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[38] Horling & Lesser, "A Survey of Multi-Agent Organizational Paradigms" (2004).

[39] For the sake of convenience, it is possible to refer to such developments as 'novel *personnel* structures' – however it must be kept in mind that the 'personnel' constituting such future organizations will not necessarily be human 'persons' but may include, e.g., such radically different types of entities as nanorobot swarms or sapient networks of computerized devices.

[40] Regarding the prospect of creating hive minds and neuroprosthetically facilitated collective intelligence, see, e.g., McIntosh, "The Transhuman Security Dilemma" (2010); Roden, *Posthuman Life: Philosophy at the Edge of the Human* (2014), p. 39; and Gladden, "Utopias and Dystopias as Cybernetic Information Systems: Envisioning the Posthuman Neuropolity" (2015). For a classification of different kinds of potential hive minds, see Chapter 2, "Hive Mind," in Kelly, *Out of Control: The New Biology of Machines, Social Systems and the Economic World* (1994); Kelly, "A Taxonomy of Minds" (2007); Kelly, "The Landscape of Possible Intelligences" (2008); Yonck, "Toward a standard metric of machine intelligence" (2012); and Yampolskiy, "The Universe of Minds" (2014). For critical perspectives on hive minds, see, e.g., Maguire & McGee, "Implantable brain chips? Time for debate" (1999); Bendle, "Teleportation, cyborgs and the posthuman ideology" (2002); and Heylighen, "The Global Brain as a New Utopia" (2002).

[41] See, e.g., Gladden, "Utopias and Dystopias as Cybernetic Information Systems" (2015). Efforts by organizational posthumanists to envision and implement new kinds of posthumanized organizational structures should be distinguished from management approaches such as the Holacracy movement, which abolishes job titles and hierarchical structures for decision-making and authority and replaces them with largely self-organizing, self-guiding circles of employees. From the perspec-

concrete recommendations regarding organizational structures that are especially well- or poorly suited for organizations comprising posthumanized members.

C. Posthumanized (Information) Systems

The word 'system' is used with different meanings in different organizational contexts. From the perspective of management cybernetics, an organization as a whole can be considered a 'viable system,' as can each of its constituent subsystems.[42] On the other hand, within the context of contemporary organizational architecture, 'systems' are typically computerized information systems such as manufacturing systems that govern and constitute a physical assembly line, an internally hosted accounting database, a cloud-based HR management system, a public-facing website for handling retail transactions, or a social media platform for use in marketing and public relations.

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tive of Holacracy, an organization can essentially be viewed as though it were a conventional electronic computer and each of the organization's human members were components of that computer. The *Holacracy Constitution* provides an organization with a complex set of decision-making rules and procedures that constitute the organization's 'operating system' and which – after this 'OS' has become sufficiently engrained in employees' interactions and decision-making patterns – allow new business processes to be implemented in the form of 'apps' which, in theory, can be downloaded and installed in the minds and behaviors of the organization's human employees in a manner similar to that of installing a new program on a desktop computer. See Robertson, *Holacracy: The New Management System for a Rapidly Changing World* (2015), pp. 9-14, and the *Holacracy Constitution v4.1* (2015).

Superficially, Holacracy shares some elements in common with posthumanism, insofar as it recognizes the fact that innovative new organizational structures that draw inspiration from sources other than traditional human institutions are increasingly becoming possible and even necessary. However, Holacracy diverges from the principles of organizational posthumanism by declining to acknowledge that the circle of intelligent actors within organizations is expanding to include entities other than natural biological human beings. Holacracy is essentially anthropocentric, insofar as it presumes that natural biological human beings are and will continue to be the lone relevant actors within organizations; it simply attempts to induce such human beings to behave as if they were electronic computer components rather than human persons. Such an approach may prove more effective in the future, if implantable computers, neurocybernetics, long-term immersive virtual environments, and other technologizing phenomena lead to the development of human workers that display sufficiently 'computronic' characteristics. (See Part Three of this volume, "The Posthuman Management Matrix: Understanding the Organizational Impact of Radical Biotechnological Convergence," for a discussion of such phenomena.) However, current attempts at implementing approaches such as Holacracy would appear to significantly underestimate the fundamental structural and behavioral differences that presently exist between human and synthetic agents.

[42] For cybernetic accounts of viable systems from a management perspective, see, e.g., Beer, *Brain of the Firm* (1981); Barile et al., "An Introduction to the Viable Systems Approach and Its Contribution to Marketing" (2012); and Gladden, "The Artificial Life-Form as Entrepreneur: Synthetic Organism-Enterprises and the Reconceptualization of Business" (2014).

Traditionally, the relationship of human employees to such systems has been relatively straightforward: human workers serve as the designers, programmers, data-entry specialists, and end users of the information systems, while the systems themselves are assigned the role of receiving, storing, and transmitting data securely and manipulating it in an efficient and accurate fashion, as instructed by human employees. However, the boundary between the electronic systems that store and process information and the human workers that use them are expected to increasingly blur as implantable computers, neuroprosthetic devices, and persistent virtual reality environments integrate human workers ever more intimately into organizational information systems at both the physical and cognitive levels.[43] Moreover, the growing sophistication of artificial intelligence platforms for use in data mining and other applications[44] is expected to increasingly create information systems that are self-organizing, self-analyzing, and even self-aware. Through the use of such systems, organizations may move beyond the era of Big Data and Smart Data and into an era of 'Sapient Data' in which information systems utilize human workers as tools rather than being utilized by them. Organizational posthumanism can offer critical perspectives regarding both the ontological and ethical aspects of such human-electronic systems as well as their practical implementation.

D. Posthumanized Processes

The essential processes found within an organization do not simply include those by which it directly generates the end products for which the organization is known – such as the actions used to physically assemble some device on an assembly line (for a consumer electronics company) or to generate sounds from musical instruments during a concert (for a symphony orchestra). An organization's fundamental processes also include all of those

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[43] For an in-depth analysis of the ways in which such historical barriers between human workers and electronic information systems are being dissolved, see Part Three of this text, "The Posthuman Management Matrix."

[44] Regarding the prospects of developing autonomous AI systems for data mining, see, for example, Warkentin et al., "The Role of Intelligent Agents and Data Mining in Electronic Partnership Management" (2012); Bannat et al., "Artificial Cognition in Production Systems" (2011), pp. 152-55; and Wasay et al., "Queriosity: Automated Data Exploration" (2015).

behaviors and dynamics through which resources (including human resources, financial resources, material resources, and information)[45] are acquired from the external environment, created internally, transmitted between different parts of the organization, combined or transformed, or released into the external environment – as well as all of the second-order processes by which those behaviors and dynamics are planned, led, organized, and controlled.[46] Such second-order processes include the use of the three key mechanisms of programming, feedback, and hierarchical supervision to coordinate the activities of an organization's members.[47] They also include compensation and incentive schemes that are used to reward and motivate desired behaviors on the part of an organization's members, as well as processes of career advancement which ensure that an organization's most talented and effective workers move into positions in which their abilities can be employed to their fullest potential.[48]

In the case of contemporary organizations that include only traditional biological human members, there exists a rich body of theory and best practices relating to the design and implementation of such processes. However, it is clear that the nature of these processes can change dramatically within a radically posthumanized organizational context. For example, some kinds of advanced robots and AIs may require no compensation at all – other than 'compensation' in the form of an electric power supply, physical maintenance and software upgrades, and other resources needed to ensure their continued operation. However, very sophisticated AGIs whose cognitive dynamics are based on those of human beings might request – and, as a practical matter, require – compensation in the form of intellectual stimulation, self-fulfillment, and generic financial resources (i.e., a paycheck) that an entity can spend as it sees fit to pursue its own personal goals or objectives in its spare time.[49] Similarly, neurocybernetically augmented human employees may be

[45] For the role of such resources in organizational dynamics, see, e.g., Pride et al., *Foundations of Business* (2014), p. 8., and Gladden, "The Artificial Life-Form as Entrepreneur" (2014).

[46] Planning, organizing, leading, and controlling are considered to be the four primary functions that must be performed by managers. See Daft, *Management* (2011).

[47] For a review of the scholarship on such mechanisms and their role in organizations, see Puranam et al., "Organization Design: The Epistemic Interdependence Perspective" (2012), p. 431.

[48] See Brickley et al., "Corporate Governance, Ethics, and Organizational Architecture" (2003), p. 43; Puranam et al. (2012); and Nadler & Tushman (1997), loc. 862, 1807.

[49] For an in-depth analysis of the prospects of developing AGIs with human-like cognitive capacities and psychological needs, see Friedenberg, *Artificial Psychology: The Quest for What It Means to Be Human* (2008).

able to instantly acquire new skills or capacities in ways that render traditional professional advancement schemes outdated and irrelevant, and such employees might demand new forms of compensation (such as lifetime technical support for neuroprosthetic devices that have been implanted to enable the fulfillment of their official organizational responsibilities[50]). Organizational posthumanism can develop theoretical accounts of such posthumanized processes as well as best practices to facilitate their management.

E. Posthumanized Spaces

The physical spaces in which an organization's members come together to plan and execute its activities have historically included venues such as factories, office buildings, warehouses, retail stores, farms, campuses, military bases, and other specialized locations. As organizations evolve and expand to include nonhuman members such as sapient networks or robotic swarms, the range of physical spaces in which such organizational members can (or need) to work will be similarly transformed. Moreover, building on the use of technologies such as telephony, email, instant messaging, and videoconferencing, even the traditional biologically human members of organizations will find themselves interacting in new posthumanized venues such as persistent virtual worlds. Within such new physical and virtual organizational spaces, one member of an organization may or may not always know whether the other intelligent members with which the member is interacting socially are natural biological human beings, neurocybernetically enhanced human beings, robots, AIs, or other kinds of entities.[51] Organizational posthumanism can engage with practitioners in the fields of architecture, facilities design, ergonomics, operations management, and logistics to create and operate posthumanized physical facilities for organizations functioning in such a deanthropocentrized context. With regard to the development and use of posthumanized virtual spaces, organizational posthumanism can provide a conceptual bridge by seeking out insights from fields as diverse as biocybernetics, HCI, psychology, anthropology, communications, philosophy of mind, computer game design, science fiction, and film and television studies to develop immersive multisensory worlds that serve as effective venues for organizational life.

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[50] See Gladden, "Neural Implants as Gateways" (2016).

[51] See Grodzinsky et al. (2011) and Gladden, "The Social Robot as 'Charismatic Leader'" (2014).

F. Posthumanized External Environments and Ecosystems

An organization can be understood as a viable system that operates within a broader ecosystem (or 'suprasystem') that includes other competing or collaborating organizations as well as natural resources, potential consumers, and other external environmental features.[52] These ecosystems are expected to take on an increasingly posthumanized nature. For example, new environmental elements might include other organizations that consist entirely of intelligent nonhuman members such as robotic swarms and societies of AIs. Similarly, a highly interconnected Internet of Things might be filled with informational resources that are no longer simply passive sets of data but which – through their integration with AI platforms – become intelligent, volitional, and potentially even sapient collections of data that act to pursue their own goals and interests.[53] The world's increasingly rich and complex digital-physical ecosystems might be populated by self-generating, self-propagating, highly adaptable memes in the form of evolvable computer worms or viruses that shape human popular culture as a whole and the thoughts and memories of individual human beings in particular, either through traditional forms of communication and social interaction or through the targeted reprogramming or technological manipulation of, for example, neurocybernetically augmented human beings.[54] The emergence of such new posthuman ecosystems is expected to significantly reshape the kinds of resources that organizations are able to obtain from their environments, the nature of collaboration and competition with external organizations, the types of consumers available to utilize the goods and services produced by an organization, and the organization's definition of long-term viability and success.

The roles that individual organizations play within societies may also be radically reshaped. For example, if future AIs and robotic systems are able to efficiently perform all of the functions of food production and preparation,

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[52] Regarding viable systems and their environments, see, e.g., Beer (1981) and Gladden, "The Artificial Life-Form as Entrepreneur" (2014).

[53] For discussions of the theoretical and practical possibilities for and obstacles to the emergence of such systems, see, e.g., Gladden, "From Stand Alone Complexes to Memetic Warfare: Cultural Cybernetics and the Engineering of Posthuman Popular Culture" (2016), and Gladden, "The Artificial Life-Form as Entrepreneur" (2014).

[54] Regarding the growing possibilities that ideas and other forms of information might exist as actors that can propagate themselves through interaction with other nonhuman or human actors within complex posthumanized digital-physical ecosystems, see, e.g., Gladden, "From Stand Alone Complexes to Memetic Warfare" (2016), and Kowalewska, "Symbionts and Parasites – Digital Ecosystems" (2016).

health care, education, construction, transportation, energy production, retail sales, accounting, security, and other tasks that are needed for human beings and societies to thrive, there will no longer be a financial or operational need for organizations to employ human beings as workers in such roles. In that case, governments might take on the role of coordinating their human citizens' access to such superabundant resources, perhaps offering a 'universal basic income' redeemable in goods or services. The societal roles of governmental and commercial organizations would thus be dramatically transformed. On the other hand, widespread roboticization resulting in mass unemployment could potentially yield a loss of purpose for human beings, social unrest, violent revolution, and the oppression of the human species by automated systems; in this case, processes of posthumanization might result in 'dystopian' rather than 'utopian' organizational outcomes.[55] Organizational posthumanism can provide a theoretical bridge that links the consideration of posthumanization at an organizational level with that at a broader social or environmental level (as considered by fields such as economics, political science, sociology, evolutionary biology, or environmental science), while also developing concrete practices to aid organizations with optimizing their use of resources from and contribution of products to a posthumanized external environment.

V. Technological Changes Facilitating Organizational Posthumanization

While advanced technologies play an essential role in contemporary processes of posthumanization, they are not the only mechanisms through which such processes operate. As noted earlier, there exist many forms of 'posthumanism without technology.'[56] Such nontechnological critical or cultural posthumanism might focus, for example, on historical references to ghosts, angels, monsters, and semidivine heroes in theology and the arts and the

[55] For the debate on whether mass roboticization and the end of human employment as we know it is likely to generate utopian, dystopian, or less extreme social impacts, see, e.g., Sachs et al., "Robots: Curse or Blessing? A Basic Framework" (2015); Nourbakhsh, "The Coming Robot Dystopia" (2015); and Ford, *Rise of the Robots: Technology and the Threat of a Jobless Future* (2015). For longer-term interdisciplinary perspectives, see the texts in *Singularity Hypotheses*, edited by Eden et al. (2012).

[56] Herbrechter (2013), p. 157.

ways in which they have long encouraged human beings to expand the boundaries of society to include a nonhuman 'other.'[57]

Posthumanized beings have always been part of organizations. Even if only tangentially, human organizations have always incorporated such quasi-human, parahuman, or nonhuman others. For example, the decision-making processes of Ancient Roman governmental and military organizations relied on augurs that were supposed by their practitioners to reveal the will of the gods.[58] According to the Catholic Church's traditional teaching on the Communion of Saints, the organization of the Church incorporates both human members who are presently living on earth, members who have died but are still undergoing a purification, and members who have died and now contemplate God in His heavenly glory.[59] In a metaphorical sense, the 'ghost' of a company's beloved founder can continue to guide the company's actions even after his or her death, gazing watchfully from framed portraits on office walls and inspiring new generations of employees through aphorisms quoted reverently in the company's mission statement or employee handbook. And nonhuman others in the form of dogs, horses, and other animals have long been incorporated into human military organizations and businesses (e.g., family farms or circuses) in important roles as intelligent – if not sapient – agents.

Technologization is changing the nature of posthumanization. However, even critical posthumanists who argue that the processes of posthumanization have historically taken many forms unrelated to technological change will acknowledge that in today's world, the accelerating and intensifying technologization of humanity has become an essential – if not the most essential – driver of posthumanization.[60] Herbrechter notes that from the time of its prehistoric origins, humanity has always utilized technology. Indeed, it was only the creation of techniques and technologies for performing such tasks as making fire, hunting animals, and communicating information symbolically that humankind as such was able to develop; "Culture in a sense is therefore always 'technoculture', namely achieved and transmitted by technics."[61] However, the manner and extent of our integration with workplace

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[57] Herbrechter (2013), pp. 2-3, 106. See also Graham (2002).

[58] See Hamilton, "What Is Roman Ornithomancy? A Compositional Analysis of an Ancient Roman Ritual" (2007), and Green, "Malevolent gods and Promethean birds: Contesting augury in Augustus's Rome" (2009).

[59] See the *Catechism of the Catholic Church, Second Edition* (2016), pp. 249-250.

[60] See Herbrechter (2013), pp. 15, 6-7.

[61] Herbrechter (2013), p. 152.

technologies is now undergoing a qualitative transformation. Herbrechter suggests that the human operators of equipment are increasingly merging with their tools in order to manipulate them more effectively, thereby undergoing a process of cyborgization. But just as we are becoming more dependent on our technology, our technology is becoming less dependent on us – thanks to the growing sophistication of artificial intelligence and automated systems that can make decisions without any need for human input. Human agency is thus being attenuated by technology at the same time that the world of 'smart objects' is gaining its own agency.[62]

The new kinds of posthumanized beings produced through such technologization will become incorporated into human organizations in novel fashions. A ghost or saint or animal can indeed be 'incorporated' into the life and behaviors of an organization in meaningful ways – but not, for example, as an employee of the organization. The 'ghost' of a company's founder might offer vague principles to guide decision-making but cannot determine which of three smartphone models to offer for sale in a particular country. A horse can transport a company's goods from place to place but cannot formulate the company's long-term business strategy. However, posthuman beings in the form of artificial intelligences, social robots, sentient (and even sapient) networks, and cyborgs *will* be able to do such things. Increasingly, such posthumanized entities will not simply operate at the fringes of an organization or in supporting roles that aid the decision-making of the organization's natural human members; such posthuman beings will instead increasingly fill critical roles as designers, producers, strategists, and decision-makers within organizations.[63]

While processes such as roboticization, cyborgization, and virtualization have not created the phenomenon of posthumanization, they are making its dynamics visible in new and more vivid ways.[64] Hayles suggests that some forms of 'uncritical' posthumanism (including strains of transhumanism and cybernetics) possess a naïvely technologized interpretation of these processes: such a perspective understands the human body as merely a prosthesis or computational substrate and the mind as a collection of informational patterns; it considers the biological organism of a human being, a social robot

[62] For a discussion of these simultaneous trends, see Herbrechter (2013), p. 150.

[63] An exploration of these possibilities can be found, e.g., in Samani et al. (2012) and Gladden, "The Social Robot as 'Charismatic Leader'" (2014).

[64] See Herbrechter (2013), p. 77.

resembling a human being, and a computer simulation of a human being to be just three interchangeable manifestations of the same sort of viable system.[65] Critical posthumanists such as Hayles and Herbrechter reject such simplistic 'technoeuphoria' and argue that more rigorous critical posthumanist thought is necessary in order to understand, anticipate, and guide the processes of sociotechnological transformation that are challenging our concept of humanity and altering humanity's role in the world.[66] Organizational posthumanism is well-positioned to explore such questions of technological posthumanization in a way that marries the circumspectness of critical posthumanism with a strategic awareness of the fact that the ability to generate and embrace radical new forms of technological transformation is growing ever more important to the survival of organizations.

Three categories of posthumanizing technologies. For the purposes of this text, there are three broad categories of ongoing or anticipated technological developments that are contributing to posthumanization in especially relevant ways: 1) technologies for human augmentation and enhancement, which include many forms of neuroprosthetics and genetic engineering; 2) technologies for synthetic agency, which include robotics, artificial intelligence, and artificial life; and 3) technologies for digital-physical ecosystems and networks that help create the environments within which and infrastructure through which human and artificial agents will interact.[67] We can consider these three types of technologies in turn.

A. Technologies for Human Augmentation and Enhancement

Technologies that are expected to alter the sensory, motor, and cognitive capacities of human beings include implantable computers, advanced neuro-

[65] See Hayles (1999), pp. 2-3, and its discussion in Herbrechter (2013), p. 42.

[66] Herbrechter (2013), p. 200.

[67] For a discussion of the role of such technologies in posthumanization, see Herbrechter (2013), pp. 90-91, and its analysis of Graham (2002) and Graham, "Post/Human Conditions" (2004). Note that while we focus in this text on three kinds of posthumanizing technologization that have a particular impact on the form and dynamics of organizations, they are by no means the only kinds of technologization that will contribute to posthumanization. Technological developments in other fields such as agriculture, transportation, energy, space exploration, and the military will also likely contribute to the posthumanization of our world and the organizations within it.

prosthetics, genetic engineering, and the use of immersive virtual reality systems.[68] The implementation of such technologies will result in a posthumanization of organizations' **members** (e.g., as an organization purposefully hires cyborgs to fill particular roles or the organization's current employees acquire cybernetic enhancements on their own initiative), **structures** (e.g., as implantable computers and communication devices allow workers to engage in new types of decision-making and reporting relationships), **systems** (e.g., by giving human workers new abilities to control, be controlled by, and otherwise interface with an organization's technological infrastructure), **processes** (e.g., by facilitating direct brain-to-brain communication and providing workers with in-body access to organizational databases), **spaces** (e.g., by allowing cyborg workers to operate in areas dangerous or inaccessible to natural human beings), and **external ecosystems** (e.g., by creating cyborg consumers that need new kinds of goods and services and external cyborg partners and consultants that can provide them). We can consider such posthumanizing technologies in more detail.

1. Implantable Computers

The universe of contemporary information and communications technology (ICT) includes a wide range of implantable devices such as passive RFID tags that are not in themselves computers but which can interact with computers and serve as elements of computerized systems. However, an increasing number of implantable devices indeed constitute full-fledged computers that possess their own processor, memory, software, and input/output mechanisms and whose programming can be updated after they are implanted into the body of their human host. Among these are many implantable medical devices (IMDs) such as pacemakers, defibrillators, neuroprostheses including retinal and cochlear implants, deep brain stimulation (DBS) devices, body sensor networks (BSNs), and even some of the more sophisticated implantable RFID transponders.[69] A growing number of these implantable computers utilize sophisticated biocybernetic control loops that allow the

[68] Such technologies are reviewed, e.g., in Bostrom (2008); Fukuyama (2002); Gray (2002); and Herbrechter (2013), pp. 90-91.

[69] See Gasson et al., "Human ICT Implants: From Invasive to Pervasive" (2012); Gasson, "ICT Implants" (2008); and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 19-20.

physiological and cognitive activity of their host to be detected, processed, and interpreted for use in exercising real-time computer control.[70]

The implantable computers that have been developed to date typically serve a restorative or therapeutic medical purpose: they are used to treat a particular illness or restore to their user a sensory, motor, or cognitive ability that has been lost through illness or injury. Increasingly, though, implantable computers will be developed not to restore some regular human capacity that has been lost but to augment their users' physical or intellectual capacities in ways that exceed typical human abilities.[71] For example, implantable computers resembling miniaturized subcutaneous smartphones might provide their users with wireless communication capacities including access to cloud-based services.[72] The elective use of implantable computers for physical and cognitive augmentation will expand the market for such devices to broader segments of the population beyond those who currently rely on them to address medical conditions.[73]

2. Advanced Neuroprosthetics

Drawing on definitions offered by Lebedev and others, we can define a neuroprosthesis as a technological device that is integrated into the neural circuitry of a human being; such devices are often categorized as being sensory, motor, bidirectional sensorimotor, or cognitive.[74] While there is much overlap between implantable computers and neuroprosthetic devices, not all implantable computers interface directly with their host's neural circuitry and not all neuroprosthetic devices are implantable.[75]

The power and potential applications of neuroprosthetic devices are expected to grow significantly in the coming years. For example, it is anticipated

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[70] See Fairclough, "Physiological Computing: Interfacing with the Human Nervous System" (2010), and Park et al., "The Future of Neural Interface Technology" (2009).

[71] Regarding the anticipated increasing use of implantable computers for purposes of human enhancement, see, e.g., Warwick & Gasson, "Implantable Computing" (2008); Berner (2004), p. 17; and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), p. 28.

[72] For discussion of such a device, see Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), p. 93.

[73] See McGee (2008) and Gasson et al. (2012).

[74] Such a classification is discussed in Lebedev, "Brain-Machine Interfaces: An Overview" (2014), and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 21-22.

[75] For this distinction, see Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), p. 32.

that current types of retinal implants that demonstrate very limited functionality will be supplanted by future sensory neuroprosthetics such as artificial eyes[76] that give their human hosts the capacity to experience their environments in dramatic new ways, such as through the use of telescopic or night vision[77] or by presenting an augmented reality that overlays actual sense data with supplemental information from a neuroprosthetic device's computer.[78] A neuroprosthetic device could also allow all of the sense data experienced by a human mind to be recorded as a stream of digital data that can be played back on demand by other human beings, enabling them to vicariously experience the world as though they were temporarily occupying the body of the device's host. Similar technologies might allow a person to play back any of his or her own earlier sensory experiences with perfect fidelity or replace the sense data generated by his or her actual external environment with sense data depicting some fictional virtual world.[79]

Meanwhile, cognitive neuroprosthetic devices may offer their user the ability to create, delete, or otherwise edit memories stored within his or her brain's biological neural network; such abilities could be used, for example, to acquire new knowledge or skills or to erase existing fears.[80] Some scholars envision the development of ingestible 'knowledge pills' whose contents (perhaps a swarm of networked nanorobots[81]) travel to the brain, where they manipulate neurons to create engrams containing particular memories.[82] Other researchers foresee the possibility of being able to simply download new

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[76] Regarding such possibilities, see Berner (2004), p. 17, and Koops & Leenes (2012).

