

Digital Modernity

Why We Need to Think Historically About the Digital Age

JAMES SMITHIES



DIGITAL MODERNITY

This is the first systematic theorization of digital modernity, arguing that the digital age cannot be understood apart from the long historical arc of modernity.

Bridging digital humanities, critical theory, sociology, philosophy, and global history, *Digital Modernity* demonstrates that contemporary digital systems are continuations rather than ruptures of the modern project. It offers a robust conceptual framework for examining how technological infrastructures intersect with democracy, governance, colonial legacies, and the public sphere. Across nine chapters, the book moves from conceptual foundations to future-facing proposals. Topics include the cultural logic of Silicon Valley, digital colonialism, digital infrastructure, and the epistemic crisis of the digital public sphere. It also engages philosophical questions about emergence, historicism, and artificial intelligence. Drawing on applied digital humanities, the book rejects technological determinism while offering accessible accounts of computing's technical and political histories. Readers benefit from a coherent theoretical lens that integrates history with socio-technical critique, enabling a clearer understanding of digital modernity's present and future stakes.

This book is intended for scholars and students across digital humanities, media and communication studies, science and technology studies, sociology, the philosophy of technology, and modern history. Its interdisciplinary scope also supports research and teaching in software studies, critical AI, infrastructure studies, and global modernities. Suitable for advanced undergraduate and postgraduate courses, it will be especially valuable for researchers seeking to historicize digital systems while advancing critiques grounded in cultural theory, political economy, and postcolonial perspectives. By placing the digital within a longer history of modernity, the book offers both a foundational text and a springboard for further research in critical digital studies.

James Smithies is Professor of Digital Humanities and Director of the Humanities and Social Sciences Digital Research Hub at The Australian National University. Previously, he was Professor of Digital Humanities at King's College London and the founding director of King's Digital Lab.

A sweeping view of how our digital age unfolds from the long history of modernity with all its tensions of determinism versus contingency, and Western universalism versus global multiplicity. Smithies's astonishingly broad, detailed, and interlaced knowledge of computation, philosophy, and history undergirds a powerful guiding message.

Alan Liu, *Distinguished Professor of English,
University of California, Santa Barbara*

Digital Modernity is an essential guide for anyone seeking to understand not just what digital technologies do but how they are deeply entangled in modernity's contested pasts and what they mean for our collective futures.

Katherine Bode, *Professor of Digital Literary Studies,
Australian National University*

The great contribution of James Smithies is to learn and to bridge the digital revolution and the tradition of critical theory and sociology. This is pioneering work, full of insight and provocation, addressing both text and context, opening up the pathways of understanding.

Peter Beilharz, *Emeritus Professor of Sociology, La Trobe University*



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About the Digital Age

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Dedicated to John and Alison Smithies



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ABOUT THE AUTHOR

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PREFACE

This book brings critical inquiry into contact with software and infrastructure, following Philip Agre’s observation that some work requires “a split identity – one foot planted in the craft work of design and the other foot planted in the reflexive work of critique”.¹ The chapters that follow examine digital systems at both levels. The aim is not to collapse critique into practice, as I do elsewhere, but to expose their interdependence.²

The scale of these challenges is considerable. Digital technologies operate across infrastructures and institutions that evolve over decades and centuries. Addressing them requires both historical awareness and sustained attention to design and governance. By situating digital systems within longer trajectories, we can better understand their implications and shape their development.

Notes

- 1 Philip E. Agre, “Toward a Critical Technical Practice: Lessons Learned in Trying to Reform AI,” in *Social Science, Technical Systems, and Cooperative Work: Beyond the Great Divide*, ed. Geoffrey C. Bowker, Susan Leigh Star, Les Gasser, and William Turner (Mahwah, NJ: Lawrence Erlbaum Associates, 1997), 55.
- 2 See James Smithies, Patrick French, and Arianna Ciula, “Droit de Cité: The Digital Lab as Digital Milieu,” in *Digital Humanities Laboratories: Perspectives on Knowledge, Infrastructure and Culture*, ed. Urszula Pawlicka-Deger and Christopher Thomson (London: Routledge, 2023), 52–66; James Smithies and Arianna Ciula, “Humans in the Loop: Epistemology & Method in King’s Digital Lab,” in *Routledge International Handbook of Research Methods in Digital Humanities*, ed. Kristen Schuster and Stuart Dunn (London: Taylor and Francis, 2020), 155–72.

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Australian colleagues welcomed me at an important stage of the project. I'm grateful to Rachel Fensham and Tyne Sumner, who epitomize the rich intellectual and cultural context I migrated into. Peter Beilharz gave me the confidence I needed to contribute to the critical theory of modernity at a crucial stage of the project and shared his friendship and intellectual wisdom. Colleagues at the Australian National University ensured I had the time and resources needed to complete the manuscript. Advisory board members of the AI as Infrastructure project welcomed me into the Australian GLAM sector and my weekly conversations with Glen Berman generated rich avenues for exploration. Hoani Lambert, Karaitiana Taiuru, and Duncan Boennic reconnected me with Aotearoa New Zealand in unexpected and rewarding ways. Other influences are too broad to mention but span the breadth of my academic career, particularly at the University of Canterbury | Te Whare Wānanga o Waitaha where Paul Millar brought me back from the wilderness of IT and colleagues in the History and English departments passed on an estimable intellectual tradition. It is no accident that Karl Popper, who wrote *The Open Society and Its Enemies* while at Canterbury University College, looms large in later chapters of the book.

Simon Smithies motivated me to explore the complex relationships between computing and society, and Elizabeth Mossemear and Mike Smithies provided important perspectives on key chapters. The book is dedicated to my parents, John and Alison Smithies, who encouraged me to explore the world.

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INTRODUCTION

Technology and History

The concept of the digital is historically complex and more profound in its implications than many of us would like to admit.¹ Like the speculative architecture on the cover of this book, it is at once real and unreal, evocative but epistemologically uncertain. Gabriele Balbi has pointed to its powerful ideological aspects, anchored by a linear view of the past that leads from an analogue world to a fractured and future-focused reality.² It is not a sophisticated or highly theorized concept, but it has had an enormous impact on contemporary life. This has implications for critical analysis. Thomas Haigh claims that digital marketing has so captured our imaginations that we forget that the vast bulk of our lives are lived in “unmistakably analog” ways, including activities as banal as looking out our kitchen windows onto the world outside.³ It does not take particularly deep reflection to realize that digital experience occupies a mere sliver of our daily lives, as much as the marketing departments of large technology companies would argue otherwise. These perspectives inform the contours of my argument in the following pages: in many ways the idea of the digital is the least important component of the book. Indeed, my guiding premise is that future generations will come to see us as ridiculously enamoured with and blinded by digital culture and identity; an intellectual and popular culture led away from the fundamentals of humanistic knowledge by shiny new baubles. That is not to suggest that digital culture and technology are inconsequential but that we need to find ways to analyse them in more robust ways.

My central claim is that we need to reconnect with the vast body of critical theory associated with the *idée force* of modernity, using it as a lever to understand contemporary life. I began that work in *The Digital Humanities and the Digital Modern* (2017), arguing that the “digital world provides a showcase

of reflexive modernity in action: fragmented, contradictory, and productive of multiple interpretations depending on context”.⁴ Our fascination with digital culture and technology elides the fact that the last three centuries have been characterized by an obsessive focus on modernity, as a creative, political, and intellectual force. Vast amounts of intellectual and creative energy have gone into its elaboration. Philosophers, historians, writers, artists, psychologists, and sociologists have debated its significance and experimented with ways to resolve its contradictions, creating an exceptional body of knowledge we can mine to understand the digital age.

Reconnecting with that critical tradition can help global society, but the process will not be straightforward. Modernity is and has always been a deeply problematic concept, similar in its implications to “civilization”.⁵ It represents the *bête noire* of twenty-first century humanities and social science (HASS) scholarship, a theory with enormous critical power and influence, but laden with the horror of Western imperialism and genocide.⁶ Many writers are uncomfortable engaging with it, and others reject it outright. Sociologist Gurminda Bhambra adopts a similar attitude to me, engaging with modernity but noting that it is predicated on “a deficient epistemology” oriented towards simplistic narratives of Western and European hegemony.⁷ We need to engage with modernity as a critical construct and historical reality, but develop new modes of understanding anchored in pluralism and viewpoints from the Global South.⁸ This is in keeping with emerging approaches to analysis of the digital age that emphasize views from the “informational periphery”.⁹ Writers from those areas will have more convincing perspectives on their regions than I can offer, but my ultimate claims are modest. What matters is whether my core claim – that our understanding of digital technology can benefit from being read through modernity’s contradictory history – can support centre-left political goals.

This is a key motivation of the book. My approach is informed by the social democratic imaginaries of Aotearoa New Zealand, Australia, Canada, Scandinavia, parts of Europe, and the United Kingdom, which differ significantly from the American liberal democratic model that dominates discussion of digital culture and politics. This is especially the case in the American emphasis on individual rights over collective welfare and its faith in market solutions to social problems. Social democracy is under pressure but still assumes the need for state regulation of capital and the provision of robust healthcare and welfare support. A series of Liberal governments from 1891 to 1912 set out to create a “social laboratory” in New Zealand, enacting “an Australasian model of state development” that remains broadly popular today.¹⁰ Concepts of freedom and liberty are discussed in the context of social responsibility in such countries, for others as well as the individual, and the need for the separation of Church and state remains an almost universal assumption. Although incomplete and painful, processes to correct the damage produced by colonialism are

underway. Part of my motivation in writing *Digital Modernity: Why We Need to Think Historically About the Digital Age* was to protect that form of social democracy from a global conversation that collapses the defence of liberal democracy into a defence of American exceptionalism. This risks the digital age obscuring democratic traditions that are better positioned than American-style liberalism to implement robust governance of digital technologies, supported by traditions of public ownership, regulatory oversight, and collective provision of essential services.

Concatenating digital + modernity into a single apparatus is more defensible in that context, because it aspires to protect existing forms of centre-left government rather than defending moribund forms of *laissez-faire* capitalism and colonialism, but it has never been attempted before in a systematic way and is a formidable task. There are models to build on, however. Writers such as Alan Liu have been exploring connections between digital technology and historical experience for decades, exhorting us to reflect on “the encounter between the sense of history and modern experience”.¹¹ More recently, in an innovative approach to media history, Alexander Galloway has demonstrated the importance of Renaissance ideas to computer graphics.¹² David Bates has demonstrated how digital technology and culture depends on the work of philosophers such as René Descartes (1596–1650), Gottfried Wilhelm Leibniz (1646–1716), and nineteenth-century innovators including Charles Babbage (1791–1871) and Ada Lovelace (1815–1852).¹³ Wendy Chun reminds us that we have inherited the historical baggage of past generations, too, from the racialized mathematics of Francis Galton (1822–1911) to social engineering in the United States 150 years later.¹⁴ Although the idea of digital modernity is new, connections between digital technology and the history of modernity are well established.

This interest in history is positive but lacks a degree of critical abstraction. We need a framework to bind the arguments together and subject them to critique. Modernity provides this, even if it needs to be recalibrated. It will take generations to connect digital experience to the grand currents of post-Enlightenment history, though. The process will require a multiplicity of voices and involve topics ranging from the ontology of mathematics and number theory to mechanization and automation, industrialization, computational complexity, and software engineering, along with the full range of sociocultural and economic theory and ideology. *Digital Modernity: Why We Need to Think Historically About the Digital Age* touches on the history of computing and ideas back to Ancient Babylon and Greece but focuses on the years after World War Two. The period began with computers the size of large rooms and ended with computers designed to wear on our wrists; the world moved from mechanized air defence systems towards systems of capitalism capable of monetizing our emotions. We have witnessed the growth of massive amounts of data, new kinds of business organization, and new modes

of communication. New modes of creative expression and philosophy have emerged to make sense of it all.

Perhaps most distinctively, the 80 years between 1945 and 2025 saw the development of algorithmic systems that have come to mediate our experience of life, transforming the media landscape, expanding and fragmenting the public sphere, and creating new modes of power and control. This has resulted in a classic dialectic between digital “revolution” and “reaction”. Product developers and corporations market algorithmically enabled tools and services, and activists and regulators struggle to control the consequences. The discourse related to this tension is as impassioned as any in the history of modernity. Frank Pasquale noted in 2015 that “[t]he shadowy masters of industrial data mining eviscerate personal privacy from behind a veil of corporate secrecy”.¹⁵ Anthony Elliott has proposed we explore “algorithmic modernity”¹⁶ to better understand the “lethal ecstasy of algorithmic violence”.¹⁷ Corporate leaders in the United States such as Elon Musk are trying to harness algorithms and the emotions connected to them to promote radical versions of libertarianism and perhaps new forms of authoritarianism. Musk’s backing of Donald J. Trump in his successful 2024 presidential bid was only one example of a growing trend towards right-wing populism in Silicon Valley. This politicization of technology is a natural result of a massive increase in the use of software over the last three decades. As Taina Bucher has noted, cultural and political power has become “increasingly materialized in and through software, as software and code have become ubiquitous...”.¹⁸

All of this is well established, but we lack ways to connect it to the landscape of the past. We need to elaborate high-level concepts capable of reconnecting intellectual and political discourse with what Annales School historian Ferdinand Braudel referred to in 1958 as the *longue durée* of history: spans of history greater than decades and centuries. David Armitage and Jo Guldi have recently called for a return to such approaches, claiming that large-scale histories provide shape and context to our self-understanding and foster solidarity with past generations.¹⁹ Bridging concepts are needed to ensure such work avoids lapsing into just-so stories that are difficult to critique because of a lack of engagement with the scholarly tradition. Modernity is one such concept, but it is by no means the only one. Other ideas, such as class, gender, economics, and culture, are all powerful. As Alan Liu has noted, whichever approach we choose, we need to work out how to produce “a measure of the sense of history not just in any age or culture but specifically in the digital age”.²⁰ Exploring digital technology and culture through the lens of modernity reconnects us with the past in ways that are at once transparent and open to critique.

It will take decades to build a common understanding of the digital age, but sociologists have provided us with some useful insights into its intellectual and cultural context, centred around our experience of time. François Hartog has suggested that the fall of the Berlin Wall ushered in a period of “disoriented

time” like that diagnosed by Hannah Arendt in *On the Origins of Totalitarianism* (1951). According to Hartog, a similar caesura or gap in time occurred in 1789, prompting massive disconnection from the stream of history and a feeling that life had become “determined by things which are no longer and things which are yet to come”.²¹ In 2015, Hartog claimed that “the present has taken hold to such an extent that one can really talk of an omnipresent present”, a mode of presentism quite distinct from previous phases of modernity.²² Peter Sloterdijk supports this view, suggesting we have experienced a “partial paralysis in thought” derived from efforts to speak about the past in “discreet, polyvalent, non-totalizing” ways.²³ If nineteenth- and twentieth-century modernity oriented intellectuals towards the future, digital modernity appears to have locked us into a “heterogeneous and unstable” present.²⁴ This is underpinned by what historian of ideas Reinhart Koselleck has referred to as a “pathogenesis” at the core of modern society, that has informed revolution and reaction for centuries.²⁵

This sense of pathogenesis – an underlying and generative sense of crisis – is a discomfiting but unavoidable feature of modernity. It is also deeply contradictory. We know that the sixteenth century European colonization of Latin America wiped out vast swathes of the population through the imposition of military and religious power, and we know that those processes have continued into the present. For centuries, imperialism connected race to “human reason and morality, to science, to colonialism and to the rights of citizenship”.²⁶ Modernity also produced the first seeds of doubt in the architecture of the European state by confronting explorers with radically different ways of life²⁷ and provided Indigenous communities with new technologies they often adopted with alacrity.²⁸ Similarly complex processes were at work in the Global North. Eighteenth century philosophers saw an opportunity to use the many “most brilliant and useful discoveries”²⁹ of modernity to master the natural world and free society from old prejudices and inequalities, but quickly came to mourn the loss of the Greek synthesis of humankind and nature.³⁰ Premodern rural life existed side by side with metropolitan culture for centuries even in the most developed nations. Wherever it has been encountered, modernity has been experienced as contradictory and often brutal.