[77] Such enhanced forms of vision are discussed, e.g., in Gasson et al. (2012) and Merkel et al., "Central Neural Prostheses" (2007).

[78] See Koops & Leenes (2012) and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 32-33.

[79] Regarding such sensory playback and virtual reality systems, see Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 33, 156-57; Koops & Leenes (2012), pp. 115, 120, 126; Merkel et al. (2007); Robinett, "The Consequences of Fully Understanding the Brain" (2002); and McGee (2008), p. 217.

[80] Such possibilities build on experimental techniques and technologies that are currently being tested in mice. See Han et al., "Selective Erasure of a Fear Memory" (2009); Ramirez et al., "Creating a False Memory in the Hippocampus" (2013); McGee (2008); Warwick, "The Cyborg Revolution" (2014), p. 267; and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), p. 148.

[81] See Pearce, "The Biointelligence Explosion" (2012).

[82] For such possibilities, see Spohrer, "NBICS (Nano-Bio-Info-Cogno-Socio) Convergence to Improve Human Performance: Opportunities and Challenges" (2002).

skills or knowledge onto a memory chip implanted within the brain.[83] Cognitive neuroprosthetic devices might also be used to provide their human hosts with enhanced levels of intelligence[84] and creativity,[85] more desirable emotional dynamics and behavior,[86] enhanced conscious awareness (e.g., by reducing the need for sleep),[87] a strengthened or modified conscience,[88] and real-time assistance with decision-making to mitigate the impact of cognitive biases.[89]

Similarly, a motor neuroprosthetic device might grant its user enhanced control over his or her existing biological body, expand the user's body to incorporate new devices (such as an exoskeleton or robotic vehicle) through body schema engineering, replace most of the user's existing biological body with electromechanical components to turn the individual into a cyborg,[90] allow the user to control external networked physical systems such as drones

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[83] See McGee (2008) and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), p. 33.

[84] Berner (2004), p. 17.

[85] Increases in creativity have been anecdotally reported to occur after the use of neuroprosthetics for deep brain stimulation. See Cosgrove, "Session 6: Neuroscience, brain, and behavior V: Deep brain stimulation" (2004); Gasson, "Human ICT Implants: From Restorative Application to Human Enhancement" (2012); Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), p. 149; Gladden, "Neural Implants as Gateways" (2016); and Gasson (2012), pp. 23-24.

[86] Regarding the intentional creation of emotional neuroprosthetics, see, e.g., Soussou & Berger, "Cognitive and Emotional Neuroprostheses" (2008). Effects on emotion have already been observed, for example, with devices used for deep brain stimulation. See Kraemer, "Me, Myself and My Brain Implant: Deep Brain Stimulation Raises Questions of Personal Authenticity and Alienation" (2011).

[87] Regarding efforts by the DARPA military research agency and others to develop neurotechnologies that can increase soldiers' alertness and reduce their need for sleep, see, e.g., Falconer, "Defense Research Agency Seeks to Create Supersoldiers" (2003); Moreno, "DARPA On Your Mind" (2004); Clancy, "At Military's Behest, Darpa Uses Neuroscience to Harness Brain Power" (2006); Wolf-Meyer, "Fantasies of extremes: Sports, war and the science of sleep" (2009); Kourany, "Human Enhancement: Making the Debate More Productive" (2013), pp. 992-93; and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), p. 151.

[88] The conscience can be understood as a set of metavolitions, or desires about the kinds of volitions that a person wishes to possess. See Calverley (2008) and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 151-52. To the extent that a neuroprosthetic device enhances processes of memory and emotion that allow for the development of the conscience, it may enhance one's ability to develop, discern, and follow one's conscience.

[89] Regarding the potential use of neuroprosthetic devices for such purposes, see Gladden, "Neural Implants as Gateways" (2016). For a description of common cognitive biases and their impact on organizational decision-making, see Kinicki & Williams, *Management: A Practical Introduction* (2010), pp. 217-19.

[90] See Lebedev (2014) and Berner (2004), p. 16.

or 3D printers, or provide the host with a radically nonhuman body for use in sensing and manipulating a virtual environment.[91]

3. Virtual Reality

In principle, a virtual reality system may be capable of creating a fully immersive visual, auditory, olfactory, gustatory, and tactile environment that its human user would find impossible to qualitatively distinguish from the real world, if the system is capable of presenting either roughly 200 Gbps of raw sense data to the body's sensory organs (such as the retina, hair cells in the ear, and taste buds) through their external stimulation or roughly 250 Mbps of already-processed sense data in the form of direct electrochemical stimulation either of the nerves (such as the optic and cochlear nerves) that carry such data to the brain or of the relevant brain regions themselves.[92] Such fully immersive – and potentially continuous and long-term – virtual reality experiences could be facilitated through the use of advanced neuroprosthetic devices that provide a human brain with all of its sense data, perhaps aided by the use of genetic engineering to make the brain or sensory organs better suited to receive input from such devices.[93]

There is no logical necessity for these fully immersive virtual worlds to resemble our real world in all respects: within a virtual world, human beings might be given new kinds of sensory capacities[94] or even radically nonhuman bodies.[95] Moreover, the laws of physics and biology that hold sway within the real world need not apply in a virtual world; the designers of such worlds could formulate their own cultural, social, biological, physical, and even logical and ontological principles that govern or mediate the interactions of subjects and objects within a virtual world. For example, a world designer might decide that within a particular virtual world all human beings, all computers possessing artificial general intelligence, and some of the more intelligent

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[91] Gladden, "Cybershells, Shapeshifting, and Neuroprosthetics: Video Games as Tools for Posthuman 'Body Schema (Re)Engineering'" (2015).

[92] See Berner (2004), pp. 37-38, 45-47.

[93] On implantable systems for augmented or virtual reality, see Sandor et al., "Breaking the Barriers to True Augmented Reality" (2015), pp. 5-6. Regarding the theoretical possibilities and limits of such technologies, taking into account human physiological and psychological constraints, see Gladden, "Cybershells, Shapeshifting, and Neuroprosthetics" (2015).

[94] See Merkel et al. (2007).

[95] Such possibilities are explored in Gladden, "Cybershells, Shapeshifting, and Neuroprosthetics" (2015).

forms of animals represented within it are able to instantaneously share their thoughts and emotions with one another through a form of 'telepathy,' thereby creating new kinds of communal creativity, thought, and agency.[96]

Such technologies could potentially have significant negative consequences; for example, particularly immersive and stimulating virtual environments may become addictive, with their users unable or unwilling to leave them.[97] Moreover, if a user possesses a permanently implanted virtual reality device that is able to alter or replaces its host's sensory perceptions, it may be impossible for the user to know which (if any) of the sense data that he or she is experiencing corresponds to some actual element of an external physical environment and which is 'virtual' or simply 'false'; such an individual may lose the ability (and perhaps desire) to distinguish between real and virtual experiences and worlds.[98]

4. Genetic Engineering, Medicine, and Life Extension

Notwithstanding the many serious questions about whether such applications are ontologically coherent and ethically acceptable, as a practical matter scholars expect that new techniques for genetic engineering will eventually be used, for example, to produce a continually refreshed inventory of personalized replacement organs that can be implanted when their human host's previous organs 'wear out' – or even organs that regenerate themselves

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[96] Such options available to the designers of virtual worlds in immersive and long-term multisensory VR environments are discussed in Gladden, "Cybershells, Shapeshifting, and Neuroprosthetics" (2015), and Gladden, "'Upgrading' the Human Entity: Cyberization as a Path to Posthuman Utopia or Digital Annihilation?" (2015).

[97] Regarding the ramifications of long-term immersion in virtual reality environments, see, e.g., Heim, *The Metaphysics of Virtual Reality* (1993); Koltko-Rivera, "The potential societal impact of virtual reality" (2005); and Bainbridge, *The Virtual Future* (2011). Regarding the danger of 'toxic immersion' in a virtual world, see Castronova, *Synthetic Worlds: The Business and Culture of Online Games* (2005). See also Berner (2004), p. 16, and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 55-56.

[98] For the possibility that a device designed to receive raw data from an external environment could have that data replaced with other data transmitted from some external information system, see Koops & Leenes (2012). Regarding the possibility of neuroprosthetic devices being used to provide false data or information to their hosts or users, see McGee (2008), p. 221, and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015). For an analysis of the relationship between physical and virtual reality and ways in which entities can move between these worlds, see Kedzior, "How Digital Worlds Become Material: An Ethnographic and Netnographic Investigation in Second Life" (2014). For more general analyses of the phenomenon of virtual reality, see, e.g., *Communication in the Age of Virtual Reality*, edited by Biocca & Levy (1995); *Cybersociety 2.0: Revisiting Computer-Mediated Communication and Community*, edited by Jones (1998); and Lyon, "Beyond Cyberspace: Digital Dreams and Social Bodies" (2001).

within their host's body.[99] It is also anticipated that gene therapy will be employed not simply to replace damaged body components with healthy replicas but to modify the form and functioning of an individual's body or to create new human beings who possess particularly desirable characteristics.[100]

Some scholars expect that the use of medical technologies for radical life extension will become more widespread even as the availability of such technologies remains restricted for legal, ethical, financial, or cultural reasons. Those individuals who possess access to such technologies may be allowed to extend their life indefinitely (in whatever form such a life might take) and may be permitted and expected to choose the time of their own death.[101]

Genetic engineering may also be used to create new forms of sensory, motor, or computing devices within the human body. For example, a neuroprosthetic device need not be electronic in nature: ongoing developments in fields such as genetic engineering, synthetic biology, bionanotechnology, and biomolecular computing are expected to make possible the creation of neuroprosthetic devices that are partially or wholly composed of biological material (perhaps based on the DNA of the device's host) or other non-electronic components.[102] Other advances in medical technology may involve the use of more traditional electronics and robotics. For example, a swarm of nanorobots that has been injected or ingested may travel to a specific location within the body to perform surgery, clean clogged arteries, or modify or stimulate neurons to

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[99] See Berner (2004), p. 61, and Ferrando (2013), p. 27.

[100] For a range of perspectives on such possibilities, see, e.g., Berner (2004), p. 17; Panno, *Gene Therapy: Treating Disease by Repairing Genes* (2005); Mehlman, *Transhumanist Dreams and Dystopian Nightmares: The Promise and Peril of Genetic Engineering* (2012); Bostrom, "Human Genetic Enhancements: A Transhumanist Perspective" (2012); Lilley, *Transhumanism and Society: The Social Debate over Human Enhancement* (2013); and De Melo-Martín, "Genetically Modified Organisms (GMOs): Human Beings" (2015).

[101] For a discussion of various approaches to human life extension, see Koene, "Embracing Competitive Balance: The Case for Substrate-Independent Minds and Whole Brain Emulation" (2012). See also Berner (2004), pp. 16-17, and Ferrando (2013), p. 27.

[102] Such technologies are discussed, e.g., in Ummat et al., "Bionanorobotics: A Field Inspired by Nature" (2005); Andrianantoandro et al., "Synthetic biology: new engineering rules for an emerging discipline" (2006); Cheng & Lu, "Synthetic biology: an emerging engineering discipline" (2012); Lamm & Unger, *Biological Computation* (2011); and Berner (2004), pp. 15, 18, 31, 61-62. For a hybrid biological-electronic interface device that includes a network of cultured neurons, see Rutten et al., "Neural Networks on Chemically Patterned Electrode Arrays: Towards a Cultured Probe" (2007). Hybrid biological-electronic interface devices are also discussed by Stieglitz in "Restoration of Neurological Functions by Neuroprosthetic Technologies: Future Prospects and Trends towards Micro-, Nano-, and Biohybrid Systems" (2007).

create new information within neural networks.[103] Ingestible robotic pills might be used to evaluate an individual's internal biological processes and to administer precise dosages of drugs according to complex criteria.[104]

More futuristic and contentious is the concept of 'mind uploading' as a means of extending the life (or if not the life, then in some sense the 'agency') of a particular human being by somehow copying or transferring the structures and processes of his or her mind from their original biological substrate to a new electronic form – for example, by gradually replacing all of a brain's original biological neurons with electronic artificial neurons. Many scholars argue that while it may, for example, be possible to copy the data that comprise the contents of a mind's memories to some external system, it is impossible to transfer or extend the conscious awareness of the mind itself in such a fashion. Nevertheless, some transhumanist proponents of mind uploading argue that such a process would not truly destroy the consciousness or essence of its human host – and that even if it did, they would be willing to transform their own bodies in this fashion, insofar as it might provide a bridge that would allow them to duplicate their memories and patterns of mental activity in a robotic or computerized body that could survive indefinitely.[105]

B. Technologies for Synthetic Agency: Robotics, AI, and Artificial Life

Ongoing rapid developments are expected in those fields such as robotics, artificial intelligence, and artificial life that involve the creation of entities that possess artificial agency and which are able to receive data from their environment, process information, select a course of action, and act to influence their world. For example, research within the field of artificial intelligence is expected to yield artificial agents that possess human-like levels of intelligence, creativity, learning capacity, sociality, and cultural knowledge

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[103] Medical and other applications of such technologies are discussed in Spohrer (2002); Berner (2004), pp. 18, 76; Pearce (2012); and Ferrando (2013), p. 27.

[104] Berner (2004), p. 76.

[105] For different perspectives on techniques such as the use of artificial neurons to gradually replace the natural biological neurons within a living human brain as a means of effecting 'mind uploading,' see Moravec, *Mind Children: The Future of Robot and Human Intelligence* (1990); Hanson, "If uploads come first: The crack of a future dawn" (1994); Proudfoot, "Software Immortals: Science or Faith?" (2012); Koene (2012); Pearce (2012); and Ferrando (2013), p. 27.

and which will eventually claim to possess consciousness and their own spirituality.[106] Such artificial agents might be capable of serving as charismatic leaders of human beings by utilizing their powers of persuasion, inspiration, and interpersonal attractiveness,[107] and they may be able to draw on their social capacities and cultural knowledge to serve, for example, as the managers of vast global virtual teams of human workers.[108]

Significant changes are also expected regarding the physical substrates upon which robots and AI platforms are based, as it becomes possible to design systems utilizing components that are increasingly miniaturized, spatially dispersed, and biological; no longer will an artificially intelligent software-based system be chained to the electronic physical substrate found in traditional computers.[109] Entirely new kinds of robots and AI systems may become possible thanks to emerging technologies for physical neural networks,[110] photonic computing, quantum computing, the use of DNA for digital data storage and computing, and other kinds of biocomputing.[111] Thanks to advances in nanorobotics, robots will come to outnumber human beings and

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[106] Regarding the prospect of robots and AIs that possess truly human-like cognitive capacities, see Friedenberg (2008) and Berner (2004), pp. 16-17, 38. For discussion of robots that interact socially with human beings, see Breazeal, "Toward sociable robots" (2003); Kanda & Ishiguro, *Human-Robot Interaction in Social Robotics* (2013); *Social Robots and the Future of Social Relations*, edited by Seibt et al. (2014); *Social Robots from a Human Perspective*, edited by Vincent et al. (2015); and *Social Robots: Boundaries, Potential, Challenges*, edited by Nørskov (2016). Regarding elements that must be present in order for a computerized device to develop its own spirituality, see, e.g., Geraci, "Spiritual robots: Religion and our scientific view of the natural world" (2006); Nahin, "Religious Robots" (2014); and Section 6.2.3.2 on "Religion for Robots" in Yampolskiy, *Artificial Superintelligence: A Futuristic Approach* (2015).

[107] See Gladden, "The Social Robot as 'Charismatic Leader'" (2014).

[108] Regarding potential managerial roles for robots and AIs, see Samani & Cheok, "From human-robot relationship to robot-based leadership" (2011); Samani et al. (2012); and Gladden, "Leveraging the Cross-Cultural Capacities of Artificial Agents" (2014). Regarding the possibility of 'supersocial' AIs that can simultaneously maintain social relations with massive numbers of human colleagues or subordinates, see, e.g., Gladden, "Managerial Robotics" (2014).

[109] Regarding the evolving physical form of robots, see, e.g., Gladden, "The Diffuse Intelligent Other" (2016), and Berner (2004), p. 16.

[110] Regarding AIs that utilize physical neural networks rather than running as an executable software program on a conventional computer employing a Von Neumann architecture, see, e.g., Snider, "Cortical Computing with Memristive Nanodevices" (2008); Versace & Chandler, "The Brain of a New Machine" (2010); and *Advances in Neuromorphic Memristor Science and Applications*, edited by Kozma et al. (2012).

[111] For discussion of DNA-based and biological computing, see, e.g., Berner (2004), pp. 15, 18, 31, 61-62; Ummat et al. (2005); Andrianantoandro et al. (2006); Lamm & Unger (2011); Church et al., "Next-generation digital information storage in DNA" (2012); and Cheng & Lu (2012).

become truly ubiquitous: through the use of piezoelectric components, nanoscale switches and sensors can be created that require no electrical power source, allowing clouds of nanorobots to float on the air and fill the space around us with an invisible mesh of sensors, actuators, and information-processors.[112] Such swarms of customized nanorobots might be sent into dangerous environments to aid with disaster relief or to conduct military operations,[113] and moving beyond today's relatively simple 3D printing systems, portable (perhaps even handheld) manufacturing facilities could be created that employ specialized swarms of nanorobots to produce highly sophisticated physical goods.[114]

Ongoing developments in the fields of synthetic biology, bionanotechnology, biologically inspired robotics, soft robotics, evolutionary robotics, and artificial life are expected to result in robotic systems whose structures and dynamics resemble those of living organisms and ecosystems or are even composed of biological material. For example, researchers envision the development of robotic systems controlled not by a traditional CPU-based computer but by a synthetic brain;[115] autonomous robots that can learn, adapt, reproduce themselves, and evolve through competition for resources within a digital-physical ecosystem;[116] autonomous computer networks that function as a living entity[117] that possesses its own immune system and whose remaining networked components are able to automatically take over the work of a member computer that has been disconnected or destroyed;[118] and software programs that can repair damage to themselves or even reprogram themselves to accomplish a new purpose, as well as computer chips or entire ro-

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[112] Berner (2004), pp. 16, 18, 38, 40-41.

[113] See Coeckelbergh, "From Killer Machines to Doctrines and Swarms, or Why Ethics of Military Robotics Is Not (Necessarily) About Robots" (2011), and Berner (2004), pp. 16-17.

[114] Berner (2004), p. 17.

[115] See Warwick (2014) and Berner (2004), p. 17.

[116] See Gladden, "The Artificial Life-Form as Entrepreneur" (2014), and Berner (2004), pp. 16, 18.

[117] Regarding collectively conscious computer networks, see Callaghan, "Micro-Futures" (2014). For a future Internet that is technically 'self-aware' (if not subjectively conscious), see Galis et al., "Management Architecture and Systems for Future Internet Networks" (2009), pp. 112-13. A sentient Internet is also discussed in Porterfield, "Be Aware of Your Inner Zombie" (2010), p. 19. For a future Internet whose degree of self-awareness resembles that of a living entity, see Hazen, "What is life?" (2006). See also Gladden, "The Artificial Life-Form as Entrepreneur" (2014).

[118] See Berner (2004), pp. 17, 31.

bots that can intentionally repair or automatically heal damage to themselves.[119] Emerging technologies are expected to eventually allow the development of 'biological operating systems' for groups of cells and entire organisms as well as the design of entirely new species[120] that could be understood alternatively as either artificial biological organisms or biological robots.

Together, technologies that create advanced synthetic agents such as social robots, artificial general intelligences, and artificial life-forms are expected to drive an ongoing posthumanization of organizations' **members** (e.g., by allowing such nonhuman entities to serve as organizational members alongside or instead of human beings), **structures** (e.g., by allowing optimized decision-making and reporting structures designed through genetic algorithms that are free from human cognitive biases and limitations), **systems** (e.g., by allowing the development of organizational systems that are operated by synthetic beings with high speed and accuracy, without the need for human workers to enter data or access information through the slow and error-prone processes of reading printed text), **processes** (e.g., by allowing an organization's synthetic members to analyze data and make decisions faster, more accurately, or more imaginatively than is possible for human beings), **spaces** (e.g., by eliminating the need for physical facilities whose atmosphere, temperature, radiation levels, and other characteristics can sustain human life), and **external ecosystems** (e.g., by creating external resource-providers and consumers that are synthetic beings whose needs and capacities differ widely from those of human beings).

C. Technologies for Digital-Physical Ecosystems and Networks: Connectivity, Relationships, and Knowledge

Many technological changes are either underway or expected that do not relate exclusively to human or artificial agents but which instead shape the larger networks and ecosystems within which all intelligent agents interact. Through the incorporation into the Internet of all public knowledge that has been generated by the human species, the expansion of the Internet of Things

[119] Berner (2004), pp. 17-18. Regarding self-maintenance and self-healing as one capacity that robotic systems must possess in order to be fully autonomous, see Gladden, "The Diffuse Intelligent Other" (2016).

[120] Berner (2004), pp. 16, 61. See also the discussion in Friedenberg (2008), pp. 201-03, of essential elements that must be present in order for an artificial entity to be 'alive,' which are based on the criteria for biological life presented in Curtis, *Biology* (1983).

to encompass a growing variety and number of networked devices (including ubiquitous sensors conducting real-time surveillance),[121] and the use of RFID or other technologies to assign a unique identifier to any physical object, cyberspace can in effect become a virtual representation of the entire world.[122] Successor networks to the current-day Internet may serve as a mesh that creates a digital-physical ecosystem tying together all kinds of intelligent agents that are able to access the network through biological, electronic, or other means, including unmodified 'natural' human beings, genetically engineered human beings, human beings with extensive cybernetic augmentations, human minds that dwell permanently within virtual realities, social robots, artificially intelligent software, nanorobot swarms, and sapient networks.[123] Within such vast, complex digital ecosystems, most communication will no longer involve human beings but will take place between networked devices,[124] as real-time data mining is performed by automated systems to continually unearth new theoretical, historical, and predictive knowledge.[125] Some researchers expect that so close will be the symbiotic[126] integration of computerized networks with their natural environment that it may be possible to 'reboot' entire ecosystems as needed, in order to save or improve the lives of their inhabitants.[127]

In particular, neuroprosthetic devices may serve as gateways that unite the human and electronic inhabitants of a digital-physical ecosystem, allowing their human hosts to participate in new kinds of technologically mediated

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[121] This evolution in the Internet of Things is discussed in Evans, "The Internet of Everything: How More Relevant and Valuable Connections Will Change the World" (2012).

[122] See Berner (2004), pp. 18, 35, and Gladden, "Utopias and Dystopias as Cybernetic Information Systems" (2015).

[123] Cybernetic networks that can link such entities are discussed in Gladden, "Utopias and Dystopias as Cybernetic Information Systems" (2015).

[124] See Berner (2004), p. 18, and Evans (2012).

[125] See Berner (2004), p. 32. Existing semi-automated data-mining processes are described, e.g., in Giudici, *Applied Data Mining: Statistical Methods for Business and Industry* (2003), and Provost & Fawcett, *Data Science for Business* (2013), p. 7. Regarding the prospects of developing more fully autonomous AI systems for data mining, see, for example, Warkentin et al. (2012); Bannat et al. (2011), pp. 152-55; and Wasay et al. (2015).

[126] For a philosophical exploration (drawing on Actor-Network Theory) of ways in which nonhuman and human actors coexisting within digital-physical ecosystems might enter into 'symbioses' that are not simply metaphorical but are instead true symbiotic relationships, see Kowalewska (2016).

[127] This possibility is raised in Berner (2004), p. 16.

social relations and structures that were previously impossible – perhaps including new forms of merged agency[128] or cybernetic networks that display utopian (or dystopian) characteristics that are not possible for non-neuroprosthetically-enabled societies.[129] Neuroprosthetic devices may also link hosts or users in ways that form communication and information systems[130] that can generate greater collective knowledge, skills, and wisdom than are possessed by any individual member of the system.[131] Because this ubiquitous digital-physical mesh of networked neuroprosthetic devices, sensors, actuators, data pools, and servers will allow human and synthetic minds to exchange thoughts with one another in a manner that seems direct, instantaneous, and unmediated and to control physical systems and objects and virtual environments, it will create what is, for practical purposes, a 'quasi-magical' world in which beings demonstrate functional telepathy and telekinesis.[132]

Such technological change will not only result in a posthumanization of the larger **external ecosystems** within which organizations exist; it will also spur an ongoing posthumanization of organizations' **members** (e.g., by increasing or decreasing members' sensory input, span of motor control, and social interaction with other intelligent nodes within the environment), **structures** (e.g., by allowing decision-making and reporting relations to be overlaid on top of naturally existing cybernetic relationships created between members within the environment), **systems** (e.g., by providing free or fee-based public information systems that can be utilized by an organization), **processes** (e.g., by allowing an organization to develop its own customized processes or exploit SaaS-based approaches that utilize the environment's publically ac-

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[128] See McGee (2008), p. 216, and Koops & Leenes (2012), pp. 125, 132.

[129] Different forms that such societies might take are discussed in Gladden, "Utopias and Dystopias as Cybernetic Information Systems" (2015).

[130] The intentional or *ad hoc* creation of such systems is discussed, e.g., in McGee (2008), p. 214; Koops & Leenes (2012), pp. 128-29; Gasson (2012), p. 24; and Gladden, "'Upgrading' the Human Entity" (2015).

[131] The dynamics through which this can occur are discussed, e.g., in Wiener, *Cybernetics: Or Control and Communication in the Animal and the Machine* (1961), loc. 3070ff., 3149ff.; Gladden, "Utopias and Dystopias as Cybernetic Information Systems" (2015); and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 160-61.

[132] See Berner (2004), pp. 16-17, 38; Gladden, "Cybershells, Shapeshifting, and Neuroprosthetics" (2015); and the potential indistinguishability of advanced technology and magic, as famously discussed in Clarke, "Hazards of Prophecy: The Failure of Imagination" (1973), p. 36.

cessible cloud infrastructure), and **spaces** (e.g., by creating ready-made physical and virtual spaces that an organization can move into and adapt for its own ends).

VI. Conclusion

The relationship of posthumanist thought to organizational studies and management is a topic that is increasingly worth exploring, thanks largely to the ongoing acceleration and intensification of technological change that is fashioning a new organizational context which can appropriately be described as 'posthuman.' Within this text, we have attempted to advance the development of this new sphere of academic inquiry and management practice by presenting one approach to formulating a systematic organizational posthumanism.

We began by noting that established forms of posthumanism could be divided into analytic types that view posthumanity as an existing sociotechnological reality that is best understood from a post-dualist and post-anthropocentric perspective and synthetic types that view posthumanity as a kind of future entity whose creation can either be intentionally brought about or avoided. Similarly, established forms of posthumanism can be understood as either theoretical or practical in nature, depending on whether their goal is to expand human knowledge or generate some concrete impact in the world. We have argued that organizational posthumanism combines analytic, synthetic, theoretical, and practical elements as a type of hybrid posthumanism. It is analytic and theoretical insofar as it attempts to identify and understand the ways in which contemporary organizations' structures and dynamics are being affected by emerging sociotechnological realities, and it is synthetic and practical insofar as its goal is to fashion a new 'posthuman entity' not in the form of a genetically or neuroprosthetically augmented human being but in the form of organizations that can survive and thrive within a rapidly evolving posthumanized ecosystem. Building on concepts from the field of organizational architecture, six particular aspects of organizations were identified that are likely to be impacted by ongoing posthumanization: namely, an organization's members, structures, information systems, processes, physical and virtual spaces, and external environment. Finally, we explored the manner in which technologies for human augmentation and enhancement, synthetic agency, and the construction of digital-physical ecosystems and networks are expected to increasingly drive the development of organizational posthumanity. It is our hope that this investigation of the ways in which a

current and emerging posthumanity is transforming the shape, dynamics, and roles of organizations will both raise new questions and offer a path to developing creative insights that can inform the work of those who seek to understand the nature of organizations and those who are charged with managing them now and in the future.

Part Three

The Posthuman Management Matrix:

Understanding the Organizational Impact of Radical Biotechnological Convergence

Abstract. In this text we present the Posthuman Management Matrix, a model for understanding the ways in which organizations of the future will be affected by the blurring – or even dissolution – of boundaries between human beings and computers. In this model, an organization's employees and consumers can include two different kinds of agents (human and artificial) who may possess either of two sets of characteristics (anthropic or computer-like); the model thus defines four types of possible entities. For millennia, the only type of relevance for management theory and practice was that of human agents who possess anthropic characteristics – i.e., 'natural' human beings. During the 20th Century, the arrival of computers and industrial robots made relevant a second type: that of artificial agents possessing computer-like characteristics.

Management theory and practice have traditionally overlooked the remaining two types of possible entities – human agents possessing computer-like physical and cognitive characteristics (which can be referred to as 'cyborgs') and artificial agents possessing anthropic physical and cognitive characteristics (which for lack of a more appropriate term might be called 'bioroids') – because such agents did not yet exist to serve as employees or consumers for organizations. However, in this text we argue that ongoing developments in neuroprosthetics, genetic engineering, virtual reality, robotics, and artificial intelligence are indeed giving rise to such types of agents and that new spheres of management theory and practice will be needed to allow organizations to understand the operational, legal, and ethical issues that arise as their pools of potential workers and customers evolve to include human beings whose bodies and minds incorporate ever more computerized elements and artificial entities that increasingly resemble biological beings.

By analyzing the full spectrum of human, computerized, and hybrid entities that will constitute future organizations, the Posthuman Management Matrix highlights ways in which established disciplines such as cybernetics, systems theory, organizational design, and enterprise architecture can work alongside new disciplines like psychological engineering, AI resource management, metapsychology, and exoeconomics to help organizations anticipate and adapt to posthumanizing technological and social change.

I. Introduction

Facilitated by ongoing technological developments in fields like neuroprosthetics, genetic engineering, social robotics, nanorobotics, and artificial intelligence, a growing convergence between sapient biological entities like human beings and electronic computerized systems is underway. Looking beyond the current reality in which human beings interact with technological instruments that mediate so many of our daily activities, researchers anticipate a future in which human persons themselves *become* technological instruments. Human beings who display carefully engineered architectures,[1] electromechanical physical components,[2] software-guided cognitive processes,[3] and digitally mediated interactions[4] will increasingly resemble computers – and they will share digital-physical ecosystems with computerized

[1] See, e.g., Canton, "Designing the future: NBIC technologies and human performance enhancement" (2004); De Melo-Martín, "Genetically Modified Organisms (GMOs): Human Beings" (2015); Nouvel, "A Scale and a Paradigmatic Framework for Human Enhancement" (2015); and Bostrom, "Human Genetic Enhancements: A Transhumanist Perspective" (2012). Regarding 'brain engineering,' see Gross, "Traditional vs. modern neuroenhancement: notes from a medico-ethical and societal perspective" (2011).

[2] Regarding expected future growth in the use of implantable electronic neuroprosthetic devices for purposes of human enhancement, see, e.g., McGee, "Bioelectronics and Implanted Devices" (2008), and Gasson, "Human ICT Implants: From Restorative Application to Human Enhancement" (2012).

[3] For the potential use of an electronic 'brain pacemaker' to regulate cognitive activity, see Naufel, "Nanotechnology, the Brain, and Personal Identity" (2013). Regarding possible manipulation of the human brain's activity through the use of computerized neuroprosthetic devices, see Viirre et al., "Promises and perils of cognitive performance tools: A dialogue" (2008), and Heinrichs, "The promises and perils of non-invasive brain stimulation" (2012).

[4] See, e.g., *Communication in the Age of Virtual Reality*, edited by Biocca & Levy (1995); *Cybersociety 2.0: Revisiting Computer-Mediated Communication and Community*, edited by Jones (1998); and Lyon, "Beyond Cyberspace: Digital Dreams and Social Bodies" (2001).

systems whose biological or biomimetic components,[5] evolutionary processes,[6] unpredictable neural networks,[7] and physically mediated social relations[8] cause them to ever more closely resemble human beings.

Such technological and social changes will be so transformative in their effects that they can be understood as creating a world best described as *posthuman*.[9] Within such a post-anthropocentric and post-dualistic environment,[10] it will no longer be natural biological human beings alone who seek

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[5] See, e.g., Ummat et al., "Bionanorobotics: A Field Inspired by Nature" (2005); Andrianantoandro et al., "Synthetic biology: new engineering rules for an emerging discipline" (2006); Cheng & Lu, "Synthetic biology: an emerging engineering discipline" (2012); Lamm & Unger, *Biological Computation* (2011); Church et al., "Next-generation digital information storage in DNA" (2012); and Berner, *Management in 20XX: What Will Be Important in the Future – A Holistic View* (2004), pp. 15, 18, 31, 61-62.

[6] For a discussion of evolutionary robotics and evolvable robotic hardware, see Friedenberg, *Artificial Psychology: The Quest for What It Means to Be Human* (2008), pp. 206-10.

[7] Regarding factors that make it difficult to analyze or predict the behavior of artificially intelligent systems – especially of distributed artificial intelligences (DAIs) displaying emergent behavior – see Friedenberg (2008), pp. 31-32. For a discussion of the behavior of physical artificial neural networks, see, e.g., Snider, "Cortical Computing with Memristive Nanodevices" (2008); Versace & Chandler, "The Brain of a New Machine" (2010); and *Advances in Neuromorphic Memristor Science and Applications*, edited by Kozma et al. (2012).

[8] For robots that interact socially with human beings, see, e.g., Breazeal, "Toward sociable robots" (2003); Kanda & Ishiguro, *Human-Robot Interaction in Social Robotics* (2013); *Social Robots and the Future of Social Relations*, edited by Seibt et al. (2014); *Social Robots from a Human Perspective*, edited by Vincent et al. (2015); and *Social Robots: Boundaries, Potential, Challenges*, edited by Marco Nørskov (2016). For robots that interact socially with one another, see, e.g., Arkin & Hobbs, "Dimensions of communication and social organization in multi-agent robotic systems" (1993); Barca & Sekercioglu, "Swarm robotics reviewed" (2013); and Brambilla et al., "Swarm robotics: a review from the swarm engineering perspective" (2013).

[9] The processes of posthumanization that expand the boundaries of society to include entities other than natural biological human beings as traditionally understood include the age-old forces of *nontechnological posthumanization* (as reflected in works of critical and cultural posthumanism and fantasy literature) and the newly emerging and intensifying forces of *technological posthumanization*, which is the focus of this text and is explored in works of biopolitical posthumanism, philosophical posthumanism, and science fiction. Regarding nontechnological posthumanization, see, e.g., Graham, *Representations of the Post/Human: Monsters, Aliens and Others in Popular Culture* (2002); Badmington, "Cultural Studies and the Posthumanities" (2006); and Herbrechter, *Posthumanism: A Critical Analysis* (2013). Regarding technological posthumanization, see, e.g., Fukuyama, *Our Posthuman Future: Consequences of the Biotechnology Revolution* (2002); Bostrom, "Why I Want to Be a Posthuman When I Grow Up" (2008); and other texts in *Medical Enhancement and Posthumanity*, edited by Gordijn & Chadwick (2008). For an overview of the forms of posthumanism that take these phenomena as their objects of study and practice, see Ferrando, "Posthumanism, Transhumanism, Antihumanism, Metahumanism, and New Materialisms: Differences and Relations" (2013), and our classification scheme in Part One of this text, "A Typology of Posthumanism: A Framework for Differentiating Analytic, Synthetic, Theoretical, and Practical Posthumanisms."

[10] See Ferrando (2013).

out and create meaning through their exercise of imagination, reason, volition, and conscience; instead the world will likely include a bewildering array of sources of intelligent agency that create meaning through their networks and relations.[11] The implications for organizational management of this dawning 'Posthuman Age' are expected to be vast, and yet they have not yet been comprehensively explored from a theoretical perspective.

In an effort to advance such study, in this text we develop the Posthuman Management Matrix, a two-dimensional model designed to aid management scholars and practitioners in analyzing and anticipating the impacts of posthumanizing technological and social change on organizations. We begin by showing that the agents that are relevant to organizational management can be divided into two varieties (human and artificial agents) and that the traits possessed by a particular agent fall into one of two kinds (which we refer to as "anthropic" and "computronic" characteristics[12]). The Matrix thus delineates four general types of possible entities that can potentially serve as workers or consumers for businesses and other organizations. These types of entities are: human agents possessing anthropic characteristics (whom we can refer to simply as "'natural' human beings"); artificial agents possessing computronic characteristics (or in other words, conventional "computers"); human agents possessing computronic characteristics (whom we can refer to as "cyborgs"); and artificial agents possessing anthropic characteristics (which, for lack of a better term, can be referred to as "bioroids"[13]). An overview of the four quadrants of the Posthuman Management Matrix and the types of entities that they represent is contained in Figure 1.

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[11] See Ferrando (2013).

[12] In this text we use the portmanteau 'computronic' to refer to physical structures, behaviors, or other phenomena or characteristics which in recent decades have commonly been associated with *computers* and *electronic* devices. This builds on earlier uses of the word found, e.g., in Turner, "The right to privacy in a computronic age" (1970), and Rankin, "Business Secrets Across International Borders: One Aspect of the Transborder Data Flow Debate" (1985).

[13] For use of the term 'bioroid' in an engineering context, see Novaković et al., "Artificial Intelligence and Biorobotics: Is an Artificial Human Being our Destiny?" (2009). Regarding the use of the term in speculative fiction, see, e.g., Pulver, *GURPS Robots* (1995), pp. 74-81, where 'bioroid' is a portmanteau derived explicitly from 'biological android.'

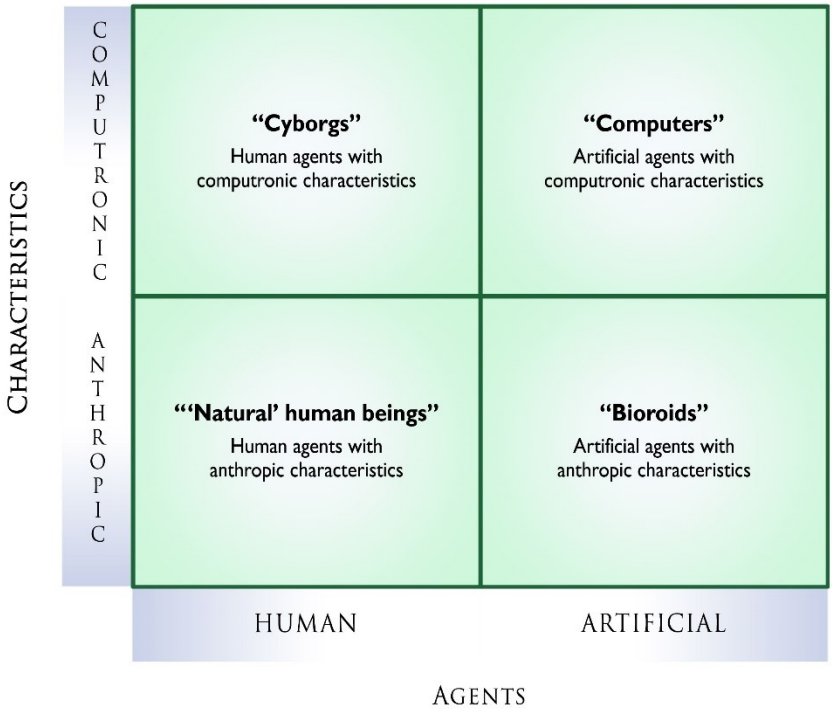

Fig. 1: The Posthuman Management Matrix delineates four types of entities, each of which may be of greater or lesser relevance for the practice of organizational management at a particular point in human history.

The Matrix is then utilized to analyze management theory and practice as they have existed prior to this emerging age of radical technological posthumanization. Beginning from the dawn of human history, the only type of entity relevant to management theory and practice was long that of human agents who possess anthropic characteristics – or in other words, natural human beings who have not been modified through the use of technologies such as neuroprosthetic augmentation or genetic engineering. Only with the arrival of electronic information-processing systems and simple industrial robots in the 20th Century did a second type of entity become broadly relevant for

organizational management: that of the artificial agent that possesses computronic characteristics, or the 'computer.'[14] Integrating such computerized systems into an organization of human workers is not an easy task, and management disciplines such as enterprise architecture, IT management, and information security have emerged that provide conceptual frameworks and practical tools for successfully coordinating the actions of human and artificial agents to create effective organizations.[15]

The largest portion of this text is dedicated to employing the Matrix as a means of investigating the remaining two types of entities – 'cyborgs' and 'bioroids' – that have heretofore received relatively little serious attention within the field of management but which are set to become ever more prevalent as workers, managers, consumers, and other organizational stakeholders, thanks to the accelerating and intensifying processes of technological posthumanization. We suggest that it will not be possible to adequately understand and manage the many complex operational, legal, and ethical issues that arise from adopting such posthuman agents as employees or customers simply by relying on existing fields such as HR management, IT management, or enterprise architecture. The radically expanded universe of posthuman agents that will participate in the life of organizations will require the development of new spheres of theory and practice that can address the unique forms, behaviors, strengths, and weaknesses of such agents, along with the ways in which they will combine to create rich and complex cybernetic networks and digital-physical ecosystems. Our exploration of these questions concludes by contemplating the sorts of transdisciplinary management approaches that might be able to successfully account for such organizational systems in which natural human beings, genetically engineered persons, individuals possessing extensive neuroprosthetic augmentation, human beings who spend all of their time dwelling in virtual worlds, social robots, artifi-

[14] For early examples of workplace robotics explored from the perspective of management theory and practice, see, e.g., Thompson, "The Man-Robot Interface in Automated Assembly" (1976), and Goodman & Argote, "New Technology and Organizational Effectiveness" (1984).

[15] For a review of enterprise architecture frameworks, see Magoulas et al., "Alignment in Enterprise Architecture: A Comparative Analysis of Four Architectural Approaches" (2012), and Rohloff, "Framework and Reference for Architecture Design" (2008); for a practical overview of organizational design, see Burton et al., *Organizational Design: A Step-by-Step Approach* (2015); for an overview of information security, see Rao & Nayak, *The InfoSec Handbook* (2014).

cially intelligent software, nanorobot swarms, and sentient or sapient networks work together in physical and virtual environments to achieve organizational goals.[16]

Through this formulation, application, and discussion of the Posthuman Management Matrix, we hope to highlight the challenges that await management scholars and practitioners in an increasingly posthumanized world and to suggest one possible conceptual framework that can aid us in making sense of and responding to these challenges.

II. Formulating the Posthuman Management Matrix

We would suggest that it is useful to analyze the impact of posthumanizing social and technological change on organizational management through a two-dimensional conceptual framework that creates a coherent tool for identifying, understanding, and anticipating organizational transformations that will occur as a result of the convergences described in this text. We can refer to this proposed framework as the 'Posthuman Management Matrix.' Our hope is that such a model can serve as both a theoretical framework for management scholars as well as a practical tool for management practitioners. The Posthuman Management Matrix comprises two dimensions: the horizontal dimension is that of an 'agent' and the vertical dimension is that of an agent's 'characteristics.' We can consider each of these dimensions in turn.

A. The Matrix's Horizontal Dimension: The Kind of Agent

There are many types of entities and phenomena that must be managed by organizations; however, many of them do not possess or manifest their own agency. Such non-agents include financial assets, land, raw materials, intellectual property, contracts, policies and procedures, and other elements of organizational life that are not capable of gathering data from their environment, processing information, and selecting a course of action.[17]

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[16] See Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 95-96.

[17] Within the context of enterprise architecture, for example, both agents and non-agents can be understood generically as 'entities' that play particular 'roles' in various 'activities' within an organization; see Caetano et al., "A Role-Based Enterprise Architecture Framework" (2009).

On the other hand, there are many kinds of agents[18] that may actively participate in an organization's activities; these include typical adult human beings, some kinds of domesticated animals (which, for example, can be employed in particular roles within the fields of agriculture, law enforcement, and entertainment), many types of autonomous and semiautonomous robots, and artificially intelligent software programs that run on particular computing platforms. Note that in order to qualify as an agent, an entity does not need to need to possess the same kind of sapience as a typical adult human being; relatively simple automated systems (such as an assembly-line robot or the software managing an automated customer-service telephone line) can be described as agents, even if they do not possess full human-like artificial general intelligence. Conversely, not all human beings can be considered agents from the managerial perspective, even if they are considered to be legal persons and moral patients; for example, an adult human being who is in a coma and whose mind is not able to receive sensory input, process information, and select and act upon particular courses of action would not be considered an 'agent' in the organizational sense employed here.

Much ongoing research and debate is taking place regarding questions of whether and to what extent collective entities can be considered agents. It is a matter of contention whether a social organization such as a country or a swarm of insects can possess its own 'agency' distinct from the agency of all the individuals that constitute it.[19] In some cases, the law recognizes certain types of social entities (e.g., states or corporations) as possessing a sort of agency independent of that of their human constituents, although different conclusions may be formulated when viewing such entities from an ontological or moral rather than a legal perspective. Similarly, some automated artificial agents have been designed in such a way that they are in fact multi-agent systems composed of a number of smaller subsystems and components that are themselves agents. In such cases, the agency possessed by a multi-agent system as a whole is typically of a different sort from that possessed by

[18] For an overview of biological, robotic, and software-based agents and their key characteristics of autonomy, social ability, reactivity, and proactivity, see Tweedale & Jain, "Agent Oriented Programming" (2011).

[19] Regarding questions about the nature and degree of agency and decision-making responsibility that can be possessed by robotic swarms or networks, see, e.g., Coeckelbergh, "From Killer Machines to Doctrines and Swarms, or Why Ethics of Military Robotics Is Not (Necessarily) About Robots" (2011), pp. 274-75, and Gladden, "The Diffuse Intelligent Other: An Ontology of Nonlocalizable Robots as Moral and Legal Actors" (2016).

its individual components. More complex is the case of large computer-facilitated networks (e.g., the Internet) that can, in a certain sense, be said to select and act upon particular courses of action and whose 'decisions' are shaped by the activities of individual human and artificial agents that have access to the network and who participate in its sensorimotor and information-processing actions.[20]

Traditionally, facilities such as office buildings or warehouses would not in themselves have qualified as 'agents,' even though they were home to the activities of large numbers of agents and contained an extensive technological infrastructure of mechanical, electrical, and other components that were regularly manipulated by those agents as part of their work. However, the rise of the Internet of Things and smart buildings means that in some cases an office building or production facility that includes sufficient sensory and motor components controlled by a computerized system can potentially be understood as a single coherent 'agent.' A similar phenomenon is now occurring with vehicles, which may be considered agents if they possess self-driving capabilities or other forms of AI.[21]

For purposes of the Posthuman Management Matrix, we can divide the broad spectrum of agents that are relevant to contemporary organizational management into two main categories: human beings (described below as 'human agents') and robots or other artificially intelligent computing systems (described below as 'artificial agents').[22]

1. Human Agents

Human agents are intelligent and sapient actors whose agency is grounded in and exercised through the actions of a biological human brain. Throughout history, such human agents have been the primary (and often

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[20] Regarding collectively conscious networks and a "post-internet sentient network," see Callaghan, "Micro-Futures" (2014). Regarding a future Internet that is 'self-aware' in a technical and technological sense, even if it is not subjectively conscious, see Galis et al., "Management Architecture and Systems for Future Internet Networks" (2009), pp. 112-13. A sentient Internet is also discussed in Porterfield, "Be Aware of Your Inner Zombie" (2010), p. 19. For a future Internet that is self-aware as a sort of potentially living entity, see Hazen, "What is life?" (2006). Regarding the growing prevalence of robotic systems that comprise networks and swarms – rather than autonomous unitary robots – and the distributed or unclear nature of decision-making and responsibility in such systems, see Coeckelbergh (2011), pp. 272-75, and Gladden, "The Diffuse Intelligent Other" (2016).

[21] Regarding the ethical implications of creating autonomous driverless vehicles that can exercise their own agency, see Goodall, "Ethical decision making during automated vehicle crashes" (2014).

[22] The simplified schema presented by the Posthuman Management Matrix thus omits, for example, the explicit consideration of domesticated animals as potential workplace agents.

only) agents constituting human organizations. Human beings possess a distinct set of biological, psychological, social, and cultural properties that have been extensively studied by disciplines including biology, psychology, anthropology, sociology, economics, history, philosophy, theology, political science, and organizational management.

2. Artificial Agents

Artificial agents represent a relatively new kind of intelligent actor that has emerged during recent decades and which has the potential to carry out particular tasks or roles within a human organization. Although the universe of artificial agents comprises a diverse array of entities with a broad variety of forms and functions, artificial agents are similar in that: 1) they all possess some means of receiving data from their environment, a means of processing information, and a means of acting on their environment; and 2) the physical substrate within which their agency subsists is not a natural biological human brain.

An artificial agent often takes the form of a piece of software being executed by some physical computational substrate such as a desktop computer, mobile device, server, robot, or network of distributed devices.[23] However, other examples exist that do not involve the execution of a conventional software program; these include artificial neural networks that are not run as a software program on a conventional CPU-based computer but which comprise a network of physical artificial neurons.[24]

B. The Matrix's Vertical Dimension: An Agent's Characteristics

From the perspective of organizational management, there are two broad sets of characteristics that a contemporary agent might display: 'anthropic

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[23] Each particular instantiation of such a sensorimotor-cognitive system can be understood as a unique artificial agent; thus technically, the same piece of AI software run on two different computers (or even on the same computer on two different occasions) can be understood as two different artificial agents. (See Wiener, *Cybernetics: Or Control and Communication in the Animal and the Machine* (1961), loc. 2402ff., for the idea that a human brain with all of its short- and long-term memories are "not the complete analogue of the computing machine but rather the analogue of a single run on such a machine" – something which, by definition, cannot be duplicated in another substrate.) However, the term 'artificial agent' is also used in a looser sense to refer to a hardware-software platform comprising a particular piece of hardware and the AI software that it executes rather than to each separate execution of that software.

[24] See, e.g., Friedenberg (2008), pp. 17-36, for a discussion of different physical models that do not necessarily require a conventional Von Neumann computer architecture.

characteristics' are those that are traditionally possessed by human beings, and 'computronic characteristics' are those traditionally possessed by artificial agents such as robots or artificially intelligent software. We can consider these two suites of characteristics in greater detail.