The concatenation of digital + modernity helps us explore such lacunae because of the complexities that accompany our confrontation with technological systems. Unlike analyses that focus on components of contemporary products and services (software, interfaces, algorithms, networks, platforms, surveillance), analysis of digital modernity requires consideration of the entire technology stack and its associated rhetoric.³¹ This is a challenging mode of analysis because of its scale and opaqueness, but it is the only level of abstraction that adequately captures contemporary experience. Digital modernity is not constrained by one or more software components. A digital product or service is more than the binary logic that defines its lower-level operations, the

algorithmic logic that drives its product features, the behavioural science that informs its interface, or even the data that defines its computational boundaries. Executives at large technology companies are aware of this and spend a great deal of time and money optimizing their communications and building teams that attend to technical and operational risk across an extremely broad range of categories. Whether we like it or not, the great problem of our age – understood by technology companies far better than many HASS researchers – is not technological determinism but socio-technical *indeterminism*. Unwinding our assumptions will take some time.

Understanding technology in this way has political implications, reducing epistemological certainty but enhancing our ability to influence the technological world. *Digital Modernity: Why We Need to Think Historically About the Digital Age* takes this potential seriously, and critiques digital modernity with the express purpose of informing product design and policy development. My goal is to present a narrative that balances technical and historical analysis so that we can chart a course towards more robust modes of liberal and social democracy. As Bernard Geoghegan has noted in his discussion of the “cybernetic apparatus”,

This enlarged context for computing history not only supplements an inadequate history that has consistently privileged engineers and their machines as the subjects of historical narrative, but it also takes steps toward a global history of information and computing that includes the suffering, strife, and participation of persons deemed less than full citizens or subjects by the state.³²

This suggests modes of analysis that combine technical and humanistic perspectives and problematize what I take to be one of the most self-defeating assumptions of the modern age: that high technology can only ever be an enabler of hyper-rationalism and control.³³

The relationship between technology and philosophy is central to this effort because of the need to understand how our digital devices inform human experience. There is a fascinating body of work on that problem, much of it highly critical of the Enlightenment opposition between technology and self. Rich veins of critical theory and philosophy complicate the dualisms of “self/other, mind/body, culture/nature, male/female, civilized/primitive...”.³⁴ Rather than assuming deterministic relationships between society and technology or reinforcing inherited structures of power, these ideas align well with liberal and social democracy, post-growth epistemologies, and political goals that aim to empower the Global South. They provide the philosophical scaffolding necessary to support centrist sociopolitical agendas as well as the recalibration of modernity as a concept. As Beatrice Fazi notes, we can either view the boundary conditions identified by early twentieth century mathematicians

as evidence of the inability of formal systems to support planetary flourishing or surmise that “the incomplete and incomputable are not errors or stopping points for axiomatics. Rather they show that indeterminacy pertains not only to the empirical realm but the formal [and we could add political] too”.³⁵ This attitude mirrors the work of writers explored in subsequent chapters, from Donna Haraway, to Katherine Hayles, Alan Liu, Bruno Latour, and Karl Popper.

Chapter 1 introduces the theory of modernity and positions it in relation to digital technology and political economy. As Bhambra and others have noted, from its inception in the seventeenth century, modernity was not a simplistic outgrowth or export from Western Europe.³⁶ It has always been a complex of ideas, politics, technology, and culture experienced by different people at different times, in different places, and in different ways.³⁷ We can define digital modernity in much the same way, as a series of interlocking and sometimes opposing digital *modernities*.³⁸ These geographically dispersed digital spaces range from tiny groups engaged in crime on the dark web to vast national and transnational milieus enabled by global digital platforms, not unlike the “swarms” referred to by Zygmunt Bauman.³⁹ They spring into being in viral ways and contain the seeds of innumerable threads from the past and present. They inform and enable the daily life of governments, MAGA supporters, rock stars, state-backed hackers, and terrorists alongside grandparents, dog lovers, and TikTok users. Digital modernities unite humans, bots, software, networks, algorithms, and physical infrastructures in formations that challenge the boundaries of understanding.⁴⁰ Depending on how we pull focus, they can be singular in a way Fredric Jameson would recognize (enveloping the planet in a capitalistic datasphere)⁴¹ or fractured by geopolitical, cultural, and linguistic boundaries in the manner presented by Ulrich Beck.⁴²

Chapter 2 uses the history of post-war computing to define the technical and cultural foundations of digital modernity. I explore issues related to computational logic, gender, and the architecture of early computers and explain the sense of alterity that results from technological complexity. As I argued in *The Digital Humanities and the Digital Modern*, a robust understanding of digital technology and culture requires engagement with technical topics. The history of computing provides the context we need to influence the design of future computer systems, emphasizing their socio-technical malleability.⁴³ This chapter provides readers with the necessary technical background for the analysis to follow, balancing descriptions of computer software and architecture with issues such as cybernetics and the changing status of software programmers. My approach is influenced by histories of computing that present technical insights into products, services, and global digital infrastructure. I argue that an adequate understanding of digital modernity requires both technical and historical analysis, but there will always be a conceptual core that resists interpretation.⁴⁴

Chapter 3 extends the history of digital modernity into the new millennium. The period opened with predictions of cyberutopia and closed with the return of great power competition and trench warfare. In 1993, *Wired* magazine compared digital technology to a “Bengali typhoon” that would launch society into a new era.⁴⁵ The following year, Douglas Rushkoff’s exposé of Silicon Valley culture, *Cyberia: Life in the Trenches of Hyperspace*, introduced a community of young middle-class white men who believed that digital technology would usher in a cyberutopian age.⁴⁶ The inherent optimism took decades to dissipate but a series of corrosive moments ensured its denouement: the Great Financial Crisis (GFC); the Cambridge Analytica and Snowden scandals; political disillusionment brought on by misinformation and cyberwarfare; the increasing Balkanization of the Internet; the bursting of the cryptocurrency bubble; increasing awareness of the negative effects of online culture; the Covid-19 pandemic; the Ukraine War; growing support for right-wing politics in Silicon Valley. I refer to this amalgam of cultural, aesthetic, and ideological mechanisms as the digital modern, through the lens of Wittgenstein’s “forms of life”.⁴⁷

It would be impossible to produce a history of digital modernity without commenting on its relationship to the public sphere, a concept first articulated by Frankfurt School sociologist Jürgen Habermas in the context of the eighteenth-century Enlightenment and discussed in Chapter 4. The concept has been acknowledged to be a central component of modernity for decades, reaching the height of its definition in the 1980s.⁴⁸ In 2003, cultural theorist Jodi Dean claimed the theory was useless because it could not account for networked communication and was “damaging to practices of democracy”,⁴⁹ but there were always critics who perceived instead the development of “multiple, sometimes overlapping or contending, public spheres”.⁵⁰ Habermas himself has recently updated his theory to account for a “mode of semi-public, fragmented and self-enclosed communication [that] seems to be spreading among exclusive users of social media that is distorting their perception of the political public sphere as such”.⁵¹ Others perceive its potential for revolutionary change. The public sphere was assumed to be of central importance to the Arab Spring of 2010–2012, and Elon Musk was so invested in the idea that he invested \$44b in it by buying Twitter in 2022. As Charles Taylor has pointed out, it is not so much that the public sphere has disappeared, but that the West fears it has been divided and poisoned.⁵²

Dean made a good point, therefore. The idea of the public sphere has always been slippery, and it was never as cohesive or pure as popular imagination would have it. John Thompson has suggested that its emergence in the eighteenth century “was not just an institutional development: it also had a moral-practical dimension”.⁵³ This was complicated three centuries later by a massive increase in participation through social media. Participation has broadened with apps as varied as Twitter (rebranded as X), Facebook, Reddit,

WeChat, VKontakte, and Odnoklassniki. The increase in networked discourse has sometimes seemed to threaten rather than enable the public sphere, but that is to confuse the effect of technology with our desired political outcome. More accurately, the increasing diversity and scale of the public sphere has undermined the ability of left-leaning political parties to influence and act on *opinion publique*: the body of opinion formed through open deliberation in the public sphere.⁵⁴ This has resulted in a weakening of those parties but that is a function of them not formulating adequate responses to changes in the public sphere rather than the *destruction* of the public sphere. Far-right trolls such as Steve Bannon who recommend “flood[ing] the zone with shit” demonstrate sophisticated awareness of how *opinion publique* is generated.⁵⁵ Similar issues were experienced in the build-up to World War Two, but liberal media eventually caught up.⁵⁶