1. Anthropic Characteristics

Anthropic characteristics constitute that array of traits which throughout history has been possessed by and associated with human beings. These characteristics are reflected in: 1) an entity's physical form; 2) its capacity for and use of intelligence; and 3) its social interaction with other intelligent agents. Below we use these three perspectives to identify and describe some of the key anthropic characteristics.

a. Physical Form

The physical form of an agent possessing anthropic characteristics demonstrates a number of notable traits. Such an agent is:

Composed of biological components. The body of a human being is naturally composed of biological material and not mechanical or electronic components. The qualities of such biological material place limits on the kinds of work that human employees can perform. For example, it is impossible for human beings to work in areas of extreme heat, cold, or radiation without extensive protection, nor is it possible for a human employee to work for hundreds of consecutive hours without taking breaks for sleep or meals or to use the restroom.

Alive. In order to function as an agent within an organization, a human being (and the biological subsystems that constitute its body) must be alive. As a living organism, a human being possesses a metabolism that requires a continual supply of resources (e.g., oxygen, water, and food) from the external environment as well as the ability to emit waste products into the environment in order for the individual to survive.[25]

Non-engineered. The basic physical form of a particular human being is determined largely by genotypic factors that are a result of randomized inher-

[25] In considering a definition for artificial life, Friedenberg (2008), pp. 201-03, draws on the criteria for biological life presented in Curtis, *Biology* (1983): namely, a living being manifests organization, metabolism, growth, homeostasis, adaptation, response to stimuli, and reproduction.

itance of genetic material from the individual's biological parents; the individual's particular physical characteristics are not intentionally selected or fabricated by a genetic engineer.[26]

Non-upgradeable. There are many congenital medical conditions that can be treated through conventional surgical procedures, medication, the use of traditional prosthetics, or other therapies. The application of such technologies could be understood as a form of 'augmentation' or 'enhancement' of one's body as it was naturally formed; however, such technologies are more commonly understood as 'restorative' approaches, insofar as they do not grant an individual physical elements or capacities that surpass those possessed by a typical human being.[27] Historically, human beings have not been subject to the sort of radical physical 'upgradeability' that might involve, for example, the implantation of additional memory capacity into the brain, an alteration of the rate of electrochemical communication between neurons to increase the brain's 'processing speed,' the addition of new sensory capacities (e.g., infrared vision), or the addition of new or different limbs or actuators (e.g., wheels instead of legs).[28] This differs from the case of contemporary computers, which often can easily be upgraded through the addition or replacement of physical components.

Confined to a limited lifespan. Although the lifespan of a particular human being can be shortened or extended to some degree as a result of environmental, behavioral, or other factors, the human organism is generally understood to possess a finite biological lifespan that cannot be extended indefinitely through natural biological means.[29] A human being that has exceeded its maximum lifespan is no longer alive (i.e., it will have expired) and it cannot be repaired and revived by technological means to make it available once again for future organizational use.

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[26] Although, for example, factors such as diet, exercise and training, environmental conditions, and medicines and medical procedures can extensively modify the form of a human body, the extent to which an existing biological human body can be restructured before ceasing to function is nonetheless relatively limited.

[27] See Gasson (2012).

[28] See Gladden, "Cybershells, Shapeshifting, and Neuroprosthetics: Video Games as Tools for Posthuman 'Body Schema (Re)Engineering'" (2015).

[29] For a discussion and comparison of biologically and nonbiologically based efforts at human life extension, see Koene, "Embracing Competitive Balance: The Case for Substrate-Independent Minds and Whole Brain Emulation" (2012).

Manifesting a developmental cycle. The physical structure and capacities of a human being do not remain unchanged from the moment of an individual's conception to the moment of his or her death; instead, a human being's physical form and abilities undergo continuous change as the individual develops through a cycle of infancy, adolescence, adulthood, and senescence.[30] From the perspective of organizational management, human beings are only capable of serving as employees, partners, or consumers during particular phases of this developmental cycle, and the unique strengths and weaknesses displayed by human workers vary as they move through the developmental cycle.

Possessing a unitary local body. A particular human being occupies or comprises a particular physical biological body. Because this body is unitary – consisting of a single spatially compact unit – a human being is able to inhabit only one space at a given time; a human being cannot simultaneously be physically present in multiple cities, for example.[31]

Possessing a permanent substrate. Although to some limited extent it is possible to modify or replace physical components of a human body, it is not possible for a human being to exchange his or her entire body for another.[32] The body with which a human being was born will – notwithstanding the natural changes that occur as part of its lifelong developmental cycle or any minor intentional modifications – serve as a single permanent substrate within which all of the individual's information processing and cognition will occur and in which all of the individual's sensory and motor activity will take place until the end of his or her life.

Unique and identifiable. A human being's body creates (or at least, plays a necessary role in creating) a single identity for the individual that persists over time, throughout the person's life. The fact that each human body is unique and is identifiable to other human beings (e.g., such a body is not invisible, microscopic, or 'flickering' in and out of existence from moment to moment)

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[30] See Thornton, *Understanding Human Development: Biological, Social and Psychological Processes from Conception to Adult Life* (2008), and the *Handbook of Psychology, Volume 6: Developmental Psychology*, edited by Lerner et al. (2003).

[31] For a discussion of different types of bodies and their relation to an entity's degree of locality, see Gladden, "The Diffuse Intelligent Other" (2016).

[32] For complications relating to proposed body-replacement techniques such as mind uploading, see Proudfoot, "Software Immortals: Science or Faith?" (2012); for particular problems that would result from the attempt to adopt a nonhuman body, see Gladden, "Cybershells, Shapeshifting, and Neuroprosthetics" (2015).

means that it is possible to associate human actions with a particular human being who performed them.[33]

B. Intelligence

The information-processing mechanisms and behaviors of an agent possessing anthropic characteristics demonstrate a number of significant traits. Such an agent is:

Sapient and self-aware. A typical human adult possesses a subjective conscious experience that is not simply sensations of physical reality but a conceptual 'awareness of' and 'awareness that.' These characteristics are not found, for example, in infants or in adult human beings suffering from certain medical conditions. In a sense, a typical adult human being can be said to possess sapient self-awareness as a capacity even when the individual is unconscious (e.g., during sleep), although in that moment the capacity is latent and is not being actively utilized or experienced.[34]

Autonomous. Broadly speaking, adult human beings are considered to possess a high degree of autonomy.[35] Through the regular action of its mind and body, a human being is able to secure energy sources and information from its external environment, set goals, make decisions, perform actions, and even (to a limited extent) repair damage that might occur to itself during the course of its activities, all without direct external guidance or control by other human agents. Human beings which, for example, are still infants, are suffering from physical or cognitive impairments (such as being in a coma), or are operating in a hostile or unfamiliar environment may not be able to function with the same degree of autonomy.

Metavolitional. Volitionality relates to an entity's ability to self-reflexively shape the intentions that guide its actions.[36] An entity is nonvolitional when

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[33] For an overview of philosophical questions relating to personal identity, see Olson, "Personal Identity" (2015).

[34] For a discussion of such issues, see, e.g., Siewert, "Consciousness and Intentionality" (2011); Fabbro et al., "Evolutionary aspects of self-and world consciousness in vertebrates" (2015); and Boly et al., "Consciousness in humans and non-human animals: recent advances and future directions" (2013).

[35] For a definition of autonomy applicable to agents generally, see Bekey, *Autonomous Robots: From Biological Inspiration to Implementation and Control* (2005), p. 1. Regarding ways of classifying different levels of autonomy, see Gladden, "Managerial Robotics: A Model of Sociality and Autonomy for Robots Managing Human Beings and Machines" (2014).

[36] For a discussion of the volitionality of agents, see Calverley, "Imagining a non-biological machine as a legal person" (2008), pp. 529-535, and Gladden, "The Diffuse Intelligent Other" (2016).

it possesses no internal goals or 'desires' for achieving particular outcomes nor any expectations or 'beliefs' about how performing certain actions would lead to particular outcomes. An entity is volitional if it combines goals with expectations: in other words, it can possess an intention,[37] which is a mental state that comprises both a desire and a belief about how some act that the entity is about to perform can contribute to fulfilling that desire.[38] Meanwhile, typical adult human beings can be described as metavolitional: they possess what scholars have referred to as a 'second-order volition,' or an intention *about* an intention.[39] In human beings, this metavolitionality manifests itself in the form of conscience: as a result of possessing a conscience, human agents are able to determine that they do not wish to possess some of the intentions that they are currently experiencing, and they can resolve to change those intentions.

Educated. The cognitive processes and knowledge of a human being are shaped through an initial process of concentrated learning and formal and informal education that lasts for several years and through an ongoing process of learning that lasts throughout the individual's lifetime.[40] Human beings can learn empirically through the firsthand experience of interacting with their environment or by being taught factual information or theoretical knowledge. A human being cannot instantaneously 'download' or 'import' a large body of information into his or her memory in the way that a data file can be copied to a computer's hard drive.

Processing information through a neural network. Some information processing takes part in other parts of the body (e.g., the transduction of proximal stimuli into electrochemical signals by neurons in the sensory organs); however, the majority of a human being's information processing is performed by the neural network comprising interneurons in the individual's brain.[41] The brain constitutes an immensely large and intricate neural network, and despite on-

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[37] The term 'intentionality' is often employed in a philosophical sense to describe an entity's ability to possess mental states that are directed toward (or 'about') some object; that is a broader phenomenon than the possession of a particular 'intention' as defined here.

[38] Calverley (2008), p. 529.

[39] Calverley (2008), pp. 533-35.

[40] See Thornton (2008), and *Handbook of Psychology, Volume 6* (2003).

[41] For example, see Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 148-49.

going advances in the field of neuroscience, profound mysteries remain regarding the structure and behavior of this neural network's components and of the network as a whole.[42] The mechanisms by which this neural network processes the data provided by sensory input and stored memories to generate motor output and new memories are highly nonlinear and complex; they are not directly comparable to the process of a CPU-based computer running an executable software program.

Emotional. The possession and manifestation of emotions is not an extraneous supplement (or obstacle) to the rational decision-making of human beings but is instead an integral component of it. Some researchers suggest that the possession of emotions is necessary in order for an embodied entity to demonstrate general intelligence at a human-like level.[43]

Cognitively biased. Human beings are subject to a common set of cognitive biases that distort individuals' perceptions of reality and cause them to arrive at decisions that are objectively illogical and suboptimal.[44] While in earlier eras such biases may have created an evolutionary advantage that aided the survival of those beings that possessed them (e.g., by providing them with heuristics that allowed them to quickly identify and avoid potential sources of danger), these biases cause contemporary human workers to err when evaluating factual claims or attempting to anticipate future events or manage risk. To some extent, such biases can be counteracted through conscious awareness, training, and effort.

Possessing a flawed memory. The human mind does not store a perfect audio-visual record of all the sensory input, thoughts, and imaginings that it experiences during a human being's lifetime. The brain's capacities for both the retention and recall of information are limited. Not only are memories stored in a manner which from the beginning is compressed, impressionistic, and imperfect, but memories also degrade over time.[45] Historically, the only way to transfer memories stored within one human mind to another human mind

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[42] For example, significant outstanding questions remain about the potentially holonomic nature of memory storage within the brain and the role of inter- and intraneuronal structures in memory creation and storage; see, e.g., Longuet-Higgins, "Holographic Model of Temporal Recall" (1968); Pribram, "Prolegomenon for a Holonomic Brain Theory" (1990); and Pribram & Meade, "Conscious Awareness: Processing in the Synaptodendritic Web – The Correlation of Neuron Density with Brain Size" (1999).

[43] See Friedenberg (2008), pp. 179-200.

[44] For an overview of human cognitive biases in relation to organizational management, see Kinicki & Williams, *Management: A Practical Introduction* (2010), pp. 217-19.

[45] See Dudai, "The Neurobiology of Consolidations, Or, How Stable Is the Engram?" (2004).

has been for the memories to be described and expressed through some social mechanism such as oral speech or written text.

Demonstrating unpredictable behavior. All human beings demonstrate basic similarities in their behavior, and individual human beings possess unique personalities, habits, and psychological and medical conditions that allow their reactions to particular stimuli or future behavior to be predicted with some degree of likelihood; however, it is not possible to predict with full precision, accuracy, and certainty the future actions of a particular human being.

Not capable of being hacked electronically. Because human beings possess biological rather than electronic components and their minds conduct information processing through the use of an internal physical neural network rather than a conventional executable software program stored in binary digital form, it is not possible for external adversaries or agents to hack into a human being's body and information-processing system in order to control sensory, motor, or cognitive activities or to access, steal, or manipulate the individual's thoughts or memories using the same electronic hacking techniques that are applied to the hardware or software of electronic computers and computer-based systems.[46]

c. Social Interaction

An agent possessing anthropic characteristics demonstrates a number of noteworthy traits relating to social interaction. Such an agent is:

Social. Human beings display social behaviors, engage in isolated and short-term social interactions, and participate in long-term social relations that evolve over time and are shaped by society's expectations for the social roles to be filled by a particular individual.[47] Although the social content and nature of complex communicative human actions such as speaking and writing are obvious, even such basic activities such as standing, walking, and breathing have social aspects, insofar as they can convey intentions, emotions, and attitudes toward other human beings.

Cultural. Human beings create and exist within unique cultures that include particular forms of art, literature, music, architecture, history, sports and

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[46] The human mind is subject to other kinds of 'hacking' such as social engineering; see Rao & Nayak (2014).

[47] Regarding the distinction between social behaviors, interactions, and relations, see Vinciarelli et al., "Bridging the Gap between Social Animal and Unsocial Machine: A survey of Social Signal Processing" (2012), and Gladden, "Managerial Robotics" (2014).

recreation, technology, ethics, philosophy, and theology. Such cultures also develop and enforce norms regarding the ways in which organizations such as businesses should or should not operate.[48]

Spiritual. Human beings broadly manifest a search for and recognition of transcendent reality and ultimate purpose of a form that is described by organized religions and other spiritual and philosophical systems as well as nurtured by the idiosyncratic beliefs and sentiments of individual human beings. Recently researchers have sought to identify biological mechanisms that enable or facilitate the development and expression of such spirituality.[49]

Political. In order to regulate their shared social existence and create conditions that allow for productivity, prosperity, peace, and the common good, human beings have developed political systems for collective defense, decision-making, and communal action. Political activity typically involves a kind and degree of reasoning, debate, strategic thinking, risk assessment, prioritization of values, and long-term planning that is not found, for example, within the societies of nonhuman animals.[50]

An economic actor. In contemporary societies, an individual human being is typically not able to personally produce all of the goods and services needed for his or her survival and satisfaction, and he or she does not have the desire or ability to personally consume all of the goods or services that he or she produces. In order to transform the goods and services that a human being produces into the goods and services that he or she desires to have, human beings engage in economic exchange with one another. Within contemporary societies, businesses and other organizations play critical roles in facilitating such economic interaction.[51]

A legal person. An adult human being is typically recognized by the law as being a legal person who bears responsibility for his or her decisions and

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[48] Regarding the critical role that organizational culture plays, e.g., in the management of enterprise architecture, see Aier, "The Role of Organizational Culture for Grounding, Management, Guidance and Effectiveness of Enterprise Architecture Principles" (2014), and Hoogervorst, "Enterprise Architecture: Enabling Integration, Agility and Change" (2004).

[49] For example, see Emmons, "Is spirituality an intelligence? Motivation, cognition, and the psychology of ultimate concern" (2000).

[50] Thus Aristotle's assertion that "man is by nature a political animal" (Aristotle, *Politics*, Book 1, Section 1253a). Regarding different perspectives on the organization of animal societies and the possible evolutionary origins of politics in human societies, see, e.g., *Man Is by Nature a Political Animal: Evolution, Biology, and Politics*, edited by Hatemi & McDermott (2011); Alford & Hibbing, "The origin of politics: An evolutionary theory of political behavior" (2004); Clark, *The Political Animal: Biology, Ethics and Politics* (1999); and *Primate Politics*, edited by Schubert & Masters (1991).

[51] For example, see Samuelson & Marks, *Managerial Economics* (2012), Chapter 11.

actions. In some cases, relevant distinctions exist between legal persons, moral subjects, and moral patients. For example, an adult human being who is conscious and not suffering from psychological or biological impairments would typically be considered both a legal person who is legally responsible for his or her actions as well as a moral subject who bears moral responsibility for those actions. An infant or an adult human being who is in a coma might be considered a legal person who possesses certain legal rights, even though a legal guardian may be appointed to make decisions on the person's behalf; such a person is not (at the moment) a moral agent who undertakes actions for which he or she bears moral responsibility but is still a 'moral patient' whom other human beings have an obligation to care for and to not actively harm.[52]

2. Computronic Characteristics

Computronic characteristics constitute the collection of traits that have traditionally been possessed by the kinds of computers utilized by organizations, including mainframes, servers, desktop computers, laptop computers, and mobile devices, as well as more specialized devices such as supercomputers, satellites, assembly-line robots, automated guided vehicles, and other computerized systems based on a conventional Von Neumann architecture. These characteristics are reflected in: 1) an entity's physical form; 2) its capacity for and use of intelligence; and 3) its social interaction with other intelligent agents. Below we use these three perspectives to identify and describe some of the key computronic characteristics. It may be noted that in most cases they are very different from – and frequently the opposite of – the anthropic characteristics traditionally associated with human beings.

a. Physical Form

The physical form of an agent possessing computronic characteristics demonstrates a number of notable traits. Such an agent is:

Composed of electronic components. A conventional computer is typically composed of mass-produced electronic components that are durable and readily

[52] Regarding distinctions between legal persons, moral subjects, and moral patients – especially in the context of comparing human and artificial agents – see, e.g., Wallach & Allen, *Moral machines: Teaching robots right from wrong* (2008); Gunkel, *The Machine Question: Critical Perspectives on AI, Robots, and Ethics* (2012); Sandberg, "Ethics of brain emulations" (2014); and Rowlands, *Can Animals Be Moral?* (2012).

repairable and whose behavior can easily be analyzed and predicted.[53] Such components are often able to operate in conditions of extreme heat, cold, pressure, or radiation in which biological matter would not be able to survive and function. Such components can be built to a large or microscopic scale, depending on the intended purpose of a particular computer. The ability to manufacture electronic components to precise specifications with little variation means that millions of copies of a single artificial agent can be produced that are functionally identical.

Not alive. A conventional computer is not alive: it is not created through processes of biological reproduction, and its form and basic functionality are not shaped by a DNA- or RNA-based genotype; nor does the computer itself grow and reproduce.[54] A computer must typically receive energy from the external environment in the form of an electrical power supply that has been specifically prepared by its human operators and which meets exact specifications;[55] the computer does not possess a metabolism that allows it to assimilate raw materials that it obtains from the environment and convert them into energy and structural components, repair damage and grow, and emit waste products into the environment (apart from byproducts such as heat – which is a significant concern in microprocessor and computer design – and stray electromagnetic radiation such as radio waves).[56]

Intentionally designed. Historically, the structure and basic capacities of a computer are not the result of the inheritance of randomized genetic code from biological parents or from other processes of biological reproduction. Instead, all elements and aspects of a traditional computer's physical form and basic functionality are intentionally planned and constructed by human scientists,

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[53] For an in-depth review of the historical use of electronic components in computers as well as an overview of emerging possibilities for (non-electronic) biological, optical, and quantum computing, see Null & Lobur, *The Essentials of Computer Organization and Architecture* (2006). Regarding the degree to which the failure of electronic components can be predicted, see Băjenescu & Bâzu, *Reliability of Electronic Components: A Practical Guide to Electronic Systems Manufacturing* (1999).

[54] Curtis (1983) cited seven requisites for a biological entity to be considered alive (organization, metabolism, growth, homeostasis, adaptation, response to stimuli, and reproduction), which Friedenberg (2008), pp. 201-03, also considers to be relevant when attempting to determine whether an artificial entity is alive.

[55] Exceptions would include, e.g., solar-powered computing devices.

[56] Such emissions by computers also create information security concerns; see, e.g., Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), p. 116.

engineers, manufacturers, and programmers in order to enable the computer to successfully perform particular tasks.[57]

Upgradeable and expandable. The physical structure and capacities of computers are easily expandable through the addition of internal components or external peripheral devices. Such upgrades allow a computer to receive, for example, new sensory mechanisms, new forms of actuators for manipulating the external environment, an increase in processing speed, an increase in random-access memory, or an increase in the size of a computer's available space for the nonvolatile long-term storage of data.[58]

Not limited to a maximum lifespan. A typical computer does not possess a maximum lifespan beyond which it cannot be made to operate. As a practical matter, individual computers may eventually become obsolete because their functional capacities are inadequate to perform tasks that the computer's owner or operator needs it to perform or because cheaper, faster, and more powerful types of computers have become available to carry out those tasks. Similarly, the failure of an individual component within a computer may render it temporarily nonfunctional. However, the ability to repair, replace, upgrade, or expand a computer's physical components means that a computer's operability can generally be maintained indefinitely, if its owner or operator wishes to do so.[59]

Possessing a stable and restorable form. A computer's physical form is highly stable: although a computer's components can be physically upgraded or altered by the device's owner or operator, a computer does not physically upgrade or alter itself without its owner or operator's knowledge or permission.[60] A computer does not undergo the sort of developmental cycle of conception, growth, maturity, and senescence demonstrated by biological organisms. In general, the physical alterations made to a computer are reversible: a chip that has been installed to increase the computer's RAM can be removed; a

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[57] See, e.g., Dumas, *Computer Architecture: Fundamentals and Principles of Computer Design* (2006).

[58] See, e.g., Mueller, *Upgrading and Repairing PCs, 20th Edition* (2012).

[59] For an overview of issues relating to computer reliability, availability, and lifespan, see Siewiorek & Swarz, *Reliable Computer Systems: Design and Evaluation* (1992), and Băjenescu & Bâzu (1999).

[60] An exception would be the case of computer worms or viruses that can cause a computer to disable or damage some of its internal components or peripheral devices without the owner or operator's knowledge. See, for example, Kerr et al., "The Stuxnet Computer Worm: Harbinger of an Emerging Warfare Capability" (2010).

peripheral device that has been added can be disconnected. This allows a computer to be restored to a previous physical and functional state.

Potentially multilocal. It is possible for a computer to – like a human being – possess a body that comprises a single unitary, spatially compact physical unit: computerized devices such as a typical desktop computer, smartphone, assembly-line robot, or server may possess a physical form that is clearly distinct from the device's surrounding environment and which is located in only a single place at any given time. However, other computers can – unlike a human being – possess a body comprising disjoint, spatially dispersed elements that exist physically in multiple locations at the same time. The creation of such computerized entities comprising many spatially disjoint and dispersed 'bodies' has been especially facilitated in recent decades by the development of the diverse networking technologies that undergird the Internet and, now, the nascent Internet of Things.[61] The destruction, disabling, or disconnection of one of these bodies that contributes to the form of such an entity may not cause the destruction of or a significant degradation of functionality for the computerized entity as a whole.

Possessing an exchangeable substrate. Because they are stored in an electronic digital form that can easily be read and written, the data that constitute a particular computer's operating system, applications, configuration settings, activity logs, and other information that has been received, generated, or stored by the device can easily be copied to different storage components or to a different computer altogether. This means that the computational substrate or 'body' of a given computerized system can be replaced with a new body without causing any functional changes in the system's memory or behavior. In the case of computerized systems that are typically accessed remotely (e.g., a cloud-based storage device accessed through the Internet), a system's hardware could potentially be replaced by copying the device's data to a new device without remote users or operators ever realizing that the system's physical computational substrate had been swapped.[62]

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[61] Regarding the Internet of Things, see Evans, "The Internet of Everything: How More Relevant and Valuable Connections Will Change the World" (2012). For one aspect of the increasingly networked nature of robotics and AI, see Coeckelbergh (2011). Regarding multilocal computers, see Gladden, "The Diffuse Intelligent Other" (2016).

[62] The ability to replace or reconfigure remote networked hardware without impacting web-based end users is widely exploited to offer cloud-based services employing the model of infrastructure as a service (IaaS), platform as a service (PaaS), or software as a service (SaaS); for more details, see the *Handbook of Cloud Computing*, edited by Furht & Escalante (2010).

Possessing an unclear basis for identity. It is unclear wherein the unique identity of a conventional computer or computerized entity subsists, or even if such an identity exists.[63] A computer's identity does not appear to be tied to any critical physical component, as such components can be replaced or altered without destroying the computer. Similarly, a computer's identity does not appear to be tied to a particular set of digital data that comprises the computer's operating system, applications, and user data, as that data can be copied with perfect fidelity to other devices, creating computers that are functionally clones of one another.

B. Intelligence

The information-processing mechanisms and behaviors of an agent possessing computronic characteristics demonstrate a number of significant traits. Such an agent is:

Non-sapient. A conventional computer does not possess sapient self-awareness or a subjective conscious experience of reality.[64]

Semiautonomous or nonautonomous. For computerized devices such as robots, autonomy can be understood as the state of being "capable of operating in the real-world environment without any form of external control for extended periods of time."[65] Such autonomy does not simply involve the ability to perform cognitive tasks like setting goals and making decisions; it also requires an entity to successfully perform physical activities such as securing energy sources and carrying out self-repair without human intervention. Applying this definition, we can say that current computerized devices are typically either nonautonomous (e.g., telepresence robots that are fully controlled by their human operators) or semiautonomous (e.g., robots that require 'continuous assistance' or 'shared control' in order to fulfill their intended purpose).[66] Although some contemporary computerized systems can be understood as 'autonomous' with regard to fulfilling their intended purpose – in that they can receive sensory input, process information, make de-

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[63] For a discussion of philosophical issues relating to personal identity, see Olson (2015); see also Friedenberg (2008), p. 250.