Digital colonialism, discussed in [Chapter 5](#), provides firmer conceptual ground and demonstrates the relationship of modernity to climate change and the environment.⁵⁷ We can see this in the children scouring toxic dumps of computer equipment for recycling; the African mines that contribute precious metals to the “blood computers”⁵⁸ we carry in our pockets; and the bitcoin server farms that use the energy of a small country. This is digital modernity in root and branch, analogous to the smokestacks of Victorian England. The global data infrastructure that supports platform capitalism is sprawling, its material footprint profound.⁵⁹ American corporations such as Apple, Google, Facebook, and Microsoft compete with Chinese firms including Alibaba, Baidu, WeChat, and Tencent. Digital platforms such as Uber, Spotify, Airbnb, Deliveroo, and Tinder control major market segments. Digital labour platforms such as Mechanical Turk, Scale, Appen, Hive Micro, and Spare5 provide platforms enabling low-paid manual labour, often to prepare training material for generative AI. Rather than attempt to resolve the confoundingly complex issues that the situation has created, I claim that the transition towards a “weightless” mode of digital colonialism was enabled by the increasingly “weightless” political economy that emerged over the millennial turn. This suggests a complex relationship between the emergence of digital modernity and the triumph of neoliberalism.⁶⁰

It is important not to assume this process was globally uniform, however. In some cases, the diffusion of digital technology took on unexpected forms, as surveillance capitalism was deployed across alternative cultural and political systems. [Chapter 6](#) explores the implications of this process in China, a country with deep experience of technology and modernity. The result is a somewhat surprising inversion of Orientalist tropes inherited from the nineteenth century, emphasizing the need for digital modernity to be explored by a wide variety of actors in a wide variety of countries. The future of culture and technology will be determined in New Delhi, Amman, and Shanghai as much as in New York and London. Many countries aspire to the geopolitical power and

sociocultural rewards of modernity and are investing heavily to ensure they do not miss future opportunities. This is not to deny the moral complexities inherent in digital technology or to ignore the reality of digital surveillance and authoritarianism in many countries, but it is important to be mindful of Western attitudes to modernity, and their connection to historical attitudes that denied colonized people control over their technological development.⁶¹

The Chinese experience of digital modernity destabilizes Western assumptions about advanced technology and its deployment across society and demonstrates why analysis of digital modernity needs to proceed with new assumptions: these issues are deeply layered and often counter-intuitive. The history of racial stereotyping through technology reaches back to the eighteenth century and earlier. The topic has been explored by a wide range of commentators over the course of modernity,⁶² critiquing the racist tropes implicit in Orientalism (via Edward Said) but also the way in which the abjection of race in *digital* modernity holds within it the possibility for “something like insubordination or creativity” to arise.⁶³ Techno-orientalism implies a reorientation of sociopolitical and epistemological perspective, away from the central assumptions of post-Enlightenment Cartesian dualism towards alternative modes of philosophy and knowing.⁶⁴ On a more prosaic level, it demands that we consider the massive contribution of labour from countries such as India and China to global centres of high technology, including but not limited to Silicon Valley.⁶⁵

This is sensitive ground, but important to confront if we are to protect civil society from disruptions caused by digital culture and technology. Digital modernity presents us with uncomfortable truths about Western prejudice, but it does not require a parallel weakening of liberal democracy or acceptance of authoritarianism. Separating those two issues is one of the main reasons the critique of digital modernity is so urgent, because (in the terms presented here) it rejects the notion that technological advancement necessarily goes hand in hand with sociopolitical regression. The political trends we are witnessing are best understood in the way twentieth century writers such as Hannah Arendt understood the politics of authoritarianism and totalitarianism, as attempts to invert the liberalizing mission of post-Enlightenment modernity.⁶⁶ This is the ultimate justification for rehabilitating the study of modernity, rather than simple historical revisionism. Although tainted by abominations, the history of modernity offers perspectives that have protected liberal democracies from authoritarianism in the past: if we are committed to our political traditions, they need to be dusted off for deployment in the present. The liberalizing momentum of the past 300 years, inaugurated in the European Enlightenment (and riven with contradictions as it is), is being undermined by billionaires ignorant of Isaiah Berlin’s two concepts of liberty. Modern liberal democracies have typically aimed to balance our freedom to speak and act with the freedom of others to enjoy the good life *they* have chosen.⁶⁷

Chapter 7 is perhaps the most important chapter of the book for that reason, exploring concepts that can help us explore the intellectual engine room of digital modernity: historism (writing about the past) and historicism (the belief that history is driven by natural laws). The distinction was articulated by the philosopher Karl Popper during World War Two to critique ideologies on the left and right that were threatening liberal democracy.⁶⁸ Historism is straightforward, referring to the impulse to understand self and world in relation to the past. A surprising amount of commentary about digital modernity adopts this approach. In her classic essay “A Cyborg Manifesto” (1985), Donna Haraway located a “technological polis”⁶⁹ in “the late twentieth century”, where people had become “chimeras, theorized and fabricated hybrids of machine and organism”.⁷⁰ Extending Haraway’s approach, Katherine Hayles identified a “historically specific construction” that emerged after World War Two based on the separation of information from the material forms it was embedded in, prompting the development of “a different construction called the posthuman”⁷¹ characterized by “a collection of heterogeneous components, a material-informational entity, whose boundaries undergo continuous construction and reconstruction”.⁷² Digital historism belies the end of history myth promulgated by the Californian Ideology,⁷³ suggesting we have long understood the need to locate digital experience in its broader temporal context.

This is quite different from historicism, as defined by Popper in *The Open Society and Its Enemies* (1945) and later (more fully) *The Poverty of Historicism* (1957).⁷⁴ Articulations of “historicism” from Vico to Gramsci tend to view it as synonymous with historism but Popper famously inverted this meaning, associating it with the most dangerous forms of intellectual lack-logic. For Popper, historicism refers to the belief that the past coheres to system-like laws that produce deterministic if not teleological effects, leading to the rise of authoritarianism and totalitarianism. This is central to a robust understanding of the intellectual *zeitgeist* of digital modernity, just as it was for Popper during the Cold War. The problem stems from the fact that machine learning technologies work by reproducing historical patterns,⁷⁵ leading to the associated (but fallacious) belief that digital society works in a similar way. The problem is not that digital modernity is teleological, but that the technical infrastructure that enables digital modernity makes it appear that might be the case, providing anti-liberal actors with a powerful narrative they are using to effect *antimodern* outcomes. This is a fine distinction, but crucial to the way we respond to the weaponization of digital modernity by provocateurs across the political spectrum. Historicist logic encourages regressive politics by uniting technology with romanticism, mysticism, and blind commitments to the will to power.⁷⁶ Believers are sent on a slippery slope towards antimodern mysticism, authoritarianism, and totalitarianism.⁷⁷ Karl Popper’s critique of historicism suggests adherents are caught in the maw of systems analysis grounded in flawed assumptions, leading them to misconstrue the potential of liberal

democracy and maximize deterministic narratives to strengthen ideological commitment.⁷⁸ His argument is tailored to support the centrist assumptions of post-World War Two social democracy.

Rejection of the positive potential of digital technology is understandable given the failure of services that spew racist and sexist bile generated from their training data, or inadequacies in poorly aligned Large Language Models (LLMs) that allow users to engage with the dark side of their stochastic logic, but we have more control than technology companies would like to us to believe. Wendy Chun has demonstrated how companies use statistical methods developed over the course of centuries, often in association with overtly racist social goals, but how those same methods can be deployed for beneficial ends.⁷⁹ Shannon Vallor has similarly pointed out that even though advanced computational models are often tuned to bring out the worst in human nature, they could also be designed to bring us together.⁸⁰ Socio-technical complexity, probabilistic system behaviour, and the profit motive are proving difficult to regulate, but arguments that reduce human agency are counterproductive. It casts a further pall over events such as the storming of the United States Capitol building in 2021 if we believe the infrastructure of digital modernity has oriented history towards the extremities of political economy; there is little evidence to suggest that advanced technological systems *inevitably* produce dystopian outcomes. The existential risks imposed by digital modernity are real, but the machinery of liberal democracy remains fundamentally sound in most Western countries.⁸¹

Chapter 8 explores this problem in more depth, demonstrating how emergence theory can help us manage the cascading complexity associated with global digital infrastructure. This considerable challenge is achieved by exploring aspects of analytical philosophy and the philosophy of science, tracing the theory of emergence from its origins in Ancient Greece and the nineteenth century writing of John Stuart Mill to more recent applications in biology, quantum physics, neuroscience, and computational complexity.⁸² The theory of emergence has traditionally been of fringe intellectual interest but was often used to make sense of unexpected behaviour arising from the first generation of LLMs. The concept is closely connected to the problem of digital historicism, being used (often quite imprecisely) to explain how grammatically correct prose, functional computer code, and compelling images “emerge” from the architecture of deep learning models. The term has occasionally been connected to canonical work in science in discussions of LLMs but is often used as a rhetorical fudge, implying that beyond a certain threshold, for unknown reasons and depending on the metrics used to measure that threshold, unexpected behaviour such as the ability to produce working computer code materializes.⁸³