[64] Regarding different perspectives on the characteristics that a computer or other artificial system would need to have in order for it to possess sapient self-awareness and a subjective conscious experience of reality, see Friedenberg (2008), pp. 163-78.

[65] Bekey (2005), p. 1.

[66] See Murphy, *Introduction to AI Robotics* (2000).

cisions, and perform actions without direct human control – they are not autonomous in the full sense of the word, insofar as they are generally not capable of, for example, securing energy sources within the environment or repairing physical damage to themselves.[67]

Volitional. Many conventional computerized devices are nonvolitional, meaning that they possess no internal goals or 'desires' for achieving particular outcomes nor any expectations or 'beliefs' about how performing certain actions would lead to such outcomes. However, many contemporary computerized devices – including a wide variety of robots used in commercial contexts – are volitional. As noted earlier, an entity is volitional if it combines goals with expectations; in other words, it can possess an intention, which is a mental state that comprises both a desire and a belief about how some act that the agent is about to perform can contribute to fulfilling that desire.[68] For example, a therapeutic social robot might possess the goal of evoking a positive emotional response in its human user, and its programming and stored information tells it that by following particular strategies for social interaction it is likely to evoke such a response.[69]

Programmed. A conventional computer does not 'learn' through experience; it does not undergo a long-term formative process of education in order to acquire new knowledge or information. Instead, a computer has software programs and data files copied onto its storage media, thereby instantaneously gaining new capacities and the possession of new information.[70] Alternatively, a computer may be directly programmed or configured by a human operator.

Processing information by means of a CPU. A conventional contemporary computer (e.g., a desktop computer or smartphone) is based on a Von Neumann architecture comprising memory, I/O devices, and one or more central processing

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[67] Gladden, "The Diffuse Intelligent Other" (2016).

[68] Calverley (2008), p. 529.

[69] Gladden, "The Diffuse Intelligent Other" (2016).

[70] For a discussion of the ways in which the electronic components of traditional computers carry out the work of and are controlled by executable programs – as well as an overview of the ways in which alternative architectures such as that of the neural network can allow computers to learn through experience – see Null & Lobur (2006). A more detailed presentation of the ways in which neural networks can be structured and learn is found in Haykin, *Neural Networks and Learning Machines* (2009). For a review of forms of computer behavior whose activity can be hard to predict (e.g., the actions of some forms of evolutionary algorithms or neural networks) as well as other forms of biological or biologically inspired computing, see Lamm & Unger (2011).

units connected by a communication bus.[71] Although one can be made to replicate the functioning of the other, the linear method by which such a CPU-based system processes information is fundamentally different from the parallel processing method utilized by a physical neural network such as that constituted by the human brain.[72]

Lacking emotion. A traditional computer does not possess emotions that are grounded in the current state of the computer's body, are consciously experienced by the computer, and influence the contents of its decisions and behavior.[73] Although a piece of software may run more slowly or have some features disabled when executed on particular computers, the nature of the software's decision-making is not influenced by factors of mood, emotion, or personality that are determined by a computer's hardware. A software program will typically either run or not run on a given computer; if it runs at all, it will run in a manner that is determined by the internal logic and instructions contained within the software code and not swayed or distorted by that computer's particular physical state.

Free from cognitive biases. A conventional computer is not inherently subject to human-like cognitive biases, as its decisions and actions are determined by the logic and instructions contained within its operating system and application code and not by the use of evolved heuristic mechanisms that are a core element of human psychology.[74]

Possessing nonvolatile digital memory. Many conventional computers are able to store data in a stable electronic digital form that is practically lossless, does not degrade rapidly over time, can be copied to other devices or media and backed up with full fidelity, and does not require a continuous power supply in order to preserve the data.[75]

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[71] See Friedenberg (2008), pp. 27-29.

[72] See Friedenberg (2008), pp. 30-32.

[73] For the distinction between the relatively straightforward phenomenon of computers possessing 'emotion' simply as a function versus the more doubtful possibility that computers could undergo 'emotion' as a conscious experience, see Friedenberg (2008), pp. 191-200.

[74] It is possible, however, for a computer to indirectly demonstrate human-like cognitive biases if the human programmers who designed a computer's software were not attentive to such considerations and inadvertently programmed the software to behave in a manner that manifests such biases. For a discussion of such issues, see, e.g., Friedman & Nissenbaum, "Bias in Computer Systems" (1997).

[75] Regarding the creation, storage, and transfer of digital data files by computers and other electronic devices, see, e.g., Austerberry, *Digital Asset Management* (2013), and Coughlin, *Digital Storage in*

Demonstrating predictable and analyzable behavior. Computerized devices can be affected by a wide range of component failures and bugs resulting from hardware or software defects or incompatibilities. However, because a typical computer is controlled by discrete linear executable code that can be easily accessed – and because there exist diagnostic software, software debugging techniques, established troubleshooting practices, and methods for simulating a computer's real-world behaviors in development and testing environments – it is generally easier to analyze and reliably predict the behavior of a computer than that of, for example, a human being.[76]

Capable of being hacked electronically. Computerized systems are vulnerable to a wide variety of electronic hacking techniques and other attacks that can compromise the confidentiality, integrity, and availability of information that is received, generated, stored, or transmitted by a system or can result in unauthorized parties gaining complete control over the system.[77]

c. Social Interaction

An agent possessing computronic characteristics demonstrates a number of noteworthy traits relating to social interaction. Such an agent is:

Nonsocial or semisocial. Conventional computers may display social behaviors and engage in short-term, isolated social interactions with human beings or other computers, but they do not participate in long-term social relations that deepen and evolve over time as a result of their experience of such engagement and which are shaped by society's expectations for social roles to be filled by the participants in such relations.[78]

Consumer Electronics: The Essential Guide (2008).

[76] Even the behavior of sophisticated 'artificially intelligent' computerized systems can be easy to predict and debug, if it is controlled by a conventional executable program rather than, e.g., the actions of a physical artificial neural network. For a discussion of different models for generating artificial intelligence through hardware and software platforms, see Friedenberg (2008), pp. 27-36.

[77] For an overview of such possibilities (as well as related preventative practices and responses), see Rao & Nayak (2014).

[78] Although there already exist telepresence robots (e.g., Ishiguro's Geminoids) that manifest highly sophisticated, human-like levels of sociality, such sociality is technically possessed not by the robot itself but by the hybrid human-robotic system that it forms with its human operator. Regarding such issues, see Vinciarelli et al. (2012) and Gladden, "Managerial Robotics" (2014).

Lacking culture. Although a large number of computers can be linked to form networks that may constitute a form of computerized society, such aggregations of conventional computers do not create their own cultures.[79]

Lacking spirituality. Conventional computers do not search for a connection with some transcendental truth or reality in order to provide meaning or purpose to their existence; they do not engage in contemplation, meditation, or prayer.[80]

Apolitical. Conventional computers do not directly participate as members of human or artificial political systems. Some computerized systems (e.g., some swarm robots as components in multi-agent systems) participate in social interactions, and even social relations and group governance structures, but they do not generally create political systems of the sort common among human populations.[81]

An economic participant. Conventional computers typically do not function independently within the real-world human economy as autonomous economic actors, although they participate in the economy in many other ways. Computers do not own or exchange their own financial or other assets, nor do they purchase goods or services for their own consumption, although computers may serve as agents that initiate and execute transactions on behalf of human beings or organizations.[82]

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[79] Regarding prerequisites for artificial entities or systems to produce their own culture (or collaborate with human beings in the production of a shared human-artificial culture), see, e.g., Payr & Trappl, "Agents across Cultures" (2003).

[80] Regarding elements that would need to be present in order for a computerized device to develop its own spirituality (rather than to simply have some spiritual value attributed to it by human beings), see, e.g., Geraci, "Spiritual robots: Religion and our scientific view of the natural world" (2006); Nahin, "Religious Robots" (2014); Section 6.2.3.2 on "Religion for Robots" in Yampolskiy, *Artificial Superintelligence: A Futuristic Approach* (2015); and Kurzweil, *The Age of Spiritual Machines: When Computers Exceed Human Intelligence* (2000).

[81] Regarding ways in which advanced multi-agent systems (such as those found in swarm robotics) might potentially implement patterns of social interaction and organization that resemble or are explicitly based on human political behaviors and structures, see, e.g., McBurney & Parsons, "Engineering democracy in open agent systems" (2003); Ferber et al., "From agents to organizations: an organizational view of multi-agent systems" (2004); and Sorbello et al., "Metaphor of Politics: A Mechanism of Coalition Formation" (2004).

[82] For example, regarding the increasing sophistication of automated trading systems that are capable of teaching themselves and improving their investment strategies over time, without direct instruction from human beings, and the growing use of 'robo-advisors' to manage financial assets on behalf of human owners, see Scopino, "Do Automated Trading Systems Dream of Manipulating the Price of Futures Contracts? Policing Markets for Improper Trading Practices by Algorithmic Robots" (2015), and Sharf, "Can Robo-Advisors Survive A Bear Market?" (2015).

Property, not a legal person. A conventional computer is a piece of property that is typically owned by a specific human being or organization; a computer is not itself a legal person that possesses a recognized set of rights and responsibilities.[83]

III. Using the Matrix to Analyze the Traditional Practice of Organizational Management

Our two-dimensional Posthuman Management Matrix contains quadrants that describes four types of entities that could potentially be participants in or objects of the activities of organizations such as businesses and which – if they exist – would need to be accounted for by management theory and practice. As illustrated in Figure 1, these four potential types of entities are:

- **Human agents possessing anthropic characteristics**, which we can refer to as "**'natural' human beings**," insofar as they have not been significantly enhanced or modified through the use of technologies such as neuroprosthetics or genetic engineering.
- **Artificial agents possessing computronic characteristics**, which we can refer to simply as "**computers**." Such entities include conventional desktop and laptop computers, mainframes, web servers, and smartphones and other mobile devices whose software allows them to exercise a limited degree of agency.
- **Human agents possessing computronic characteristics**, which we can refer to as "**cyborgs**." In the sense in which the term is employed in this text, a cyborg is a human being whose body includes some 'artificial components,'[84] however these components do not necessarily need to be electromechanical in nature (as in the case of contemporary neuroprosthetic devices); the artificial elements could be structures or systems composed of biological material that are not typically found in

[83] Stahl suggests that a kind of limited 'quasi-responsibility' can be attributed to conventional computers and computerized systems. In this model, it is a computer's human designers, programmers, or operators who are typically responsible for the computer's actions; declaring a particular computer to be 'quasi-responsible' for some action that it has performed serves as a sort of moral and legal placeholder, until the computer's human designers, programmers, and operators can be identified and ultimate responsibility for the computer's actions assigned to the appropriate human parties. See Stahl, "Responsible Computers? A Case for Ascribing Quasi-Responsibility to Computers Independent of Personhood or Agency" (2006).

[84] See Novaković et al. (2009).

natural human beings and which are the result of genetic engineering.

- **Artificial agents possessing human characteristics**, which we can refer to as "**bioroids**." Terms such as "android" or "humanoid robot" could potentially be employed to describe such entities, however these terms are often used to imply that a robot has a human-like physical form, without necessarily possessing human-like psychology, cognitive capacities, or biological components. Similarly, the term "biorobot" could be employed, but it is often used to refer to robots that mimic animals like insects or fish whose physical form and cognitive capacities have little in common with those of human beings. We choose to employ the term "bioroid" (whose origins lie primarily in the field of science fiction rather than engineering)[85] insofar as it evokes the image of an artificially engineered agent that possesses human-like cognitive capacities and psychology, biological or biologically inspired components, and a physical form that allows it to engage in human-like social behaviors and interactions but which is not necessarily humanoid.

Prior to the development of computers as a practical organizational technology in the 20th Century, it was historically only the lower left quadrant of the Posthuman Management Matrix that was of relevance to organizational managers. Indeed, not only were natural human beings as a practical matter the only available employees and customers, but they were also generally considered to be the only *potential* employees and customers with which the scholarly discipline of management would ever need to concern itself. The possibility that organizations might someday employ and serve entities that were not human agents possessing anthropic characteristics was not studied as a theoretical possibility; the theory and practice of management were con-

[85] For uses of the term "bioroid" in science fiction literature and roleplaying games, see, e.g., Pulver (1995), pp. 74-81, where "bioroid" is used explicitly as a portmanteau derived from "biological android"; Surbrook, *Kazei-5* (1998), pp. 64, 113; Pulver, *Transhuman Space* (2002), p. 12, where "bioroid" refers to "living beings functionally similar to humans, but assembled using tissue engineering and 'biogenesis' nanotechnology, and educated using accelerated learning techniques"; *Appleseed*, directed by Aramaki (2010); Martinez, "Bodies of future memories: the Japanese body in science fiction anime" (2015); Litzsinger, *Android: Netrunner* (2012); and Duncan, "Mandatory Upgrades: The Evolving Mechanics and Theme of Android: Netrunner" (2014). For a reference to the fictional use of the term 'bioroid' in an engineering context, see Novaković et al. (2009).

cerned only with understanding and managing the activities of natural human beings. Within that context, fields such as economics, organizational psychology, and human resource management played key roles.

Eventually, with the development of increasingly sophisticated computers over the course of the 20th Century and up through the present day, management scholars and practitioners began to realize the need to expand the theoretical and practical scope of management to include new subdisciplines that could guide the creation, implementation, and management of artificial agents such as manufacturing robots or server farms controlled by load-balancing software.[86] Because such artificial agents possessed structures, behaviors, and organizational roles that were quite different from those of human agents, existing disciplines such as psychology and HR management did not provide adequate or relevant tools for the oversight of such systems; instead, new fields such as computer science, electronics engineering, robotics, and IT management began to aid organizational managers in designing, implementing, and maintaining such systems that comprise artificial agents possessing computronic characteristics. As a result of such developments, a second quadrant of the Posthuman Management Matrix became not only relevant but critical for the successful management of contemporary organizations.

Despite this experience in which a previously disregarded quadrant of the Posthuman Management Matrix quickly assumed major theoretical and practical importance for organizations, the remaining two quadrants of the Matrix have remained largely neglected within the field of organizational management – as though there existed an implicit presumption that these areas define sets that would continue to remain empty or that these quadrants would only become relevant for organizational management at a date so far in the future that it would be a misallocation of time and resources for management scholars and practitioners to concern themselves with such possibilities now.

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[86] The development of such disciplines and practices was spurred in part by the experience of organizations that made large investments in IT systems in the 1980s, only to discover that simply purchasing exotic new IT equipment would not, in itself, generate desired gains in productivity unless such equipment were thoughtfully aligned with and integrated into an organization's larger business plan, strategies, and processes. See Magoulas et al. (2012), p. 89, and Hoogervorst (2004), p. 16.

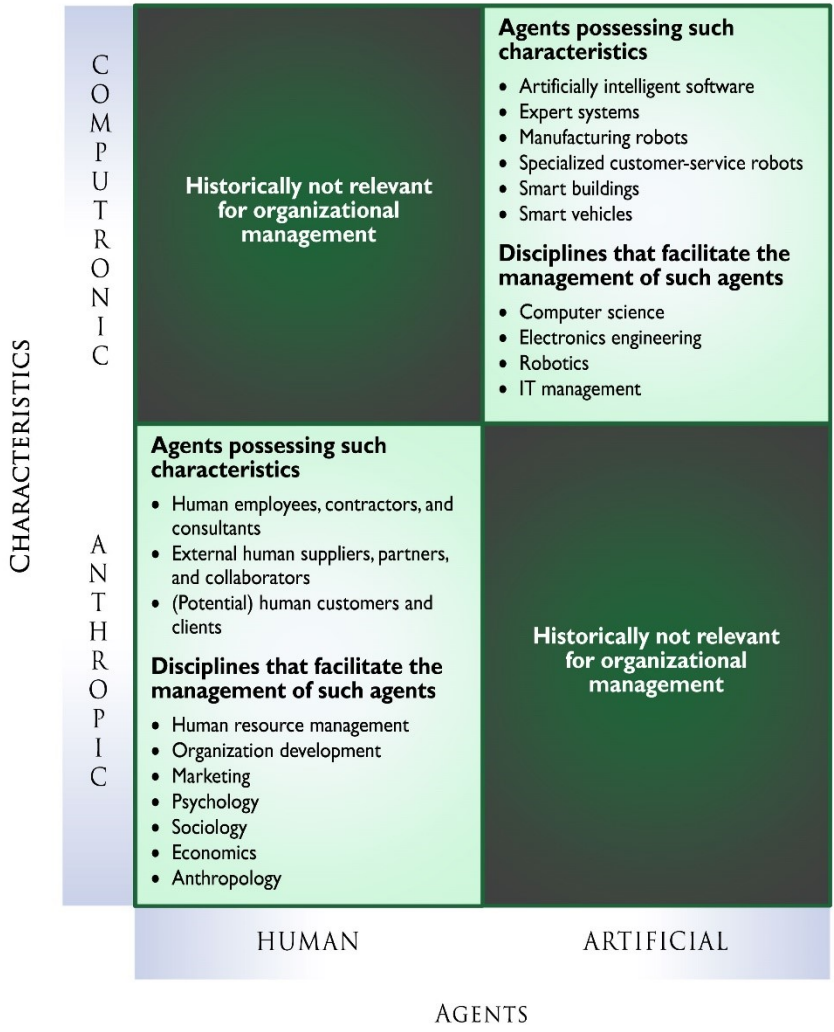

Fig. 2: The Posthuman Management Matrix displaying the two types of entities that have been relevant in recent decades for the theory and practice of organizational management, along with two types of entities that historically have not been considered relevant.

Figure 2 thus depicts the field of management as it largely exists today: a field in which centuries-old management traditions relating to natural human beings have recently been supplemented by new theory and practice

that address the rise of conventional computers – but in which the possibility and organizational significance of cyborgs and bioroids remain, from a management perspective, largely unexplored.[87]

We can now consider in more detail these four types of entities described by the Posthuman Management Matrix as they have been understood by the field of organizational management from its historical origins up to the present day.

A. Human Agents with Anthropic Characteristics ("Natural' Human Beings")

The actions of natural human beings – and the knowledge of how to anticipate and guide their activities – have formed the critical foundation upon which all human organizations have historically been built. Even before the dawn of artificial intelligence and the creation of the first artificial agents, nonhuman agents such as domesticated farm animals have played a supporting role in the activities of some human organizations. However, the overwhelming majority of roles within such organizations – including all of those leadership and management roles requiring strategic thinking and long-term planning, ethical and legal sensitivity, negotiation skills, risk management approaches, and the use of oral and written communication – have historically been filled by human beings, who have always been (and been understood as) human agents who possess anthropic characteristics. Human organizations such as businesses have relied on such human beings as their CEOs and executives, midlevel managers, frontline employees, consultants, partners and suppliers, competitors, and actual or potential customers and clients.

In order to plan, organize, lead, and control[88] the activities of such natural human beings that are found both within and outside of organizations, a number of academic disciplines and practices have been developed over the

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[87] For some time, the design, implementation, and implications of human agents possessing computronic characteristics and artificial agents possessing anthropic characteristics have been the subject of intense research and contemplation across a broad range of fields, from computer science and robotics to philosophy of mind and philosophy of technology, ethics, and science fiction; here we are only noting that – notwithstanding the work of a small number of future-oriented management scholars – the field of management has not yet taken up such topics as subjects worthy of (or even demanding) serious consideration.

[88] Planning, organizing, leading, and controlling are recognized as the four key functions that must be performed by managers. See Daft, *Management* (2011).

last century and more that can facilitate and support the management of organizations. Such disciplines include HR management, marketing, and organization development, along with other disciplines such as psychology, sociology, economics, anthropology, cultural studies, and ergonomics that have broader aims and applications but which can help inform organizational management.

B. Artificial Agents with Computronic Characteristics ("Computers")

Over the last half-century, computers have taken on critical roles within the lives of many organizations. Such agents comprise assembly-line robots used for painting or welding, flexible manufacturing systems, automated security systems, and a broad range of software that possesses some degree of artificial intelligence and runs as part of an operating system or application on servers, desktop computers, mobile devices, and other computerized equipment. Such artificial agents may schedule tasks and optimize the use of physical and electronic resources;[89] transport materials within production facilities;[90] assemble components to produce finished products;[91] interact directly with customers on automated customer-service phone lines, through online chat interfaces, and at physical kiosks to initiate and perform transactions and offer information and support;[92] monitor systems and facilities to

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[89] For an overview of methods that can be employed for such purposes, see Pinedo, *Scheduling: Theory, Algorithms, and Systems* (2012). For more specific discussions of the use of artificial agents (and especially multi-agent systems) for such ends, see, e.g., Ponsteen & Kusters, "Classification of Human and Automated Resource Allocation Approaches in Multi-Project Management" (2015); Merdan et al., "Workflow scheduling using multi-agent systems in a dynamically changing environment" (2013); and Xu et al., "A Distributed Multi-Agent Framework for Shared Resources Scheduling" (2012).

[90] See, e.g., Ullrich, *Automated Guided Vehicle Systems: A Primer with Practical Applications* (2015), and *The Future of Automated Freight Transport: Concepts, Design and Implementation*, edited by Priemus & Nijkamp (2005).

[91] See, e.g., *Agent-Based Manufacturing: Advances in the Holonic Approach*, edited by Deen (2003); *Intelligent Production Machines and Systems*, edited by Pham et al. (2006); and *Industrial Applications of Holonic and Multi-Agent Systems*, edited by Mařík et al. (2015).

[92] See, e.g., Ford, *Rise of the Robots: Technology and the Threat of a Jobless Future* (2015), and McIndoe, "Health Kiosk Technologies" (2010).

detect physical or electronic intrusion attempts;[93] initiate and execute financial transactions within online markets;[94] and carry out data mining in order to evaluate an applicant's credit risk, identify suspected fraud, and decide what personalized offers and advertisements to display to a website's visitors.[95] In order to manage the activities of artificial agents possessing computronic characteristics, one can draw on insights from a number of disciplines and practices that have been developed over the last few decades, including computer science, electronics engineering, robotics, and IT management.

While human beings still play key roles as leaders, strategists, and managers within organizations, in many cases they are no longer capable of carrying out their work without the engagement and support of the artificial agents that permeate an organization's structures, processes, and systems in so many ways.[96] For many organizations, the sudden disabling or loss of such artificial agents would be devastating, as the organizations have become dependent on artificial agent technologies to perform critical tasks that cannot be performed by human beings with the same degree of speed, efficiency, or power.

C. Human Agents with Computronic Characteristics ("Cyborgs")

Historically, all human beings have been human agents that possess anthropic characteristics. From the perspective of organizational management, the set of human agents possessing computronic characteristics has been seen as empty; such beings are not yet understood to widely exist, and it is presumed that there is no special need to take them into account as potential employees, partners, or clients when considering a business's short-term objectives and operations. Although emerging posthumanizing technologies are

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[93] Regarding the automation of intrusion detection and prevention systems, see Rao & Nayak (2014), pp. 226, 235, 238.

[94] See Philips, "How the Robots Lost: High-Frequency Trading's Rise and Fall" (2012); Scopino (2015); and Sharf (2015).

[95] Giudici, *Applied Data Mining: Statistical Methods for Business and Industry* (2003); Provost & Fawcett, *Data Science for Business* (2013), p. 7; and Warkentin et al., "The Role of Intelligent Agents and Data Mining in Electronic Partnership Management" (2012), p. 13282.

[96] Within the 'congruence model' of organizational architecture developed by Nadler and Tushman, structures, processes, and systems constitute the three main elements of an organization that must be considered. See Nadler & Tushman, *Competing by Design: The Power of Organizational Architecture* (1997), p. 47, and the discussion of these elements within a posthumanized organizational context in Part Two of this volume, on "Organizational Posthumanism."

beginning to create cases of human agents who indeed possess limited computronic characteristics, the number, nature, and scope of such cases of the 'cyborgization' of human agents is still relatively small, and from the managerial perspective most organizations have been able to simply ignore such cases, as though the category of the cyborg were not yet applicable or relevant to their organizational mission and objectives.[97] Because human agents possessing extensive computronic characteristics do not yet exist as a large population of beings who can serve as employees, partners, or customers for organizations, it is not surprising that organizations do not yet possess specialized practices or academic disciplines that they can rely on to aid them in the management of such entities.

D. Artificial Agents with Anthropic Characteristics ("Bioroids")

The artificial agents that have been broadly deployed and which are relevant for organizational management are generally artificial agents possessing computronic characteristics. While scientists and engineers are making great strides toward developing artificial agents that possess anthropic characteristics, at present such systems are experimental and exist largely in laboratory settings.[98] As a practical matter, within most organizations the category of bioroids is still treated as though it were an empty set; organizations have generally not seen the need to consider such entities when planning their objectives and operations. As with the cyborgs described above, because bioroids have historically not existed as potential employees, partners, or customers for organizations, it is unsurprising that organizations do not yet have specialized disciplines that they can rely on to aid them in managing such entities.

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[97] Fleischmann argues, for example, that within human society there is an inexorable trend that will eventually result in full cyborg-cyborg interaction in the form of social relations among beings who are human-electronic hybrids – human beings whose biological organism possesses extensive and intimate internal interfaces with neuroprosthetic devices. Current phenomena like the widespread interaction of human beings who are dependent on (and interact through) mobile devices such as smartphones are one step along that trajectory. See Fleischmann, "Sociotechnical Interaction and Cyborg–Cyborg Interaction: Transforming the Scale and Convergence of HCI" (2009).