This is a loose use of an otherwise powerful concept that could result in dangerous political outcomes if a connection was made between the “emergent”

behaviour of artificial intelligence (AI) and extreme political philosophy. It is important to understand that emergence cannot be properly understood without the associated concept of supervenience.⁸⁴ In digital modernity, supervenience defines the relationship between micro components of its infrastructure such as XOR, NOR, and AND logic gates and macro phenomena such as the storming of the Capitol building. At that level of analysis, although we must assume *some* kind of supervenience between micro components and macro phenomena, the relationship suffers from explanatory incompressibility: there is simply too much complexity to trace effects across the system with any degree of precision.⁸⁵ Assuming deterministic or teleological relationships between digital technology and the future represents a massive leap of faith. This is also the case, perhaps surprisingly, with even the most basic computationally complex systems such as John Conway's Game of Life (GOL), consisting of "cellular automata" that propagate within a grid pattern according to simple rules. The simple game generates a range of complex behaviour, but "the majority of sufficiently large patterns explode quadratically" after a short period of time.⁸⁶ It is impossible to trace the connections between component¹ and phenomena¹ in any meaningful way even though it is obvious that one "emerges" from the other.

The theory of emergence becomes exceptionally useful when used in this more precise way, allowing us to bracket unexplained behaviour in lieu of further research. This is not dissimilar to the way scientists designed experiments to explore why magnetism emerges from metals held near electrical currents before the theory of electromagnetism existed, or to explain gaps in classical physics before quantum mechanics offered new perspectives. In the most reductive sense, it supports the basic premises of scientific rationalism but allows for the iterative exploration of the complex architectures and algorithms that comprise the infrastructure of digital modernity. Peter Turchin's work in cultural analytics is tangentially related, although more confident in its conclusions and more willing to make predictions for the future.⁸⁷ The theory of emergence allows space for the normal functioning of liberal democracy by reducing the potential for alarmist discourse and fostering gradual improvements (never fast enough) in social and economic equality. The topic speaks to the importance of developing a robust and transparent conceptual grammar for digital modernity that supports wide-ranging sociocultural analysis, embraces relational methods of enquiry, and is informed by the full history of post-Enlightenment science and mathematics.

The final chapter of the book takes this argument a step further by reconfiguring AI as industrialized cognition (IC) and then exploring it from mathematical, computational, and epistemological perspectives. Descriptions of AI are loaded with cultural meaning that can be traced back to the Old Testament, making interpretation difficult.⁸⁸ The interpretation of IC presented in [Chapter 9](#) returns to the thought of Karl Popper and other theorists, who

view computers as exosomatic systems entangled with human evolutionary development,⁸⁹ and Katherine Hayles, who separates the concept of human cognition from “nonconscious” cognition.⁹⁰ The resulting analysis focusses our attention on the functional limitations of LLMs and (perhaps as importantly) the intersection between IC and political economy. The chapter anchors analysis in neuroscience, hardware, programming languages, data models, algorithms, and related statistical methods instead of Silicon Valley marketing, Hollywood movies, and science fiction.⁹¹ Both modes of analysis are needed but a scientifically and historically grounded approach is more suited to the study of digital modernity. It is important to remember that LLM output is generated by a vast physical infrastructure designed and engineered primarily for market dominance rather than for the advancement of society,, not unlike the industrialized mass media infrastructures of previous generations.

The ultimate justification for reconsidering our relationship to modernity lies in the dangers of its dark side. Contemporary researchers are largely unaware of the intellectual leverage critical engagement with modernity offers, leading to a situation where we analyse component parts of modernity (such as the public sphere and colonialism) without considering their capacious historical context. Twentieth century cultural theory has significant responsibility for this situation, rejecting modernity so forcefully that a discursive vacuum has developed and reactionary tendencies have resurfaced.⁹² It is largely irrelevant whether the resulting politics veer towards the extreme right (as with Nazi Germany) or extreme left (as with the Soviet Union): we need modes of analysis that support socio-technical equity and political stability. Considerable work is needed to fill in the historical silences that have developed over the last 30 years, building understanding progressively and from many different angles to achieve this goal. The perspectives outlined in the following pages will not satisfy readers seeking new forms of social or political theory, but those are much larger projects. The first step is to locate the fine line between revolution and reaction.

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1

DIGITAL MODERNITIES

The idea of modernity is grandiose, associated with ways of life that emerged in the sixteenth century and accelerated after the European Enlightenment. Anthony Elliott usefully notes that “its twists and trajectories can be mapped using manifold conceptual lenses”.¹ The concept captures the experience of life in the *neuzeit* (new time) across sociopolitical, cultural, psychological, philosophical, and technological dimensions. Modernity usually refers to the abandonment of traditional modes of social and political organization (whether forcibly or by choice) in favour of “principles of individual freedom and instrumental mastery” after the European Enlightenment of the eighteenth century, but there are important departures from that theme.² Miriam Cooke has shown how modernity has been harnessed to reactionary politics in the Middle East in recent decades,³ and theories such as decolonialism have critiqued modernity while demanding that countries in the Global South⁴ be provided with better access to its benefits.⁵ In its classical articulation, the onset of modernity was believed to be of profound historical significance, referring to societies that abandoned millennia of social and political organization. We now know that the break with the past was less complete than might be supposed and that an “archaic and stable past” has never existed, but the *idée-force* of modernity remains with us.⁶ For centuries, intellectuals have used the idea of modernity to mark a transition from darkness and myth to the anxiety-inducing light of urban life, technology, secularism, and rationalism. It is a deeply flawed concept but offers powerful insights into the human predicament.

Sociological traditions generally locate the origins of the critical theory of modernity (as opposed to modernity as a historical phenomenon) in writers such as Émile Durkheim and Georg Simmel.⁷ The classical view of modernity identified radical changes in the sociocultural, economic, and political

composition of societies after the eighteenth century. Such theories tended to emphasize the transition from feudalism to democracy, and from societies focused around rural and religious lifeways to cultures influenced by new urban experiences driven by scientific rationalism, secularism, capitalism, and democracy. Max Weber's account of the transition from Protestantism to capitalism in post-Enlightenment Europe is one of several canonical examples of the genre.⁸ Subsequent articulations of modernity include reformulations in favour of concepts such as "post modernity",⁹ "late modernity",¹⁰ "reflexive modernity",¹¹ "liquid modernity",¹² and "multiple modernities",¹³ but the denominator has proven to be remarkably persistent. More radical rejections of modernity recommend the adoption of post-liberal, theocratic, or authoritarian attitudes, but they remain as shackled to our historical foundations in the *neuzeit* as alternatives.¹⁴ In its purest sociopolitical form, modernity implies the enormous historical baggage associated with post-Enlightenment debates about the good society and appears to be impossible to transcend.

Intellectual historians have noted strong associations in the critical theory of modernity with themes of degeneration and crisis, a belief in a persistent "pathogenesis" that has removed humankind from natural modes of life.¹⁵ During the Cold War, Western scholars isolated this conceit to "aberrant" forms of modernity (such as fascism and Communism),¹⁶ but digital modernity has demonstrated its persistence across all modes of government and political economy.¹⁷ Febrile discourse reminiscent of the darkest phases of modernity pervades even the most advanced liberal economies. Anthony Elliott claims that in "algorithmic modernity"¹⁸ fear "...is not just a matter of cognitive distortion or derailed belief systems, but rather goes all the way down into our deepest emotional sensibilities and affective commitments".¹⁹ The suggestion is that we are experiencing an epidemic of algorithmic anxiety driven by a distinct new phase in the history of modernity:

The digital revolution, one could say, reignited cultural appetites for order-building, order-maintenance and 'controlled digital intervention' in daily social life. The digital revolution, especially in the aftermath of the combined forces of AI, advanced robotics and accelerating automation, promised an altogether new 'stage' of the ordering techniques of human mastery – in a line of development beyond the monotony, repetition and regularity of organized modernity.²⁰

This is the (pathogenic) state of modernity described by Reinhart Koselleck, returned in digital form to haunt liberal democracies and authoritarian regimes alike.²¹

We need to question whether a return to the discourse of pathogenesis is helpful, however. As Peter Beilharz has suggested, "the challenge is both to register the bright and dark sides of this modernity".²² The problem is

complicated by the fact that modernity did not expand in uniform ways or from a single centre and has never been equitably distributed. The *neuzeit* initially developed in Europe but has been experienced and diffused in different ways by different people, at different times. The seeds of modernity can be seen in Europe in the fifteenth and sixteenth centuries but mainly in metropolitan areas: there was considerable variation in its diffusion to the provinces.²³ The term usually implies a focus on science and technology, but sometimes involves the integration of science and technology into premodern modes of life (as occurred across the Pacific in the nineteenth century).²⁴ In the United States, modernity was enabled by *laissez-faire* capitalism; in the Soviet Union and China, it was enabled through Communism. The experience of modernity in Western Europe in the 1800s was completely different from the experience of modernity in Africa in 2020.²⁵ Some people have experienced modernity as colonizers, others as colonized. Gender, sexual orientation, race, age, and location – all impact how the modernizing process is expressed and experienced. Modernity is not unitary but plural, and its connection to colonialism and capitalism is complex. We should not expect digital modernity to be any different.

Accounts of modernity have long questioned simplistic interpretations of its mechanisms. Narratives arguing that modernity spread from the capitals of Western Europe to the wider world in a linear manner succumb to what Charles Taylor has described as the “Enlightenment package error”.²⁶ Rather than spreading in an uninterrupted manner, Enlightenment values (*liberté, égalité, fraternité* in their most historically evocative form) travelled separately from science, technology, and industrialization and were in no way magically embedded within them. We could assume the same processes are at work in digital modernity, with its component parts (software, networks, interfaces, algorithms, infrastructure) being received and negotiated in different ways across different time periods, geographies, and demographics. This perspective acts against the perception of digital products as inevitably determinative. Examples such as the French Minitel system, which Andrew Feenberg notes was co-opted by hackers in the 1980s and turned into a “means of personal encounter, the very opposite of the rationalistic project for which it was originally created”, provide a compelling, if short-lived, example.²⁷ We could perhaps identify a new conceptual fallacy for digital modernity named the “digital component error”: the assumption that one or more of the components of digital technology (software, networks, interfaces, algorithms, infrastructure) are so powerful as to determine our experience of digital modernity as a whole or grant one group (such as Silicon Valley billionaires) complete control over their deployment and use. Although dangerous in the wrong hands, technology is more socio-technically and geographically malleable than the discourse of pathogenesis would have us believe.

This is true of the modernization process more generally. As Ambrose King and others have noted, modernization “is as much the result of responses and

the strong counter-forces coming from other cultures and civilizations when the encounter occurs”²⁸ This perspective is partially informed by Edward Said’s 1978 critique of orientalism, which criticized the positioning of Asian countries as an exotic Other to European modernity,²⁹ but goes beyond it in recognizing multiple modernities that assimilate Western modernity for local benefit.³⁰ Historical sociologist Johann P. Arnason has explored “colonial modernity”³¹ and the relationship between modernity and different civilizations (notably Japan and East Asia) to build on these perspectives.³² The assumption that the diffusion of digital technologies would contribute to the triumph of Western liberalism over the turn of the millennium would have benefited from these perspectives.³³ As with earlier phases of modernity, quite different processes were at work, suggesting “a story of continual development and formation, constitution and reconstitution of a multiplicity of cultural programs of modernity” emerging as local and global cultures meet and transform each other.³⁴ When we add the component parts of digital products and services to our analysis, the analytical complexity increases exponentially.

This complexity requires that we move beyond Shoshana Zuboff’s suggestion that a future “third modernity” might institutionalize “principles of a new rational digital capitalism aligned with a society of individuals and supported by democratic institutions”.³⁵ We need a theory of modernity tailored to our current situation, rather than possible future circumstances. There is no need to adhere to linear notions of a first, second, and possible future third modernity: we can begin analysis right now and avoid being implicated in futuristic rhetoric. The concept of first and second (or Reflexive) modernity that Zuboff structured *The Age of Surveillance Capitalism* (2019) with was developed by sociologists including Ulrich Beck, Anthony Giddens, and Scott Lash in the 1990s, in an attempt to explain the increasingly individualistic nature of life in late twentieth century capitalism.³⁶ Their focus on “globalized informational capitalism”³⁷ was prescient and Beck’s notion of the risk society remains powerful,³⁸ but they could not foresee the impact of the World Wide Web, mobile phones, and social media. Future analyses of digital modernity could gain much from their work, but it is too anchored in twentieth century debates about postmodernism and expert systems for my purposes. We need a theory of digital modernity grounded in the socio-technical details of contemporary computing systems, capable of attending to their wide-ranging and fragmented impact. It is unlikely that a single explanatory principle (reflexivity, risk, globalization) will suffice to explain the diffusion and experience of digital modernity around the world. Dividing the history of modernity into a handful of phases such as First, Second, and Third, is similarly unsatisfying.

This book relies on another theory circulating at the turn of the millennium: *multiple modernities*. Designed to offset the Enlightenment package error described by Charles Taylor, the theory of multiple modernities assumes “that the best way to understand the contemporary world – indeed to explain

the history of modernity – is to see it as a story of continual constitution and reconstitution of a multiplicity of cultural programs” rather than a linear diffusion of ideas, or a linear progression from one moment in time to the next.³⁹ Ambrose King explores the concept through the history of Asia, citing Taylor’s claim that the “belief that modernity comes from one single universally applicable operation imposes a falsely uniform pattern on the multiple encounters of non-Western culture with the exigencies of science, technology, and industrialization”.⁴⁰ Although open to critique (like all critical theories of modernity), this provides the degree of analytical flexibility we need. Depending on how we pull focus, “digital modernities” can be singular in a way Fredric Jameson would recognize (enveloping the planet in a capitalistic datasphere)⁴¹ or fractured by technical, geopolitical, cultural, and linguistic boundaries.⁴² The difficulty is working out how to update dated articulations of multiple modernities to accommodate the digital age.

Zygmunt Bauman’s theory of “swarms” is useful in this context, referring to cultural groupings that “are coordinated without being integrated”.⁴³ Bauman’s swarms are enabled by the digital technologies that precipitated the development of what he terms liquid modernity.⁴⁴ They are dominated by self-interest and are increasingly being influenced by algorithms (bots). Viewed in the context of digital modernity, we can assume that they include tiny groups engaged in crime on the dark web as well as vast national and transnational milieux enabled by platform capitalism. David Lyon has noted how Bauman’s concept of swarms can also be used to explain the transition from primarily state-based modes of surveillance anchored in Benthamite notions of the panopticon to the more ubiquitous and often “opt-in” modes of surveillance typical of Shoshana Zuboff’s notion of surveillance capitalism.⁴⁵ Swarms can be interpreted as socio-technical assemblages, enabled by data that flows

increasingly freely between organizational and even national databases. But as they are combined and mined, they alter so that with a hard-wired Kafka effect we can never be sure how we are being read or what the consequences are. This might just mean that we miss some rewards from our loyalty program but it could also mean that we find ourselves denied a boarding pass for a plane or refused credit at a bank.⁴⁶

Although they *appear* fragmented, the digital modernities we experience in our daily lives are often connected by data surveillance infrastructure derived from either targeted hacking or digital advertising profiles that function as our “data doubles”.⁴⁷ Significantly, especially in the context of the critical theory of modernity, this amounts to a datasphere controlled not only by Capital but also by governments and corporations alongside a motley crew of hackers for hire, organized criminal gangs, and teenage miscreants. The important point for our present purposes is that digital modernities unite humans, networks,

interfaces, software, algorithms, and physical infrastructure in formations that challenge our understanding.⁴⁸ As with the infrastructure that enables them, they are easiest to see when they fail.⁴⁹

There are still fundamental issues to navigate, however. Gurminder Bhambra reminds us that any theory of multiple modernity fails to achieve its objectives if it retains the Global North as the baseline against which other countries are measured.⁵⁰ A more radical epistemological stance is needed, informed by postcolonial theory, where analysis details the reception, adoption, diffusion, and adaptation of digital technology to local needs and from local perspectives. That research can then be added to our communal self-understanding in an act of epistemological pluralism. In their introduction to *Informational Peripheries*, Ayona Datta and Fenna Imara Hoefsloot note that for the Global South in a digital age, “[t]he informational periphery is fragmented, diffuse and dispersed and cannot be fixed or determined through simple cause-and-effect analysis.”⁵¹ The idea of digital modernities can only succeed, in other words, if it is filled in from myriad locations (and by myriad languages and cultures) around the world. It is “not simply that there is a series of alternative histories to be acknowledged, but that in doing so, what is involved is a reformed understanding of the processes represented within dominant histories.”⁵² An attempt is made to implement this approach in [Chapters 5](#) and [6](#), although it should be obvious at this juncture that this is impossible to achieve in a monograph by a single author. The point is to make a tentative and at times merely indicative start (one that should be updated as perspectives accumulate) rather than complete the process.