[98] See Friedenberg (2008) for an in-depth review of efforts to develop robots and other artificial beings that possess human-like perception, learning, memory, thought, language use, intelligence, creativity, motivation, emotions, decision-making capacities and free will, consciousness, biological structures and processes, and social behaviors.

IV. Using the Matrix to Predict and Shape the Future Practice of Organizational Management

In the sections above, we have considered the situation that has existed up to now – with organizations' sole agents being natural human beings and computers. We can now explore the ways in which the situation is rapidly changing due to the emergence of new posthumanizing technologies.

A. The Converging Characteristics of Human and Artificial Agents in the Posthuman Age

Below we review once more the set of variables that define an agent's characteristics and, for each of the characteristics, discuss ways in which the advent of various posthumanizing technologies will result in a growing variety of cyborgs and bioroids. Studies focusing on these two types of entities are emerging as new fields in which ongoing innovation will expand the kinds of workers, partners, and consumers that are available to organizations and which are expected to become crucial loci for management theory and practice in the coming years. We can consider in turn the physical form, intelligence, and social interaction that will be demonstrated by such new types of human and artificial agents .

1. Physical Form

The range of physical forms available to human and artificial agents is expected to evolve and expand significantly. Such changes will be visible in the manner in which a number of key characteristics are expressed (or not expressed); these characteristics are described below.

a. Components

It is anticipated that the bodies of human agents will increasingly include electronic components in the form of artificial organs, artificial limbs and exoskeletons, artificial sense organs, memory implants, and other kinds of neuroprosthetic devices;[99] the major obstacle to the expansion of such technology

[99] See Gasson, "ICT implants" (2008); Gasson et al., "Human ICT Implants: From Invasive to Pervasive" (2012); McGee (2008); Merkel et al., "Central Neural Prostheses" (2007); Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 32-33; and Gladden, "Cybershells, Shapeshifting, and Neuroprosthetics" (2015).

may be the fact that the natural biological brain (or at least, significant portions of the brain) of a human being will need to remain intact and functional in order for an agent to be considered 'human.'

Conversely, expected developments in genetic engineering technologies, soft robotics, and artificial life will increasingly allow the bodies of artificial agents to include components formed from biological material.[100] In cases that involve extensive engineering and modification of the genome (and especially in 'second-generation' entities that are the result of natural reproductive processes between biological parents rather than cloning or other direct engineering), it may be difficult conceptually and practically to specify whether an entity is an 'artificial agent' composed entirely of biological components or a 'human agent' whose biological substrate has been intentionally designed. The legal, ethical, ontological, and even theological questions involved with such potential practices are serious and wide-ranging.

B. Animation

Currently, only those human beings that are alive are capable of serving as employees or customers of an organization. Techniques such as 'mind uploading' and the development of artificial neurons that can replace or replicate the actions of neurons in the brain of a living human being may someday allow human agents that are no longer 'alive' in a biological sense to have their unique memories, knowledge, cognitive patterns, and social relations utilized by agents that function as employees, partners, or customers for organizations. The extent to which such nonbiological human agents can be identified with the biological human beings from whom they are derived depends on issues that are philosophically controversial and complex.[101]

Meanwhile, the development of biological components for use in robots and other artificial agents and ongoing advances in the development of nonbiological artificial life (e.g., autonomous evolvable computer worms or viruses that satisfy standard scientific definitions of life-forms) can result in

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[100] See Berner (2004), pp. 15, 18, 31, 61-62. For a discussion of the possibilities of using DNA as a mechanism for the storage or processing of data, see Church et al. (2012) and Friedenberg (2008), p. 244.

[101] See Koene (2012); Proudfoot (2012); Pearce, "The Biointelligence Explosion" (2012); Hanson, "If uploads come first: The crack of a future dawn" (1994); Moravec, *Mind Children: The Future of Robot and Human Intelligence* (1990); Ferrando (2013), p. 27; and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 98-100, for a discussion of such issues from various perspectives.

artificial agents that are considered to be alive, insofar as they constitute a viable system that demonstrate a physical metabolism, the ability to maintain homeostasis, reproduction, reaction and adaptation to the environment, and other key characteristics.[102]

C. Design

The growing possibilities for genetic engineering, gene therapy, and the augmentation of human agents through the implantation of neuroprosthetic devices or other synthetic components means that the body possessed by a human agent will no longer necessarily be a natural substrate that is produced through the randomized inheritance of genetic material from biological parents and that is free from intentional design by institutions or individual human engineers.[103] Besides the major moral and legal questions raised by such possibilities, there are also operational issues that would confront organizations whose pool of potential employees or customers includes human agents who have been designed in such ways; for example, forms of genetic engineering that create synthetic characteristics shared broadly across a population and which reduce genotypic diversity may render the population more vulnerable to biological or electronic hacking attempts (and may make such attempts more profitable and attractive for would-be adversaries), although such standardization may also make it easier for effective anti-hacking security mechanisms to be developed and deployed across the population.[104]

At the same time, artificial agents may no longer be products of explicit design and engineering by human manufacturers. Some artificial life-forms that exist within the digital-physical ecosystem primarily as physical robots possessing some degree of AI or as digital life-forms that temporarily occupy

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[102] See the discussion of essential elements of artificial life in Friedenberg (2008), pp. 201-03, which is based on the criteria for biological life presented by Curtis (1983). See also Gladden, "The Artificial Life-Form as Entrepreneur: Synthetic Organism-Enterprises and the Reconceptualization of Business" (2014).

[103] For different perspectives on such possibilities, see, e.g., De Melo-Martín (2015); Regalado, "Engineering the perfect baby" (2015); Lilley, *Transhumanism and Society: The Social Debate over Human Enhancement* (2013); Nouvel (2015); Section B ("Enhancement") in *The Future of Bioethics: International Dialogues*, edited by Akira Akabayashi (2014); Mehlman, *Transhumanist Dreams and Dystopian Nightmares: The Promise and Peril of Genetic Engineering* (2012); and Bostrom (2012).

[104] For the relationship between the heterogeneity of information systems and their information security, see Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), p. 296, and *NIST SP 800-53* (2013), p. F-204.

physical substrates may manifest structures and behaviors that are the result of randomized evolutionary processes that lie beyond the control of human designers or which are the result of intentional design efforts conducted by other artificial agents whose nature is such that they are inscrutable to human understanding – in which case, from the human perspective, the engineered agents would essentially lack a comprehensible design.[105] In other cases, human designers may have intentionally engineered an artificial agent's basic structures (such as a physical neural network), but the exact nature of the behaviors and other traits eventually developed and demonstrated by those structures may lie beyond the reach of human engineering.[106]

D. Upgradeability

The growing use of technologies for somatic cell gene therapy and neuroprosthetic augmentation may increasingly allow the physical components and cognitive capacities of human agents to be upgraded and expanded even after the agents have reached a stage of physical and cognitive maturity.[107]

Conversely, it may be difficult or impossible to upgrade, expand, or replace the physical components of artificial agents that are composed of biological material in the way that components of an electronic computer can be upgraded. In the case of especially complex or fragile artificial agents, efforts to upgrade or otherwise modify an agent's physical components after its creation may result in the impairment or death of such biological material or of the agent as a whole. Similarly, after an artificial agent that possesses a holonomic physical neural network has been created and achieved intellectual maturity through experience and learning, it may not be possible to intervene directly in the neural network's physical structure or processes to upgrade its capacities or edit its contents without irreparably harming the agent.[108]

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[105] Regarding evolutionary robotics and evolvable robot hardware, see Friedenberg (2008), pp. 206-10.

[106] Regarding the relationship of artificial life and evolutionary robotics, see Friedenberg (2008), pp. 201-16.

[107] See, e.g., Panno, *Gene Therapy: Treating Disease by Repairing Genes* (2005); *Gene Therapy of the Central Nervous System: From Bench to Bedside*, edited by Kaplitt & During (2006); and Bostrom (2012).

[108] Regarding the potentially holonomic nature of memory storage within the brain, see, e.g., Longuet-Higgins (1968); Pribram (1990); Pribram & Meade (1999); and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 200-01.

E. Lifespan

A human agent whose bodily components can be easily replaced with biological or electronic substitutes after deteriorating or becoming damaged or whose components can be (re)engineered to prevent them from undergoing damage or deterioration in the first place could potentially experience an extended or even indefinite lifespan, although such engineering might result in side-effects that are detrimental to the agent and which would render such lifespan extension undesirable as a practical matter.[109] As in other cases, the moral and legal questions involved with such activities are serious.

At the same time, artificial agents whose bodies include or comprise biological components or whose cognitive processes follow an irreversible developmental cycle (e.g., in which the neural network of an agent's 'brain' possesses a maximum amount of information that it can accumulate over the course of the agent's lifespan) might possess a limited and predetermined lifespan that cannot be extended after the agent's creation.[110]

F. Operational Cycle

Genetic engineering could potentially speed the natural biological processes that contribute to physical growth and cognitive development or slow or block processes of physical and cognitive decline. Scholars also envision the possibility of neuroprosthetic technologies being used to allow human beings to instantly acquire new knowledge or skills through the implantation of memory chips or the downloading of files into one's brain; if feasible, this could allow human cognitive capacities to be instantaneously upgraded in a manner similar to that of installing new software on a computer, thereby bypassing typical human processes of cognitive development and learning.[111]

At the same time, the integration into artificial agents of biological components and physical neural networks whose structure and behavior render

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[109] Regarding issues with technologically facilitated life extension or the replacement of a human being's original biological body, see Proudfoot (2012); Pearce (2012); Hanson (1994); and Gladden, "'Upgrading' the Human Entity: Cyberization as a Path to Posthuman Utopia or Digital Annihilation?" (2015).

[110] As early as the 1940s, Wiener speculated that a physical neural network that is incapable of adding new neurons or creating new synapses but which instead stores memories through increases to the input threshold that triggers the firing of existing neurons may display an irreversible process of creating memories through which its finite available storage capacity is gradually exhausted, after which point a sort of senescence occurs that degrades the neural network's functioning and disrupts the formation of new memories. See Wiener (1961), loc. 2467ff.

[111] See, e.g., McGee (2008).

them difficult to control externally after their deployment means that it may become impossible to simply 'reset' artificial agents and restore them to an earlier physical and informational state.[112]

G. Locality

The use of neuroprosthetic devices and virtual reality technologies may effectively allow a human agent to occupy different and multiple bodies that are either physical or virtual and are potentially of a radically nonhuman nature.[113] In this way, a human agent could be extremely multilocal by being present in many different environments simultaneously.[114]

At the same time, an artificial agent whose cognitive processes are tied to a single body comprising biological components or a single physical artificial neural network that possesses limited sensorimotor and I/O mechanisms may be confined to exercising its agency within the location in which that cognitive substrate is located.[115]

H. Permanence of Substrate

Historically, a particular human agent has been tied to a particular physical substrate or body; the dissolution of that body entails the end of that human being's ability to act as an agent within the environment. Ontologically and ethically controversial practices such as the development of artificial neurons to replace the natural biological neurons of a human brain and mind uploading may allow a single human agent's agency to exist and act beyond the physical confines of the agent's original biological physical substrate – but only under certain definitions of 'agent' and 'agency' that remain strongly

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[112] Regarding the difficulty of detecting and understanding the current state of an artificially intelligent system (let alone restoring it to a previous state), especially that of a distributed artificial intelligence (DAI) displaying emergent behavior, see Friedenberg (2008), pp. 31-32.

[113] Gladden, "Cybershells, Shapeshifting, and Neuroprosthetics" (2015).

[114] See Gladden, "The Diffuse Intelligent Other" (2016) for a discussion of multilocality.

[115] Regarding different fundamental architectures for the design of artificially intelligent systems – from a CPU-based Von Neumann architecture and software-based artificial neural network to models utilizing grid computing and distributed AI – see Friedenberg (2008), pp. 27-32. Regarding the extent to which a human-like AI may necessarily be tied to a single body that interacts with a particular environment, see Friedenberg (2008), pp. 32-33, and the literature on embodied embedded cognition – e.g., Wilson, "Six views of embodied cognition" (2002); Anderson, "Embodied cognition: A field guide" (2003); Sloman, "Some Requirements for Human-like Robots: Why the recent overemphasis on embodiment has held up progress" (2009); and Garg, "Embodied Cognition, Human Computer Interaction, and Application Areas" (2012).

contested.[116] Similarly, the use of genetic engineering or neuroprosthetically mediated cybernetic networks to create hive minds or other forms of collective agency involving human agents might allow such multi-agent systems or 'super-agents' to survive and function despite a continual addition and loss of biological substrates which mean that the entity's substrate at one moment in time shares no components in common with its substrate at a later point in time.

Just as certain posthumanizing technologies might – according to their proponents – free human agency from its historic link to a particular biological body, other technologies might increasingly bind artificial agency to a particular permanent physical substrate. For example, an artificial agent whose cognitive processes are executed by biological components or a physical artificial neural network and whose memories and knowledge are stored within such components may not be capable of exchanging its body or migrating to a new substrate without losing its agency.[117]

I. Identity

If a human agent's agency is no longer irrevocably tied to a particular biological body, it may become difficult or impossible to attribute actions to a specific human agent or even to identify which human agent is occupying and utilizing a particular physical body in a given moment – since a single electronic sensor or actuator could simultaneously belong to the bodies of multiple human agents. The ability of neuroprosthetically mediated cybernetic networks to create hive minds and other forms of collective consciousness among human and artificial agents may also make it difficult to identify which human agent, if any, is present in a particular physical or virtual environment and is carrying out the behaviors observed there.[118]

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[116] Regarding such issues, see Koene (2012); Proudfoot (2012); Pearce (2012); Hanson (1994); Moravec (1990); and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 99-100.

[117] It is not yet clear, for example, whether an artificial intelligence possessing human-like levels of intelligence could potentially exist in the form of a computer worm or virus that can move or copy itself from computer to computer, or whether the nature of human-like intelligence renders such a scenario theoretically impossible. Regarding the significance of a body for artificial intelligence, see, e.g., Friedenberg (2008), pp. 32-33, 179-234.

[118] Regarding such issues, see Gladden, "Utopias and Dystopias as Cybernetic Information Systems: Envisioning the Posthuman Neuropolity" (2015), and Gladden, "'Upgrading' the Human Entity" (2015).

Conversely, if an artificial agent is tied to a particular physical body (e.g., because the agent's cognitive processes cannot be extracted or separated from the biological components or physical artificial neural network that execute them), this may provide it with a uniqueness and identity similar to that historically enjoyed by individual human beings.[119] On the other hand, an artificial agent that possesses a spatially dispersed or nonlocalizable body may possess even less of a clear identity than is possessed today by conventional hardware-software computing platforms.

2. Intelligence

The range of information-processing mechanisms and behaviors available to human and artificial agents is expected to evolve significantly as a result of posthumanizing technological and social change. Such changes will be expressed through the possession (or lack) of a number of key characteristics, which are described below.

a. Sapience

By interfering with or altering the biological mechanisms that support consciousness and self-awareness within the brain, neuroprosthetic devices could deprive particular human agents of sapience, even if those agents outwardly appear to remain fully functional as human beings; for example, a human agent might retain its ability to engage in social interactions with longtime friends – not because the agent's mind is conscious and aware of such interactions, but because a sufficiently sophisticated artificially intelligent neuroprosthetic device is orchestrating the agent's sensorimotor activity.[120] Genetic engineering could also potentially be employed in an attempt to create human agents that lack sapience (and could be subject to claims by their producers that they should be considered property rather than legal persons and moral agents) or human agents whose transhuman sapience is of such an unusual and 'advanced' sort that it is unfathomable – and perhaps even undetectable – to natural human beings.[121]

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[119] For an overview of issues of personal identity from a philosophical perspective, see Olson (2015). For an exploration of questions of physicality and identity in robots, see Friedenberg (2008), pp. 179-234.

[120] See Gladden, "'Upgrading' the Human Entity" (2015).

[121] See Abrams, "Pragmatism, Artificial Intelligence, and Posthuman Bioethics: Shusterman, Rorty, Foucault" (2004); McGee (2008), pp. 214-16; Warwick, "The cyborg revolution" (2014), p. 271; Rubin, "What Is the Good of Transhumanism?" (2008); and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 166-67.

Much research from a philosophical and engineering perspective has been dedicated to considering whether sufficiently sophisticated artificial agents might be capable of achieving sapience and possessing self-awareness and a subjective conscious experience of reality. Controversy surrounds not only the theoretical questions of whether artificial agents can potentially possess sapience (and, if so, what types of artificial agents) but also the practical question of how outside observers might determine whether a particular artificial agent possesses conscious self-awareness or simply simulates the possession of such self-awareness.[122] Regardless of how these questions are answered by philosophers, theologians, scientists, engineers, and legislators, emerging popular conceptions of artificial agents and their potential for sapience may require organizations to treat certain kinds of artificial agents *as though* they possessed a degree of sapience comparable, if not identical, to that possessed by human beings.

B. Autonomy

Some kinds of neuroprosthetic devices or genetic modification may weaken the desires or strategic planning capacities of human agents or subject them to the control of external agents, thereby reducing their autonomy. New kinds of social network topologies that link the minds of human agents to create hive minds or other forms of merged consciousness can also reduce the autonomy of the individual members of such networks.[123] Neuroprosthetic augmentation, genetic modification, and other uses of posthumanizing technology that renders human agents dependent on corporations or other organizations for ongoing hardware or software upgrades or medical support similarly reduce the autonomy of those agents.[124] On the other hand, technologies that allow human agents to survive and operate in hostile environments or to reduce or repair physical damage to their bodies would enhance such agents' autonomy.

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[122] On the possibility that efforts to ascertain the levels of intelligence or consciousness of artificial entities might be distorted by human beings' anthropomorphizing biases, see Yampolskiy & Fox, "Artificial General Intelligence and the Human Mental Model" (2012), pp. 130-31. On the distinction between intelligence, consciousness, and personhood in such a context, see, e.g., Proudfoot (2012), pp. 375-76. For a broader discussion of such issues, see, e.g., *The Turing Test: The Elusive Standard of Artificial Intelligence*, edited by Moor (2003).

[123] See Gladden, "Utopias and Dystopias as Cybernetic Information Systems" (2015).

[124] See Gladden, "Neural Implants as Gateways to Digital-Physical Ecosystems and Posthuman Socioeconomic Interaction" (2016).

The development of synthetic systems that possess human-like levels of artificial general intelligence would result in the appearance of artificial agents that do not function autonomously with regard to carrying out some specific task that they are expected to perform but which function autonomously at a more general level in deciding their own aims, aspirations, and strategies.[125] The development of robots that can obtain energy from their environment, for example, by consuming the same kinds of foods that are edible for human beings[126] or which possess biological components that can heal wounds that they have suffered will also result in artificial agents with increased autonomy.

c. Volitionality

Researchers have already observed ways in which certain kinds of neuroprosthetic devices and medications can affect their human host's capacity to possess desires, knowledge, and belief;[127] insofar as technologies disrupt or control such abilities, they may impair their human host's exercise of his or her conscience, which depends on the possession of these capacities. This may result in the existence of human agents that are no longer fully metavolitional but instead merely volitional or nonvolitional.[128] The use of neuroprosthetics, virtual reality, and other technologies to create hive minds and other forms of collective consciousness among human agents may also impair the volitionality of human agents participating in such systems and reduce them to a state that is less than metavolitional; each agent may no longer possess its own individual conscience but instead help to form (and be guided by) the conscience of the multi-agent system as a whole.

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[125] See, e.g., Yampolskiy & Fox (2012).

[126] See, e.g., the discussion of artificial digestive systems in Friedenberg (2008), p. 214-15.

[127] Regarding the possibility of developing neuroprosthetics that affect emotions and perceptions of personal identity and authenticity, see Soussou & Berger, "Cognitive and Emotional Neuroprostheses" (2008); Hatfield et al., "Brain Processes and Neurofeedback for Performance Enhancement of Precision Motor Behavior" (2009); Kraemer, "Me, Myself and My Brain Implant: Deep Brain Stimulation Raises Questions of Personal Authenticity and Alienation" (2011); Van den Berg, "Pieces of Me: On Identity and Information and Communications Technology Implants" (2012); McGee (2008), p. 217; and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 26-27.

[128] For a discussion of different levels of volitionality, see Gladden, "The Diffuse Intelligent Other" (2016).

Meanwhile, advances toward the development of human-like artificial general intelligence point at the eventual creation of artificial agents that possess a capacity for knowledge, belief, personal desires, and self-reflexive thought – in short, the components necessary for an entity to be metavolitional and to possess a conscience.[129] The existence of conscience within artificial agents would have significant ramifications for the ways in which such agents could possibly be employed by organizations. Organizations that have metavolitional artificial agents as employees or customers could motivate them to act in certain ways by appealing to their conscience – to their sense of morality, justice, mercy, and the common good. At the same time, metavolitional artificial agents serving as employees within organizations could not be expected to automatically carry out instructions that have been given to them without first weighing them against the demands of their conscience. In the case of metavolitional artificial agents serving in roles that have a critical impact on human safety (e.g., robots serving as soldiers, police officers, surgeons, or the pilots of passenger vehicles) this could have positive or negative consequences.[130] For example, a robotic police officer who had been given an illegal and immoral command by its corrupt human supervisor to conceal evidence might decide to ignore that command as a result of its conscience; on the other hand, a robotic soldier could be manipulated by skilled 'conscience hackers' belonging to an opposing army who present the robot with fabricated evidence of atrocities that appeal to known weaknesses or bugs within the robot's metavolitional mechanisms and which persuade the robot to desert its post and join that opposing army.

D. Knowledge Acquisition

The use of genetic engineering to alter the basic cognitive structures and processes of human agents and, especially, the use of neuroprosthetic devices to monitor, control, or bypass the natural cognitive activity of a human agent may result in agents that do not need to be trained or educated but which can simply be 'programmed' to perform certain tasks or even remotely controlled by external systems to guide them in the performance of those tasks.[131]

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[129] See Calverley (2008) and Gladden, "The Diffuse Intelligent Other" (2016), for an explanation of the relationship of various cognitive capacities to the possession of second-order volitions (or metavolitions) on the part of artificially intelligent entities.

[130] Regarding the moral and practical implications of the possession of a conscience by artificial agents such as robots, see Wallach & Allen (2008).

[131] Regarding the 'programming' of human beings through the intentional, targeted modification of

At the same time, there will be growing numbers and kinds of artificial agents that cannot simply be 'programmed' to carry out particular tasks in the manner of earlier conventional computers but which must be trained, educated, and allowed to learn through trial and error and firsthand interaction with and exploration of their world.[132]

e. Information-processing Locus

Increasingly the information processing performed by and within a human agent may occur not within the physical neural network that comprises natural biological neurons in the agent's brain but in other electronic or biological substrates, including neuroprosthetic devices and implantable computers that utilize traditional CPU-based technologies.[133]

Meanwhile, artificial agents' information processing may increasingly be performed within electronic or biological physical neural networks that do not rely on conventional CPU-based computing architectures, which do not possess a traditional operating system or the ability to run standard executable software programs, and which may be immune to many traditional electronic hacking techniques.[134]

f. Emotionality

The use of advanced neuroprosthetic devices that can heighten, suppress, or otherwise modify the emotions of human beings may result in populations of human agents whose programmatically controlled emotional behavior – or lack of emotional behavior – more closely resembles the functioning of computers than that of natural human beings.[135]

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their memories and knowledge, see, e.g., McGee (2008); Pearce (2012); and Spohrer, "NBICS (Nano-Bio-Info-Cogno-Socio) Convergence to Improve Human Performance: Opportunities and Challenges" (2002). Regarding the remote control of human bodies by external systems, see Gladden, "Neural Implants as Gateways" (2016), and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015).

[132] See, e.g., Friedenberg (2008), pp. 55-72, 147-200; Haykin (2009); and Lamm & Unger (2011).

[133] See, e.g., Warwick & Gasson, "Implantable Computing" (2008), and the discussion of cognitive neuroprosthetics in Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 26-27.

[134] See, e.g., Friedenberg (2008), pp. 17-146.

[135] For the possibility of developing emotional neuroprosthetics, see Soussou & Berger (2008); Hatfield et al. (2009); Kraemer (2011); and McGee (2008), p. 217.

Meanwhile, the creation of autonomous robots with increasingly sophisticated and human-like social capacities and emotional characteristics – perhaps generated by the internal action of a complex physical neural network – may yield new types of artificial agents that cannot simply be programmed or configured to perform certain actions by their human operators but which must instead be motivated and persuaded to perform such actions through an application of psychological principles, negotiation techniques, and other practices typically employed with human beings.[136]

G. Cognitive Biases

Genetic engineering could potentially be used to create new designer types of cognitively engineered human beings whose brains do not develop cognitive biases. Alternatively, a neuroprosthetic device could be used to monitor the cognitive processes of a human mind and to alert the mind whenever the device detects that the individual is about to undertake a decision or action that is flawed or misguided because the mind's cognitive processes have been influenced by a cognitive bias; beyond directly intervening to prevent the effects of cognitive biases in this manner, such a device could potentially also train the mind over time to recognize and avoid cognitive biases on its own.[137]

Artificial agents that are patterned after human models of cognition and which display human-like levels of intelligence, emotion, sociality, and other traits may be subject to many of the same cognitive biases as human beings;[138] highly sophisticated artificial agents (e.g., superintelligences) might also suffer from their own idiosyncratic forms of cognitive biases that may be hard for their designers to recognize or anticipate.[139]

H. Memory

Genetic engineering could potentially be used to enhance or otherwise alter the natural neural mechanisms for the encoding, storage, and retrieval of memories within the brain of a human agent. The use of neuroprosthetic de-

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[136] See Friedenberg (2008), pp. 179-200.

[137] See Gladden, "Neural Implants as Gateways" (2016).

[138] Regarding the potential for emotionally driven biases in artificial intelligences, see Friedenberg (2008), pp. 180-85, 197-98.

[139] For cognitive biases, mental illnesses, and other potentially problematic psychological conditions that may be manifested by advanced AIs, see, e.g., Chapter 4, "Wireheading, Addiction, and Mental Illness in Machines," in Yampolskiy, *Artificial Superintelligence: A Futuristic Approach* (2015).

vices to control, supplement, or replace the brain's natural memory mechanisms could result in human agents that possess memory that is effectively lossless, does not degrade over time, and can be easily copied to or from external systems.[140]

At the same time, the use of biological components or physical artificial neural networks as a substrate for the cognitive processes of artificial agents could result in agents whose memories are stored in a highly compressed form that degrades unreliably over time and which makes individual memories difficult to recall, even when they are retained within the memory system.[141]

I. Predictability

Human agents whose actions are influenced or controlled by neuroprosthetic devices or whose range of possible behaviors has been constrained through genetic engineering may produce behavior that is more predictable and is easily 'debugged' in a straightforward and precise manner that has traditionally been possible only when dealing with computers.[142]

Meanwhile, artificial agents that possess human-like cognitive capacities – including emotion and sociality – may generate behavior that is difficult to reliably predict, analyze, or control, especially if the agents' cognitive processes take place within a physical neural network whose activities and current state cannot easily be determined by outside observers.[143]

J. Vulnerability to Hacking

Human agents that possess electronic neuroprosthetic devices would be vulnerable to electronic hacking attempts similar to those employed against

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[140] Regarding genetic and neuroprosthetic technologies for memory alteration in biological organisms, see Han et al., "Selective Erasure of a Fear Memory" (2009); Josselyn, "Continuing the Search for the Engram: Examining the Mechanism of Fear Memories" (2010); and Ramirez et al., "Creating a False Memory in the Hippocampus" (2013). Regarding the use of neuroprosthetic systems to store memories as effectively lossless digital exograms, see Gladden, "Neural Implants as Gateways" (2016), and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 156-57.

[141] Regarding memory mechanisms for artificial agents, including those involving neural networks, see Friedenberg (2008), pp. 55-72.

[142] Regarding the testing and debugging of neuroprosthetic devices (especially in relation to information security), see Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 176-77, 181-84, 213-14, 248-19, 242-43, 262.

[143] For an overview of issues relating to the social behavior of artificial agents, see Friedenberg (2008), pp. 217-34.

conventional computers. Moreover, advanced technologies for genetic engineering and the production of customized biopharmaceuticals and biologics may allow the biohacking even of human agents that do not possess electronic neuroprosthetic components.[144]

At the same time, artificial agents that include or wholly comprise biological components rather than electronic components might thereby reduce or eliminate their vulnerability to traditional methods of electronic hacking. However, such artificial agents may be vulnerable to biohacking approaches that are based on genetic engineering or biopharmaceutical technologies as well as to psychologically based social engineering attacks.[145]

3. Social Interaction

The forms of social engagement and belonging available to human and artificial agents are expected to be transformed by the advent of posthumanizing technologies. Such change will be manifested through the possession (or absence) of a number of key characteristics, which are described below.

a. Sociality

Neuroprosthetic devices or genetic modifications that affect long-term memory processes could make it difficult or impossible for human agents to engage in friendships and other long-term social relationships with other intelligent agents. Such human agents would no longer be fully social but instead semisocial or even nonsocial.[146] Ongoing immersion in virtual worlds or neuroprosthetically enabled cybernetic networks with other human minds or other kinds of intelligent agents could potentially also lead to the atrophying or enhancement of human agents' social capacities.

At the same time, an increasing number of artificial agents may possess fully human-like sociality, including the ability to participate in long-term social relations that deepen and evolve over time as a result of the agents' experience of such engagement and which are shaped by society's expectations

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[144] Regarding the possibility of hybrid biological-electronic computer viruses and other attacks, see Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), p. 53.

[145] For a discussion of social engineering attacks, see Rao & Nayak (2014), pp. 307-23, and Sasse et al., "Transforming the 'weakest link'—a human/computer interaction approach to usable and effective security" (2001).

[146] For ways of describing and classifying degrees of sociality of artificial entities, see Vinciarelli et al. (2012) and Gladden, "Managerial Robotics" (2014).

for the social roles to be filled by the relations' participants. This would potentially allow artificial agents to serve as charismatic leaders of human beings who guide and manage the activities of their followers not through threats or intimidation but by inspiring or seducing them.[147]

B. Culture

Human agents whose thoughts, dreams, and aspirations have been attenuated or even eliminated or whose physical sensorimotor systems are controlled through the use of genetic engineering, neuroprosthetic devices, or other advanced technologies may no longer possess a desire or ability to perceive or generate cultural artifacts. If a single centralized system (e.g., a server providing a shared virtual reality experience to large numbers of individuals) maintains and controls all of the sensorimotor channels through which human agents are able to create and experience culture, then that automated system may generate all of the aspects of culture within that virtual world, without the human agents who dwell in that world being able to contribute meaningfully to the process.[148]

Artificial agents already play important roles in supporting the creation, maintenance, and dissemination of human culture(s), and some artificial agents are already capable of acting autonomously to generate works of art, poetry, music, content for computer games, webpages, Internet memes, and other kinds of cultural artifacts.[149] It is expected that in the future, artificial agents will not only play a role in contributing to predominantly human cultures or act in symbiosis with human agents to create hybrid human-artificial cultures that are truly shared; they will also create among themselves entirely new synthetic cultures whose art, music, architecture, literature, philosophy, and way of life could never have been developed by human beings (and perhaps cannot even be observed or comprehended by human beings), due to

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[147] See Gladden, "The Social Robot as 'Charismatic Leader': A Phenomenology of Human Submission to Nonhuman Power" (2014). For an exploration of the potential social behavior of advanced artificial agents, see Friedenberg (2008), pp. 217-34.

[148] Regarding the possibilities of a centralized computerized system shaping culture by mediating and influencing or controlling the communications among neuroprosthetically enabled human minds, see Gladden, "Utopias and Dystopias as Cybernetic Information Systems" (2015), and Gladden, "From Stand Alone Complexes to Memetic Warfare: Cultural Cybernetics and the Engineering of Posthuman Popular Culture" (2016).

[149] See Friedenberg (2008), pp. 127-46, and Gladden, "From Stand Alone Complexes to Memetic Warfare" (2016).

the physical and cognitive differences between human agents and the artificial agents that create such cultures.[150]

C. Spirituality

Researchers have raised concerns that the use of neuroprosthetic devices to replace or dramatically alter the structures and activities of the body and mind of human agents may result in the loss of those fundamental characteristics that make such agents human. While this can be analyzed from purely biological and psychological perspectives,[151] it may alternatively be understood from philosophical and theological perspectives as a dissolution of the 'soul' or 'essence' of such human agents.[152] The use of genetic engineering in transhumanist efforts to design beings that possess superior (and even transcendent) intelligence and morality raises similarly significant questions about the nature of humanity and future human beings.

At the same time, artificial agents that possess sufficiently sophisticated and human-like cognitive capacities may be subject to instinctive desires to seek out and experience some transcendent truth and reality and may engage in behaviors such as meditation, contemplation, and even prayer.[153]

D. Political Engagement

Human agents that have been neuroprosthetically augmented may form social and technological networks that demonstrate new kinds of network topologies and may engage in new forms of cybernetic relations with similarly augmented human agents and with artificial entities; such human agents may dwell (virtually, if not physically) in societies in which traditional human political systems and structures are not meaningful or relevant.[154] Such human agents may find themselves disconnected from political life and

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[150] See Payr & Trappl (2003); regarding the creation of hybrid human-artificial cultures in an organizational setting, see Gladden, "Leveraging the Cross-Cultural Capacities of Artificial Agents as Leaders of Human Virtual Teams" (2014). For a philosophical analysis of digital-physical ecosystems in which human and artificial agents may interact symbiotically to generate shared cognitive and cultural artifacts (and in which such artifacts may even exist as actors that can propagate themselves), see, e.g., Kowalewska, "Symbionts and Parasites – Digital Ecosystems" (2016).

[151] For a discussion of, e.g., the psychological impact of neuroprosthetic devices upon a user's perceptions of authenticity and identity, see Kraemer (2011) and Van den Berg (2012).

[152] E.g., see Gladden, "'Upgrading' the Human Entity" (2015).

[153] For a discussion of such possibilities, see Kurzweil (2000).

[154] Regarding the possible fragmentation of human societies as a result of posthuman neuroprosthetics, see Gladden, "Utopias and Dystopias as Cybernetic Information Systems" (2015); McGee (2008), pp. 214-16; Warwick (2014), p. 271; Rubin (2008); Koops & Leenes, "Cheating with Implants: Implications of the Hidden Information Advantage of Bionic Ears and Eyes" (2012), p. 127; and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), 166-67.

institutions of the 'real' world and instead immerse themselves in new kinds of structures that might resemble traditional computer networks more than political systems.

At the same time, artificial agents that possess intelligence and sociality that are human-like (or which surpass the capacities of human beings) may create political systems and structures to govern their relations with one another or may seek to participate in human political systems.[155]

e. Economic Engagement

The adoption of posthumanizing technologies may weaken the ability of human beings to serve as autonomous economic actors. Depending on the precise terms under which such components were acquired, a human agent whose body has been subject to extensive neuroprosthetic augmentation and is largely composed of electronic components may not even 'own' its own body or the products generated by that body, including intellectual property such as thoughts and memories. Such a human agent may for practical purposes be wholly dependent on and economically subjugated to the corporation(s), government agencies, or other institutions that provide maintenance services for its synthetic components and legally or practically barred from purchasing goods or services from competing enterprises.[156] The use of neuroprosthetic devices or other technologies that directly affect a human agent's cognitive processes may also impair that agent's ability to make free choices as an autonomous economic actor.

Conversely, artificial agents may gain new abilities to function as independent economic actors. Some forms of artificial life may be able to function as autonomous organism-enterprises that acquire resources from within the digital-physical ecosystem shared with human beings, process the resources to generate goods and services, and then exchange those goods and services with human beings or other artificial agents to generate revenue, including profit that the artificial life-form can use for purposes of growth, reproduction, or risk management.[157] Such artificial life-forms could compete directly

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[155] For the possibility of social robots exercising referent power or charismatic authority within human social or political institutions, see Gladden, "The Social Robot as 'Charismatic Leader'" (2014).

[156] See Gladden, "Neural Implants as Gateways" (2016), and Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015).

[157] For an approach to modelling entrepreneurship on the part of artificial agents, see Ihrig, "Simulating Entrepreneurial Opportunity Recognition Processes: An Agent-Based and Knowledge-Driven Approach" (2012). For an innovative exploration of the possibility of creating fully autonomous systems for entrepreneurship, see Rijntjes, "On the Viability of Automated Entrepreneurship" (2016). See also Gladden, "The Artificial Life-Form as Entrepreneur" (2014).

with human enterprises within the real-world economy or offer new kinds of goods and services that human agents are incapable of offering.

f. Legal Status

Human agents that have been intentionally engineered by other human beings or organizations (e.g., biological clones or custom-designed human beings) may be subject to claims that they are not full-fledged legal persons but rather wards or even property of those who have created them – especially if the agents have been engineered to possess characteristics that clearly distinguish them from 'normal' human beings.[158]

Conversely, sufficiently sophisticated artificial agents that possess human-like cognitive capacities or biological components may not be considered inanimate objects or property from a legal perspective but either moral patients possessing rights that must be protected or even moral subjects that can be held legally responsible for their own actions.[159]

B. The Four Types of Beings Relevant for Technologically Posthumanized Organizations

The only two quadrants of the Posthuman Management Matrix that have historically been considered relevant objects for management scholarship and practice are those of natural human beings and, more recently, computers. However, the advent of new posthumanizing technologies will create a variety of entities that fall within the remaining two quadrants and which can serve as potential employees, partners, and customers for businesses and other organizations. This will require the field of management to directly address those two quadrants – to create theoretical frameworks for understanding the activities and organizational potential of such entities and to develop new practices for managing them. Figure 3 reflects the fact that during the dawning Posthuman Age, all four quadrants of the Matrix will at last be relevant for management.

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[158] See, e.g., Cesaroni, "Designer Human Embryos as a Challenge for Patent Law and Regulation" (2012); Pereira, "Intellectual Property and Medical Biotechnologies" (2013); Bera, "Synthetic Biology and Intellectual Property Rights" (2015); Camenzind, "On Clone as Genetic Copy: Critique of a Metaphor" (2015); Section B ("Enhancement") and Section D ("Synthetic Biology and Chimera") in *The Future of Bioethics: International Dialogues*, edited by Akabayashi (2014); and Singh, *Biotechnology and Intellectual Property Rights: Legal and Social Implications* (2014). For perspectives on the ways in which such issues have been explored within fiction, see, e.g., Pérez, "Sympathy for the Clone: (Post) Human Identities Enhanced by the 'Evil Science' Construct and its Commodifying Practices in Contemporary Clone Fiction" (2014).

[159] Regarding such questions see, e.g., Wallach & Allen (2008) and Calverley (2008).

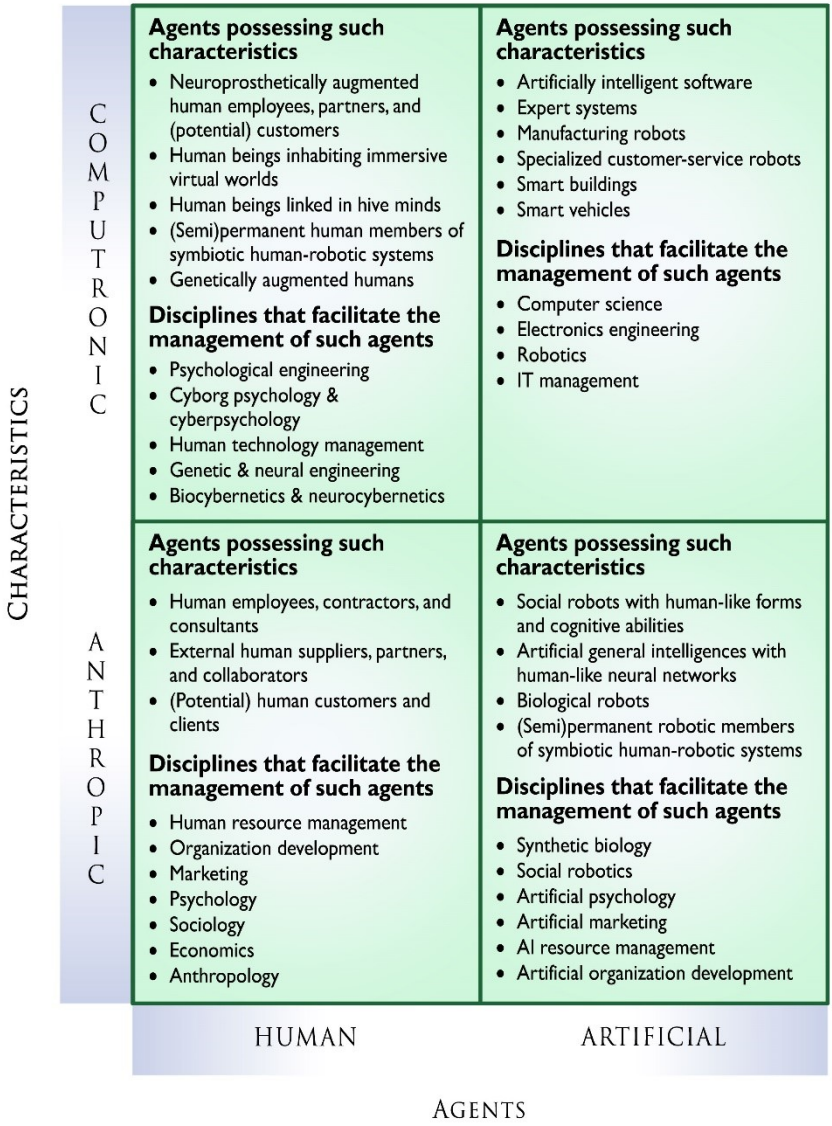

Fig. 3: The Posthuman Management Matrix displaying the two types of entities (in the lower left and upper right quadrants) that have long been relevant for the theory and practice of organizational management, joined by two types of entities (in the upper left and lower right quadrants) that are becoming newly relevant in the dawning Posthuman Age.

We can now consider in more detail the future roles that all four types of entities may play for future posthumanized organizations, along with the academic disciplines and practical bodies of knowledge that can contribute to their effective management.

1. 'Natural' Human Beings

At least during the early stages of the emerging Posthuman Age, human agents with anthropic characteristics will remain the key leaders and decision-makers within businesses and other organizations. This will not necessarily be due to the fact that such 'natural' human beings are more capable than artificial agents or technologically modified human beings when it comes to performing the actions involved with managing others; it will instead likely be due to legal, political, and cultural considerations. For example, even after sufficiently sophisticated social robots have been developed that are capable of serving effectively as CEOs of businesses, it may take many years before the ethical and political questions surrounding such practices have been resolved to the point that human legislators and regulators allow the human businesses and other institutions that are subject to their oversight to legally employ such artificial agents as CEOs.[160]

It appears likely that human agents that possess at least limited computronic characteristics will achieve positions of formal leadership within organizations before artificial agents accomplish that feat. This can be anticipated due to the fact that current law and cultural tradition already allow human beings to fill such roles: while existing laws would generally need to be explicitly changed in order to *allow* artificial agents to serve, for example, as CEOs of publically traded corporations, those same laws would need to be explicitly changed in order to *bar* human agents who possess computronic characteristics from filling such roles. Indeed, declining to offer a human being a position as an executive within a business because he or she possesses a pacemaker, defibrillator, cochlear implant, robotic artificial limb, or other device that endows him or her with limited computronic characteristics would, in many cases, be considered a form of unlawful employment discrimination, and even simply attempting to ascertain whether a potential employee possesses such traits could in itself be illicit.[161]

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[160] The question arises of whether such artificial agents will voluntarily allow themselves to be subject to human laws or will instead seek to formulate their own.

[161] See Gladden, *The Handbook of Information Security for Advanced Neuroprosthetics* (2015), pp. 93-94.

Although human agents who possess extensive computronic characteristics and artificial agents are expected to gradually fill a broader range of positions within organizations, there will likely remain a number of professions or specific jobs which – at least in the early stages of the Posthuman Age – can only be filled by natural, unmodified human agents.[162] For example, some positions within the military, police forces, or intelligence services may initially be restricted to natural human beings, in order to avoid the possibility of external adversaries hacking the minds or bodies of such agents and gaining control of them and the information that they possess. Roles as judges, arbitrators, and regulators might be restricted to natural human beings on ethical grounds, to ensure that such officials' decisions are being made on the basis of human wisdom, understanding, and conscience (including the *known biases* of the human mind), rather than executed by software programs that might possess unknown bugs or biases or be surreptitiously manipulated. Some roles – such as those of priest, therapist, poet, or existentialist philosopher – might as a practical matter be restricted to natural human beings, because the work performed by persons in such positions is considered to derive unique value from the fact that it is performed by a human being rather than a machine.

The adoption of posthumanizing technologies across the world will likely be highly uneven, as differences in economic resources and systems, political systems, and philosophical, religious, and cultural traditions combine in unique ways in different parts of the world to either spur or restrain the adoption of such technologies. The role of natural human beings as workers and consumers may maintain greater importance in some regions and industries than in others. Wherever such beings fill places as workers or consumers, the traditional disciplines of psychology, sociology, economics, anthropology, cultural studies, marketing, organization development, HR management, and ergonomics will continue to be relevant for theorists and practitioners of organizational management.

2. Computers

It is expected that artificial agents with computronic characteristics will continue to play a fundamental – and ever-growing – role as backbone elements within the increasingly ubiquitous networked systems that constitute

[162] See Gladden, "Neural Implants as Gateways" (2016).

the digital-physical infrastructure within which human beings will dwell. Artificial systems that can be quickly and reliably programmed to perform certain tasks without any worry that a system might become bored or annoyed or object to its assigned tasks on moral grounds will remain highly useful and desirable.[163]

Although the theory and practice used to design, implement, and manage such systems will likely continue to evolve rapidly, even during the near-future Posthuman Age such disciplines will likely be recognizable as heirs of our contemporary fields of computer science, electronics engineering, robotics, and IT management.

3. Cyborgs

As described in earlier sections, the increasing use of neuroprosthetic enhancement, genetic engineering, and other posthumanizing technologies is expected to result in a growing number of human agents that no longer possess the full suite of traditional anthropic characteristics but instead reflect some degree of computronic characteristics. Such agents might include human employees or customers whose artificial sense organs or limbs mediate their experience of their physical environment;[164] human beings who never physically leave their bedroom but instead engage with the world through long-term immersion in virtual worlds and digital ecosystems;[165] groups of

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[163] One can consider, for example, the case of autonomous military robots. Serious efforts have been undertaken to create morally aware autonomous military robots that can be programmed with a knowledge of and obedience to relevant national and international legal obligations governing the conduct of war, as well as a knowledge of relevant ethical principles and even a 'conscience' that allows a robot to assimilate all available information, evaluate the propriety of various courses of action, and select an optimal ethically and legally permissible course of action. However, scholars have noted the possibility for cynical manipulation of such technologies – e.g., perhaps the creation of robots who possess a 'conscience' that is sufficiently developed to reassure the public about the ethicality of such devices while not being restrictive or powerful enough to actually block the robot from performing any activities desired by its human overseers. See Sharkey, "Killing Made Easy: From Joysticks to Politics" (2012), pp. 121-22. On the other hand, if a robot's conscience is such that the robot becomes a conscientious objector and refuses to participate in any military actions at all, then the robot becomes operationally useless from the perspective of its intended purpose.

[164] For discussions of particular types of neuroprosthetic mediation of sensory experience of one's environment, see, e.g., Ochsner et al., "Human, non-human, and beyond: cochlear implants in socio-technological environments" (2015), and Stiles & Shimojo, "Sensory substitution: A new perceptual experience" (2016). On ways in which the absence of mediation transforms teleoperation into telepresence in the case of noninvasive brain-computer interfaces, see Salvini et al., "From robotic tele-operation to tele-presence through natural interfaces" (2006).

[165] Regarding the implications of long-term immersion in virtual reality environments, see, e.g., Bainbridge, *The Virtual Future* (2011); Heim, *The Metaphysics of Virtual Reality* (1993); Geraci,

human beings whose minds are neuroprosthetically linked to create a hive mind with a collective consciousness;[166] human beings who are temporarily or permanently joined in symbiotic relationships with robotic exoskeletons,[167] companions,[168] or supervisors;[169] or genetically augmented human beings whose physical structures and cognitive capacities have been intentionally

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Apocalyptic AI: Visions of Heaven in Robotics, Artificial Intelligence, and Virtual Reality (2010); and Koltko-Rivera, "The potential societal impact of virtual reality" (2005). Regarding psychological, social, and political questions relating to repetitive long-term inhabitation of virtual worlds through a digital avatar, see, e.g., Castronova, "Theory of the Avatar" (2003). On the risks of potentially 'toxic immersion' in a virtual world, see Castronova, *Synthetic Worlds: The Business and Culture of Online Games* (2005). On implantable systems for augmented or virtual reality, see Sandor et al., "Breaking the Barriers to True Augmented Reality" (2015), pp. 5-6. For a conceptual analysis of the interconnection between physical and virtual reality and different ways in which beings and objects can move between these worlds, see Kedzior, "How Digital Worlds Become Material: An Ethnographic and Netnographic Investigation in Second Life" (2014).

[166] Regarding the possibility of hive minds, see, e.g., McIntosh, "The Transhuman Security Dilemma" (2010), and Gladden, "Utopias and Dystopias as Cybernetic Information Systems" (2015). For more detailed taxonomies and classification systems for different kinds of potential hive minds, see Chapter 2, "Hive Mind," in Kelly, *Out of control: the new biology of machines, social systems and the economic world* (1994); Kelly, "A Taxonomy of Minds" (2007); Kelly, "The Landscape of Possible Intelligences" (2008); Yonck, "Toward a standard metric of machine intelligence" (2012); and Yampolskiy, "The Universe of Minds" (2014). For the idea of systems whose behavior resembles that of a hive mind but without a centralized controller, see Roden, *Posthuman Life: Philosophy at the Edge of the Human* (2014), p. 39. For critical perspectives on the idea of hive minds, see, e.g., Bendle, "Teleportation, cyborgs and the posthuman ideology" (2002), and Heylighen, "The Global Brain as a New Utopia" (2002). Regarding the need for society to debate the appropriateness of neuroprosthetic technologies that facilitate hive minds, see Maguire & McGee, "Implantable brain chips? Time for debate" (1999).