However inadequate the present analysis is in speaking for the Global South (and marginalized communities everywhere), analysis of digital modernity requires the kind of epistemological pluralism Bhambra and others demand and can only be fully realized from the accretion of multiple perspectives. It is important to note that this is a direct result of its socio-technical complexity, rather than (necessarily) being an issue of theoretical or ideological commitment. Although computer technology is profoundly material (servers, cables, data centres), it crosses borders more readily than the telegraphs and steamships that symbolized earlier forms of modernity, resulting in site-specific implementations and modes of reception that demand analysis on their own terms. This is even the case with global platforms such as Facebook, where local communities use it in different ways depending on their cultural and linguistic norms, and Meta implements policies and guardrails tailored to profit maximization and government regulations. The combination of rapid diffusion and local adaptation is further facilitated by planetary-scale data centres and fibre-optic cabling that support rapid deployment and scaling, independent of local infrastructural capacity.⁵³ Adding to this (as I explain in [Chapter 3](#)), digital modernity emerged during an expansionary phase of neoliberal capitalism, leading countries such as China and Russia to base their economic

policies around importation and exploitation of the technology in ways both independent from and subversive of Western liberal democracy. A lot can be achieved by an engineer in a Chinese government department, or a teenage hacker in their bedroom in Suva.

It is important not to oversimplify digital modernity in temporal terms either, assuming our experience of digital infrastructure (massive data centres, fibre-optic cabling encircling the globe) represents a break in time specific to the turn of the millennium. On the contrary, public infrastructure began to frame urban experience as early as the eighteenth century in some parts of the world. As Tung-Hui Hu notes, there are few innovations in contemporary life without parallel in the material history of modernity: "...centuries before computers were invented, sewers kept each household's private business private even as it extended the armature of the state into individual homes".⁵⁴ Previous generations marvelled at the ability of railways, steamships, and eventually skyscrapers to dominate the landscape in the same way we marvel at the vast data centres that power our digital lives. Even if modernity *was* diffused from centre to periphery in a simple linear fashion (an implausible scenario), it was certainly fully diffused before digital modernity emerged from it. The cultural and psychological impact of modern technology has been woven into the collective global unconscious for centuries. Machine guns, factories, telegraph lines, and lightbulbs changed the material and, from there, intellectual and aesthetic experience of life over many decades, presenting local communities across the world with a profound experience of technological change and the power dynamics that accompany it. This was the case even on the colonial frontier, where the importation and deployment of new technologies had major impacts from the very earliest years of contact, perhaps in more concentrated form because of the stark contrast with premodern human society.⁵⁵ Rural dislocation and urban life combined to produce radical changes that penetrated the psyche as it unleashed a wide range of machines on society and industry across the world.⁵⁶ Although digital modernity has caused disruption and its benefits and power structures are unevenly distributed, many communities around the world have had an opportunity to define its course.

This is not the place to offer a detailed description of the uncountable digital modernities that would drive this point home, but some examples spring to mind. Mumsnet is a classic example, an online parenting network based in the United Kingdom that became known as a combative but intellectually rich space, ostensibly designed to provide parenting advice for women. The site came to symbolize "new forms of femininities" that were more aggressive and paralleled ostensibly "male" online behaviours.⁵⁷ Sarah Pedersen and Janet Smithson claim the site transformed from an online space intended to be safe from male cyberbullying and misogyny characteristic of web culture to one where gender norms were complicated and "wit and aggression" reinforced particular styles of middle-class mothering.⁵⁸ There is some evidence

to suggest that Mumsnet has altered modes of identity formation in motherhood, due to the radically open approach to discussing everything from health issues to feminism and economics.⁵⁹ Similar findings apply to more contentious websites such as the right-wing and deeply misogynistic 4chan message board, which has been implicated in a broad range of digital culture.⁶⁰

eSports provide another evocative example, blending the online and offline world. In their purely online mode, eSports involves competitive multiplayer competitions involving games such as League of Legends, DOTA 2, Counter-Strike: Global Offensive, StarCraft II, FIFA, Overwatch, Heroes of the Storm, NBA2KX, Rocket League, and Call of Duty, but it is a fast evolving space.⁶¹ Offline Local Area Network (LAN) competitions attract professional teams and hundreds of thousands of dollars in prize money, creating a new class of professional sport.⁶² The socio-technical context of these events is broad-ranging, supporting academic studies across business, sports science, cognitive science, informatics, law, media studies, and sociology.⁶³ Any detailed analysis of eSports in the context of digital modernity would presumably also need to factor in the rich history of play in modernity and its later expression in board games and early video game culture.⁶⁴

Neil Niman has explored how hardcore gamers can be understood through Thorstein Veblen's theory of the leisure class, their enjoyment of beating video game algorithms being converted into social status.⁶⁵ This puts a different tenor on interpretations of digital modernity that focus on negative critique and the overwhelming power of algorithms. In professional eSports, players actively wrestle with algorithms for enjoyment, income, and status. The nature of the gameplay requires analysis far beyond the behavioural characteristics of the game engine to network latency, multi-player tactics, physical dexterity and stamina, and psychology. More darkly, Adrienne Massanari has explored how gaming culture has contributed to the rise of far-right ideologies, with otherwise disparate groups of misogynists, incels, white nationalists, extremist ideologues, anti-Semites, and Islamophobes being bonded through "gamified" social media interfaces.⁶⁶ This implies a fascinating political angle to the study of digital modernities, where personal identity and political economy blend online and offline behaviour in ways that are continuous with long-standing issues in post-Enlightenment political philosophy.

Future research will need to account for the relationship of those kinds of digital modernities to cyberwarfare and (from there) physical warfare. There is a hint to their connections in the identification of the Russian Internet Research Agency (IRA) by the United States in 2016, a building in Moscow housing Internet trolls that used LAN and wider Internet infrastructure for offensive cyber operations. The IRA was one of the first high-profile state assets to be found interfering in the 2016 United States election⁶⁷ and was the subject of a massive cyberattack by the United States military in 2019.⁶⁸

Digital modernities of this kind reflect the long-standing synergies between the military-industrial complex and the computing industry, but their hybrid nature creates analytical problems. They require teams of people occupying physical spaces (not unlike a typing pool in a major city in the early twentieth century) but depend on national and global network infrastructures and the various other components of digital modernity. In their most kinetic form, militarized digital modernities extend to drones in the sky and viruses planted in critical national infrastructure. As threatening as the spectre of semi-autonomous and autonomous warfare is, militarized digital modernities remain frighteningly dependent on the traditional calculus of geopolitical decision-making.⁶⁹

As Mercedes Bunz has noted, digital sensibilities have moved a long way from the introspective psychological traditions that influenced twentieth-century modernity. “When creating a digital subject, data is always interlinked and processed, a technical aspect that is essential: digital traces of one individual subject alone are algorithmically not relevant”.⁷⁰ This is not particularly surprising, however. As Anthony Giddens has noted, “[e]veryone living in conditions of modernity is affected by a multitude of abstract systems and can at best process only superficial knowledge of their technicalities”.⁷¹ This has always produced confounding relationships between self and society. In modernity, historical experience is layered in complex ways, from the digital connections referred to by Bunz to myriad layers that reach back to post-Enlightenment Europe and (indeed) premodern society around the world.⁷² Technical aspects of digital modernity are merely the topmost layer of deeply historical phenomena.⁷³

Marxist theory is important in this regard, whether we want to embrace its more radical conclusions or not. We could start with the title of Berman’s sweeping history of modernity⁷⁴ which was inspired by *The Communist Manifesto* by Karl Marx and Frederick Engels (1848):