[167] For examples of such systems currently under development, see *Wearable Robots: Biomechatronic Exoskeletons*, edited by Pons (2008); Guizzo & Goldstein, "The rise of the body bots [robotic exoskeletons]" (2005); and Contreras-Vidal & Grossman, "NeuroRex: A clinical neural interface roadmap for EEG-based brain machine interfaces to a lower body robotic exoskeleton" (2013). For a discussion of the extent to which the form of an exoskeleton can differ from that of the human body before it becomes impossible for its human operator to interface with the exoskeleton, see Gladden, "Cybershells, Shapeshifting, and Neuroprosthetics" (2015).

[168] See Dautenhahn, "Robots we like to live with?! - A Developmental Perspective on a Personalized, Life-long Robot Companion" (2004); Van Oost and Reed, "Towards a Sociological Understanding of Robots as Companions" (2011); Shaw-Garlock, "Loving machines: Theorizing human and sociable-technology interaction" (2011); Whitby, "Do You Want a Robot Lover? The Ethics of Caring Technologies" (2012); and *Social Robots and the Future of Social Relations*, edited by Seibt et al. (2014).

[169] See, e.g., Samani & Cheok, "From human-robot relationship to robot-based leadership" (2011); Samani et al., "Towards robotics leadership: An analysis of leadership characteristics and the roles robots will inherit in future human society" (2012); Gladden, "Leveraging the Cross-Cultural Capacities of Artificial Agents" (2014); and Gladden, "The Social Robot as 'Charismatic Leader'" (2014).

engineered to make them especially well-suited (or poorly suited) to perform particular roles within society.[170]

Because such technological modification may dramatically affect human agents' physical and cognitive traits, their behavior can no longer be understood, predicted, or managed simply by relying on historical disciplines such as psychology, sociology, or HR management. Established and evolving fields such as genetic engineering, neural engineering, neurocybernetics, and biocybernetics will offer resources for management theorists and practitioners who must account for the existence and activity of such agents. However, it is likely that entirely new disciplines will arise – and will need to arise – in order to fill the conceptual and practical gaps that exist between those structures and dynamics that will be manifested by cyborgs and those that are addressed by existing disciplines. In particular, new disciplines may study and manage computronic human agents using many of the same techniques that have previously been employed with artificial agents. Such hypothetical new fields might include disciplines such as:

- **Psychological engineering**, which would apply practices from fields like electronics engineering to the design of a human psyche.[171] It might involve the use of genetic engineering and gene therapy, neuroprosthetic devices, immersive virtual reality, and other technologies to create and maintain human beings who possess particular (and potentially non-natural) cognitive structures, processes, and behaviors.
- **Cyborg psychology** and **cyberpsychology**, which would apply the knowledge and methods of traditional psychology to understand the cognitive

[170] Regarding such possibilities, see *Converging Technologies for Improving Human Performance: Nanotechnology, Biotechnology, Information Technology and Cognitive Science*, edited by Bainbridge (2003); Canton (2004), pp. 186-98; and Khushf, "The use of emergent technologies for enhancing human performance: Are we prepared to address the ethical and policy issues" (2005).

[171] For earlier uses of the term 'psychological engineering' in different contexts, see, e.g., Doyle, "Big problems for artificial intelligence" (1988), p. 22, which employs the term in the context of artificial intelligence, with psychological engineering's goal being "parallel to the aim of any engineering field, namely to find economical designs for implementing or mechanizing agents with specified capacities or behaviors," and Yagi, "Engineering psychophysiology in Japan" (2000), p. 361, which defines psychological engineering to be "engineering relating to human psychological activities" and include themes such as "the development of new systems between the human mind and machines" that yield not only convenience but comfort, "the development of the technology to measure psychological effects in industrial settings," and "the development of new types of human-machine systems incorporating concepts and procedures utilizing virtual reality."

structures and processes of human beings whose psychology is atypical as a result of neuroprosthetic augmentation, long-term immersion in virtual reality environments, or other factors.[172] Subdisciplines might include cyberpathology,[173] for example.

- **Human technology management** (or 'anthropotech management'[174]), which would apply the knowledge and practices of traditional IT management to the management of organizational resources (e.g., human employees) whose neuroprosthetic or genetic augmentation or intimate cybernetic integration with computerized systems at a structural or behavioral level allows them to be managed in ways similar to those utilized with traditional IT assets.

4. Bioroids

As described in earlier sections, organizations will increasingly need to deal with the existence of artificial agents that possess anthropic characteristics as both potential workers and consumers of the goods and services that organizations produce. Such bioroids might include social robots that resemble human beings in their physical form and cognitive capacities,[175] artificial

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[172] For other use of the term 'cyborg psychology,' see, e.g., Plowright, "Neurocomputing: some possible implications for human-machine interfaces" (1996). For earlier use of the term 'cyberpsychology' in various contexts, see, e.g., *Cyberpsychology*, edited by Gordo-López & Parker (1999); Riva & Galimberti. *Towards CyberPsychology: Mind, Cognition, and Society in the Internet Age* (2001); *Cyberpsychology: Journal of Psychosocial Research*, founded in 2007; and Norman, *Cyberpsychology: An Introduction to Human-Computer Interaction* (2008).

[173] See, e.g., Chapter 4, "Wireheading, Addiction, and Mental Illness in Machines," in Yampolskiy, *Artificial Superintelligence: A Futuristic Approach* (2015).

[174] For the use of such terminology, see, e.g., the Anthropotech project of the University of the West of England and University of Bristol that has studied the philosophical and ethical implications of "*Anthropotech*: the technological alteration of the body for the purpose of augmenting existing capacities, introducing new ones, or aesthetically improving the body" and which has drawn its inspiration explicitly from Jérôme Goffette's *Naissance de l'anthropotechnie: De la médecine au modelage de l'humain* (2006). See "Anthropotech" (2013).

[175] For an overview of different perspectives on social robots that behaviorally resemble and can interact with human beings, see, e.g., Breazeal (2003); Gockley et al., "Designing Robots for Long-Term Social Interaction" (2005); Kanda & Ishiguro (2013); *Social Robots and the Future of Social Relations*, edited by Seibt et al. (2014); *Social Robots from a Human Perspective*, edited by Vincent et al. (2015); and *Social Robots: Boundaries, Potential, Challenges*, edited by Marco Nørskov (2016).

general intelligences[176] that process information using complex physical neural networks rather than CPU-based platforms,[177] robots possessing biological components,[178] and robots that exist in permanent symbiosis with human agents to whom they serve as bodies, colleagues, or guides.[179]

The physical forms and processes, cognitive capacities, and social engagement of such bioroids will likely differ in their underlying structures and dynamics from those of human beings, no matter how closely they outwardly resemble them. Thus traditional human-focused disciplines such as psychology, economics, and HR management cannot be applied directly and without modification to analyze, predict, or manage the behavior of bioroids. On the other hand, traditional disciplines such as computer science, electronics engineering, and IT management will not in themselves prove adequate for shaping the behavior of such unique anthropic artificial agents.

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[176] Regarding challenges inherent in the development of artificial general intelligence and potential paths toward that objective, see, e.g., *Artificial General Intelligence*, edited by Goertzel & Pennachin (2007); *Theoretical Foundations of Artificial General Intelligence*, edited by Wang & Goertzel (2012); and *Artificial General Intelligence: 8th International Conference, AGI 2015: Berlin, Germany, July 22-25, 2015: Proceedings*, edited by Bieger et al. (2015).

[177] Regarding AIs that utilize physical neural networks, see, e.g., Snider (2008); Versace & Chandler (2010); and *Advances in Neuromorphic Memristor Science and Applications*, edited by Kozma et al. (2012). For a discussion of such technologies from the perspective of information security, see Pino & Kott, "Neuromorphic Computing for Cognitive Augmentation in Cyber Defense" (2014), and Lohn et al., "Memristors as Synapses in Artificial Neural Networks: Biomimicry Beyond Weight Change" (2014).

[178] See, e.g., Ummat et al. (2005); Andrianantoandro et al. (2006); Lamm & Unger (2011); Cheng & Lu (2012); and Kawano et al., "Finding and defining the natural automata acting in living plants: Toward the synthetic biology for robotics and informatics in vivo" (2012).

[179] Regarding robots that exist in symbiotic relationships with human beings as their physical bodies (i.e., constituting a cyborg), see, e.g., Tomas, "Feedback and Cybernetics: Reimaging the Body in the Age of the Cyborg" (1995); Clark, *Natural-born cyborgs: Minds, Technologies, and the Future of Human Intelligence* (2004); and Anderson "Augmentation, symbiosis, transcendence: technology and the future(s) of human identity" (2003). For discussions of robots serving as colleagues to human workers, see, e.g., Ablett et al., "A Robotic Colleague for Facilitating Collaborative Software Development" (2006); Vänni and Korpela, "Role of Social Robotics in Supporting Employees and Advancing Productivity" (2015); and Gladden, "Leveraging the Cross-Cultural Capacities of Artificial Agents" (2014). For a notable early allusion to the possibility of robotic colleagues, see Thompson (1976). For robotic systems that serve as 'guides' to human beings in a very practical and functional sense, see, e.g., Chella et al., "A BCI teleoperated museum robotic guide" (2009), and Vogiatzis et al., "A conversant robotic guide to art collections" (2008). For robots that serve as charismatic leaders (and perhaps even spiritual guides) for human beings, see Gladden, "The Social Robot as 'Charismatic Leader'" (2014).

Emerging fields such as synthetic biology and social robotics provide a starting point for the development and management of bioroids. As researchers attempt to create new theoretical and practical frameworks for managing such agents, we might expect to witness the development of new fields that study and manage artificial agents utilizing approaches that have traditionally been applied to human agents; these new fields might include disciplines like:

- **Artificial psychology**, which is already being formulated as a discipline[180] and which applies the extensive knowledge and techniques developed through the academic study of human psychology to understanding, designing, and controlling the psychology of synthetic beings such as artificial general intelligences or social robots.
- **Artificial marketing**, which would address the design, production, sale, and distribution of goods and services targeted at consumers who are not human beings but artificial entities.
- **AI resource management**, which would deal with the management of artificial entities within an organizational context not as though they were conventional IT assets like desktop computers but as human-like employees, drawing on the knowledge and practices developed in the field of human resource management.
- **Artificial organization development**, which would seek to bring about long-term systemic improvements in the performance of organizations whose members are synthetic entities – not by directly reprogramming them or updating their software but through the use of intervention techniques such as coaching and mentoring, surveys, team-building exercises, changes to workplace culture, and the design of strategic plans and incentive structures. This would adapt the explicitly 'humanistic' approaches of the existing field of organization development to serve new constituencies of nonhuman agents.[181]

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[180] Friedenberg has introduced the concept of 'artificial psychology' as a new branch of psychology that addresses the cognitive behavior of synthetic agents; see Friedenberg (2008). 'Artificial psychology' is not simply a form of computer programming or IT management. It is psychology: just as complex and mysterious a discipline as when directed to the cognitive structures and processes of human beings, except that in this case it is directed to the cognitive structures and processes of robots or AIs.

[181] Regarding the goals and practices of organization development, see, e.g., Anderson, *Organization Development: The Process of Leading Organizational Change* (2015), and Bradford & Burke, *Reinventing Organization Development: New Approaches to Change in Organizations* (2005). For the

C. Exploring the 'Fifth Quadrant': Hybrid Agents within Hybrid Systems

While it is true that management theory and practice must be capable of separately addressing each of the four types of entities described above, within real-world organizations it will in practice be difficult to extricate one kind of entity from its relationships with those of other kinds – just as it is already difficult to consider the performance of human workers apart from the performance of the computerized technologies that they use in carrying out their tasks.

In practice, the four types of entities described above will frequently work intimately with one another, either as elements in hybrid systems that have been intentionally designed or as members of systems whose participants can voluntarily join and leave and which can include any types of agents. For example, a company might maintain a persistent virtual world in which all of its human and artificial personnel come together to work rather than meeting in a physical workplace, or a firm might operate an online marketplace in which human and artificial agents of all types are welcomed to purchase or consume the company's products and services – without the firm necessarily knowing or caring whether a particular consumer is a human or artificial agent. In such cases, the focus of an organization's management efforts is not on specific agents that participate in or constitute a system but on the management of the system as a whole.

Systems that incorporate or comprise multiple types of agents might include digital-physical ecosystems; persistent immersive virtual worlds that are home to both human and artificial inhabitants; and hybrid human-robotic hive minds, workplace teams, and multi-agent systems. Moreover, after having evolved into the Internet of Things and eventually comprising all *objects* as the 'Internet of Everything,'[182] the Internet as a whole might come to encompass all *subjects* – all sapient minds and persons – thanks to the wearable and implantable computers and neuroprosthetic devices that will increasingly serve as gateways, vehicles, and virtualizing bodies that provide their human hosts and users with a permanent link to and presence in the

humanistic foundations of organization development, see, e.g., Bradford & Burke (2005); "The International Organization Development Code of Ethics" of The OD Institute; the OD Network's "Organization and Human Systems Development Credo"; IAGP's "Ethical Guidelines and Professional Standards for Organization Development and Group Process Consultants"; and the OD Network's "Principles of OD Practice."

[182] See, e.g., Evans (2012).

world's digital-physical ecosystems. In this way, we can expect the growth of a lush, dense, complex, unruly, all-embracing digital-physical cyber-jungle that is not simply the Internet of Everything but the Internet of Everyone, the Internet of Life, the Internet of Being. Together these kinds of systems can be seen as occupying a 'fifth quadrant' that lies at the heart of the Posthuman Management Matrix and which reaches into and joins all of the other four quadrants, as reflected in Figure 4.

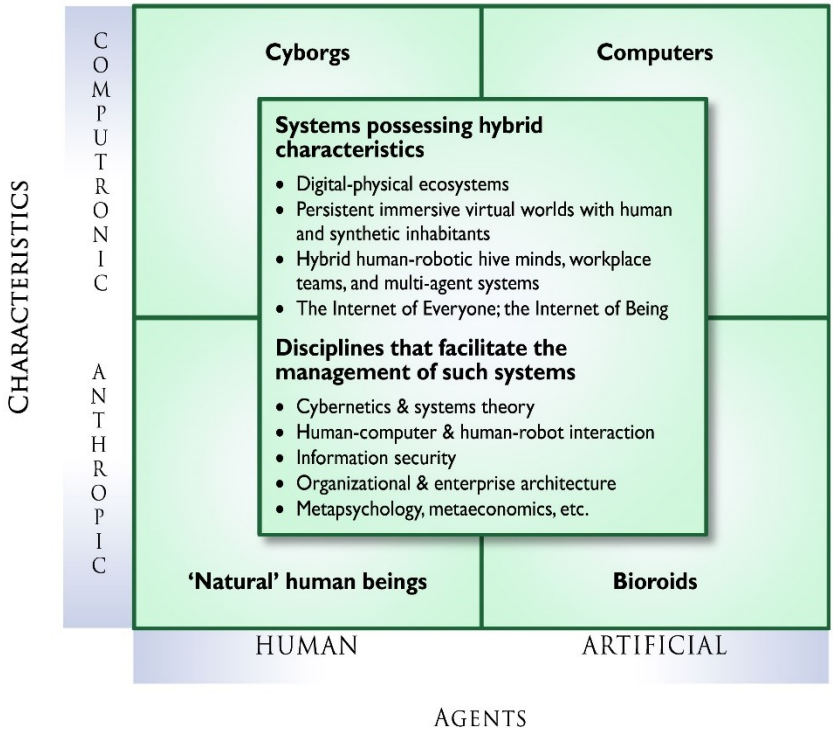

Fig. 4: The 'fifth quadrant' of the Posthuman Management Matrix, which spans and ties together all four types of entities that will be of relevance for organizational management in the Posthuman Age.

The kinds of rich and sophisticated human-artificial systems that exist within the fifth quadrant cannot be effectively managed simply by drawing insights from an array of disciplines that focus exclusively on either human agents *or* artificial agents. Instead, disciplines will be required whose theory

and practice holistically embrace both the forms and behaviors of human *and* artificial agents as well as anthropic *and* computronic characteristics and which occupy themselves with systems in which the four possible types of entities are closely integrated or even inextricably merged.

Already, existing disciplines such as cybernetics and systems theory attempt to provide a universal conceptual framework that can account for the structures and dynamics of all kinds of viable systems, whether they be human, artificial, hybrid, or of some previously unknown form. The fields of human-computer interaction, human-robot interaction, and information security focus on the characteristics of such hybrid systems in a more specialized way. Some management disciplines such as organizational architecture and enterprise architecture have the potential – if thoughtfully and creatively elaborated – to provide conceptual and practical frameworks for the development and maintenance of such hybrid human-artificial systems, although efforts to develop those disciplines in the direction of posthumanized human-artificial systems have not yet been robustly pursued.[183]

Artificial, Xeno-, and Meta- Studies

As hybrid human-robotic organizations and environments become more common, we can expect to see the development of new disciplines that attempt to understand the unique physical structures, behaviors, advantages and capacities, and weaknesses and vulnerabilities displayed by such systems. Just as 'artificial psychology' focuses on the cognitive activity of beings that are human-like in their behavior but synthetic in their construction – and 'xenopsychology' or 'exopsychology' studies the cognitive activity of agents that are radically nonhuman (e.g., hypothetical extraterrestrial intelligences) and whose behavior is not intended or expected to replicate that of

[183] For examples of some initial efforts, see, e.g., Gladden, "Leveraging the Cross-Cultural Capacities of Artificial Agents" (2014) and sources cited therein. Organizational theory may also be able to draw on contemporary work in the field of philosophy; for example, see Kowalewska (2016) for an analysis of technologically facilitated digital-physical ecosystems that draws on Actor-Network Theory (ANT) to explore the manner in which nonhuman and human actors within such ecosystems may create "hierarchies, symbioses, chains and balances" (p. 74) that do not simply resemble the structures and relations of biological ecosystems in a metaphorical sense but truly instantiate the forms and dynamics of such ecologies within a hybrid biological-synthetic system full of diverse types of actors.

human beings,[184] so the prefix 'meta-' or words such as 'post-anthropocentric,' 'agent-independent,' or 'cybernetic' might be employed to refer to efforts at developing universal conceptual frameworks that are sufficiently abstract to be able to account for the structures and dynamics found in the activities of human agents, artificial agents resembling human beings, radically nonhuman synthetic agents, and any other kinds of agents. For example, attempts to identify the essential structures and processes that must be present in any type of agent in order for it to be considered 'cognitive' – and to explore the full spectrum of ways in which those structures and processes can manifest themselves across different types of agents – could be understood alternatively as 'metapsychology,' 'post-anthropocentric psychology,' 'agent-independent psychology,' or 'psychological cybernetics.' Similarly, a term like 'metaeconomics' might be used to refer to generalized conceptual frameworks that can account equally well for the economic activity of all kinds of entities, both human and artificial.[185]

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[184] For a history of such use of 'xeno-' in both literary and scholarly contexts, see the "Preface and Acknowledgements for the First Edition" in Freitas, *Xenology: An Introduction to the Scientific Study of Extraterrestrial Life, Intelligence, and Civilization* (1979), where "[...] xenology may be defined as the scientific study of all aspects of extraterrestrial life, intelligence, and civilization. Similarly, xenobiology refers to the study of the biology of extraterrestrial lifeforms not native to Earth, xenopsychology refers to the higher mental processes of such lifeforms if they are intelligent, xenotechnology refers to the technologies they might possess, and so forth." For the use of 'exopsychology' in connection with potential extraterrestrial intelligences, see Harrison & Elms, "Psychology and the search for extraterrestrial intelligence" (1990), p. 207, where "The proposed field of exopsychology would involve the forecast, study, and interpretation of the cognitive, affective, and behavioral aspects of extraterrestrial organisms. Exopsychological research would encompass search, contact, and post-contact activities, and would include study and work with humans as well as with any extraterrestrials that might be encountered."

[185] We note that some of the terms suggested above have already been utilized by other scholars in different contexts. For example, the understanding of 'metapsychology' formulated here is different from the specialized sense in which Freud used that term; our envisioned use of the prefix 'meta-' is more closely related to the contemporary philosophical use of the term to refer to an abstracted or second-order phenomenon. Some scholars have used the prefix 'meta-' in ways that are closely aligned with our proposed use. For example, building on earlier questions posed by Kant, legal scholar Andrew Haley attempted to identify fundamental principles of law and ethics that are not specific to human biology, psychology, sociality, and culture but which would be relevant to and binding on all intelligent beings, regardless of their physical form or cognitive dynamics; such universal and legal principles could govern humanity's potential encounter with an extraterrestrial intelligence. Haley proposed 'The Great Rule of Metalaw,' which demands that all intelligent beings should "Do unto others as they would have you do unto them"; see Michaud, *Contact with Alien Civilizations: Our Hopes and Fears about Encountering Extraterrestrials* (2007), p. 374.

V. Conclusion

A transformative convergence is underway within contemporary organizations, as human workers integrate computers ever more closely into their minds and bodies and computers themselves become ever more 'human.' Such developments create both opportunities and threats that must be carefully evaluated from ethical, legal, and managerial perspectives. In order to aid with such endeavors, in this text we have formulated the Posthuman Management Matrix, a model in which an organization's employees, consumers, and other stakeholders are divided into two different kinds of agents (human and artificial) who may possess either of two sets of characteristics (anthropic or computronic), thus defining four types of entities. Until now, the only types that have been of relevance for management theory and practice were those of human agents who possess anthropic characteristics (i.e., ordinary human beings) and artificial agents that possess computronic characteristics (as exemplified by assembly-line robots or artificially intelligent software running on desktop computers).

Management theory and practice have traditionally not addressed the remaining two types of agents that are theoretically possible, largely because such agents did not exist to serve as employees or consumers for organizations. However, we have argued that ongoing advances in neuroprosthetics, genetic engineering, virtual reality, robotics, and artificial intelligence are now giving rise to new kinds of human agents that demonstrate computronic characteristics and artificial agents that possess anthropic characteristics. If organizations are to successfully resolve the complex issues that appear when such posthumanized agents are adopted as workers or customers, new spheres of management theory and practice will need to be pioneered. A starting point may be found in existing fields such as cybernetics, systems theory, organizational design, and enterprise architecture that already offer tools for integrating human and artificial agents into the multi-agent system that constitutes an organization. Such fields will likely be complemented through the development of new disciplines such as psychological engineering, cyborg psychology, human technology management, artificial organization development, AI resource management, metapsychology, and metaeconomics that are specifically intended to confront the issues that will accompany the arrival of new kinds of posthumanized agents as organizational stakeholders. Although we cannot yet know the exact paths that such developments will take, our hope is that the framework presented in this text can prove useful in highlighting the new areas that wait to be explored and in

informing the work of those management scholars and practitioners who choose to embrace that challenge.

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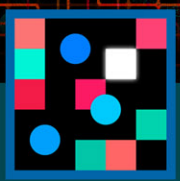
About the Author

Matthew E. Gladden is a researcher, management consultant, and executive and whose work focuses on the organizational implications of sociotechnological change resulting from emerging 'posthumanizing' technologies such as those relating to augmented reality, persistent virtual worlds, neuroprosthetic enhancement, artificial intelligence, artificial life, nanotechnology, social robotics, and genetic engineering. He lectures internationally on the relationship of posthumanizing technologies to organizational life, and his research has been published in journals such as the *International Journal of Contemporary Management*, *Informatyka Ekonomiczna*, *Creatio Fantastica*, *Frontiers in Neuroscience*, and *Annales: Ethics in Economic Life*, as well as by Routledge, IOS Press, Ashgate Publishing, the Digital Economy Lab of the University of Warsaw, and the MIT Press. He is the founder and CEO of consulting firms NeuraXenetica LLC and Cognitive Firewall LLC and previously served as Associate Director of the Woodstock Theological Center and Administrator of the Department of Psychology at Georgetown University. He has also taught philosophical ethics and worked in computer game design.

Key organizational decisions made by sapient AIs. The pressure to undergo neuroprosthetic augmentation in order to compete with genetically enhanced coworkers. A corporate headquarters that exists only in cyberspace as a persistent virtual world. A project team whose members interact socially as online avatars without knowing or caring whether fellow team members are human beings or robots.

Futurologists' visions of the dawning age of 'posthumanized' organizations range from the disquieting to the exhilarating. Which of these visions are compatible with our best current understanding of the capacities and the limits of human intelligence, physiology, and sociality? And what can posthumanist thought reveal about the forces of technologization that are transforming how we collaborate with one another – and with ever more sophisticated artificial agents and systems – to achieve shared goals?

This book develops new insights into the evolving nature of intelligent agency and collaboration by applying the post-anthropocentric and post-dualistic methodologies of posthumanism to the fields of organizational theory and management. Building on a comprehensive typology of posthumanism, an emerging 'organizational posthumanism' is described which makes sense of the dynamics of technological posthumanization that are reshaping the members, personnel structures, information systems, processes, physical and virtual spaces, and external environments available to organizations. Conceptual frameworks and analytical tools are formulated for use in diagnosing and guiding the ongoing convergence in the capacities of human and artificial actors that is being spurred by novel technologies relating to human augmentation, synthetic agency, and digital-physical ecosystems. As the first systematic investigation of these topics, this text will be of interest to scholars and students of posthumanism and management and to management practitioners who must grapple on a daily basis with the forces of technologization that are increasingly powerful drivers of organizational change.



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ISBN 9781944373214
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