Constant revolutionizing of production, uninterrupted disturbance of all social conditions, everlasting uncertainty and agitation distinguish the bourgeois epoch from all earlier ones. All fixed, fast-frozen relations, with their train of ancient and venerable prejudices and opinions, are swept away, all new-formed ones become antiquated before they can ossify. All that is solid melts into air, all that is holy is profaned, and man is at last compelled to face with sober senses, his real conditions of life, and his relations with his kind.⁷⁵

As Berman noted, Marx was aware that this tendency of “the bourgeois epoch” might apply equally to successful Communist solutions, threatening to force them towards dissolution as well, but the analysis stands as a testament to the predicament of modern society.⁷⁶

Marxist analysis has heavily influenced analysis of the digital economy, fuelled by the emergence of data platforms⁷⁷ and associated “data exhaust”.⁷⁸ Shoshana Zuboff’s account of the data-driven “instrumentarian power” wielded by large technology companies engaging in “surveillance capitalism” critiques the armatures of corporations and nation states in a manner continuous with twentieth century Marxist critiques of power.⁷⁹ Thomas Piketty’s analysis of twenty-first century economics overtly signals its intellectual debts:

modern growth, which is based on the growth of productivity and the diffusion of knowledge [through data], has made it possible to avoid the apocalypse predicted by Marx and to balance the process of capital accumulation. But it has not altered the deep structures of capital – or at any rate has not truly reduced the macroeconomic importance of capital relative to labour.⁸⁰

Analysis has been updated to account for such innovations as Bitcoin farming and bicycle delivery apps but still demonstrates obvious continuities between twentieth- and twenty-first-century critiques of economic modernity.⁸¹ Seb Franklin’s claim that “the progenitors of the fuzzy but operational metaphors between behaviour, social organization, and computer technology can be located in both dreams and nightmares of universal subsumption and valorisation in political-economic writings of the nineteenth century” conveys the intellectual milieu succinctly.⁸²

Negative analyses of digital modernity are often informed by perspectives drawn from post-Marxist and postcolonial perspectives for understandable reasons (see Chapter 5). Nick Couldry and Ulises Mejias explained this in *The Costs of Connection* (2019), pointing to the long-standing connections between capitalism and modernity.⁸³ As Claudia Aradau and Mercedes Bunz have pointed out, however, the extension of the leftist critique of modernity to digital culture and economy is more complex than it might appear at first glance, implying acceptance of a certain plurality of experience and a wide range of attitudes to technology. This is particularly the case with emerging forms of artificial intelligence (AI):

The critique of power addresses AI as an apparatus of domination and traces the technology through the production of data – data collected by corporations thriving in so-called ‘platform capitalism’ as well as by the state and its repressive agencies. Power emerges in multiple forms, from the historicity of data, its extraction by corporations and the state, its valorisation and the effects of surveillance and oppression it creates.⁸⁴

Aradau and Bunz are interested in how leftist critiques of AI struggle to account for its alteration of not only the relationship between labour and capital

but also our status as modern subjects. Their goal is to resist the “discourse of AI catastrophe” and present analyses capable of offering a degree of socio-technical control.⁸⁵

This leads us to the final mode of digital modernity to be explored in this chapter, of the infinite possible types: digital *antimodernism*. In simple terms, this refers to the kind of “digital detox” culture highlighted by researchers such as Zeena Feldman, who are interested in the tendency of people to resist the “always-on” culture enabled by mobile devices and increasingly expected in corporate life.⁸⁶ Feldman’s work emphasizes the agency users have over their technology and the movement to simply switch devices off, even while recognizing that “[w]ithout a radical rupture, our individualised digital detoxes will achieve little...”.⁸⁷ More research is needed to understand how these contemporary movements are related to other moments in the history of modernity when people rejected technology in favour of simpler modes of being although, as Feldman is quick to point out, the situation is complicated by more recent generations of users who never experienced life before digital modernity: “They feel trapped by social media’s performative demands because they cannot envision life without these technologies”.⁸⁸ Movements towards digital detox echo earlier periods when the pathogenetic critique of modernity weighed heavily on the imagination, nevertheless. The Arts and Crafts movement of the late nineteenth and early twentieth centuries remains the classic example of this, starting in the United Kingdom but spreading around the world.⁸⁹ Significantly for our purposes, however, and despite its associations with movements that laud a return to craft and artisanship, digital antimodernism does not inevitably imply the rejection of technology or the adoption of cosy methods of self-improvement.⁹⁰ It has important connections to authoritarian and totalitarian modes of political economy too. This is a theme that will be returned to at various points through the following chapters. It is enough to note here that the tension between technology, modernity, and antimodernism is complex and connected to powerful ideological and cultural currents. The conflation of *Geist* (World Spirit) and technology in Nazi Germany provides a good example of this.⁹¹

There is no simple explanation for the development of synergies between technology and spiritualism or romanticism, although the historian Jackson Lears has suggested the different forms are usually “shaped by particular national circumstances”.⁹² Rather than necessarily engaging in political activity, adherents merely point “back toward something lost, a heritage worth recapturing”, even (as with the case of digital natives) they have never experienced it themselves. Sometimes the sentiment deepens, curdling into a desire for a post-liberal order *beyond* modernity.⁹³ An attempt might be made, in the absence of any clear way of transcending or rolling back technological advances, to conflate technology with spiritualism and romanticism, combining futurism with reactionary politics as occurred in fascist Germany in the twentieth century.⁹⁴ Extreme forms of digital antimodernism attempt to transcend the ravages of

digital modernity using its defining technology, animated by the enchantments offered by (variously) nature, spiritualism, or the will to power. They are at once beguiling and dangerous, starting as liminal or even comical sideshows before hardening into dogma. For the most radical adherents, digital antimodernism develops deterministic or teleological characteristics. As the billionaire technologist Peter Thiel claimed in a notorious piece of writing in 2007, the only thing certain to them is that “the modern age will not be permanent, and ultimately will give way to something very different”.⁹⁵ The shiny products of digital modernity are not an end in themselves in this kind of world view, but a mere way station on the path to political and spiritual transcendence.

Rejection of digital technology, or its conversion into a mechanism for spiritual or political transcendence, stems from the same impulse. It is an attempt to transcend the antinomies of modernity, understood as a trap set by science and philosophy in the eighteenth century to block humankind from authentic experience. Zygmunt Bauman described the dilemma well when he noted that

[w]e can think of modernity as of a time when order – of the world, of the human habitat, of the human self, and of the connection between all three – is *reflected upon*; a matter of thought, of concern, of a practice that is aware of itself, conscious of being a conscious practice and wary of the void it would leave were it to halt or merely relent.⁹⁶

Post-liberal Silicon Valley philosophies are merely a contemporary example of this long-standing tradition, animated by American versions of the romantic sublime.⁹⁷ This might feel like a depressing end to a preliminary analysis of digital modernity, but it acts as a warning for some of the chapters to follow, and a call to action for future studies into digital modernities. Modernity has always had the potential to enhance our collective experience, but it contains the seeds of our destruction too. Antimodern political philosophies are of a piece with this and cannot be interpreted separately from the historical traditions they grew out of. Digital technologies, similarly, are connected to broad sociopolitical and cultural processes and need to be interpreted in suitably holistic ways. The rejection of technology cannot protect us from the dark side of modernity, as much as we might hope it will.

Notes

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- 3 Miriam Cooke, *Tribal Modern: Branding New Nations in the Arab Gulf* (Berkeley: University of California Press, 2014).
- 4 I follow writers such as Walter Mignolo, Enrique Dussel, and Gurminder K. Bhambra in interpreting the term Global South (and its corollary Global North) “not simply [as] a geographic location, but [as] an epistemological position”. Gurminder K. Bhambra, *Connected Sociologies* (London: Bloomsbury Academic, 2015), 89.
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- 6 Bruno Latour, *We Have Never Been Modern* (Cambridge, MA: Harvard University Press, 1993), 10.
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- 16 Bhambra, *Connected Sociologies*, 151.
- 17 James Smithies, “Computation and the Discourse of Crisis,” in *The Digital Humanities and the Digital Modern* (Basingstoke: Palgrave Macmillan, 2017), 47–77; Alexander R. Galloway, “Times of Crisis,” in *Uncomputable: Play and Politics in the Long Digital Age* (Brooklyn: Verso, 2021), 177–87; Marinus Ossewaarde, “‘Crises of Modernity’ Discourses and the Rise of Financial Technologies in a Contested Mechanized World,” *Philosophy & Technology* 31 (2018): 59–76; Wendy Hui Kyong Chun, “Crisis, Crisis, Crisis, or Sovereignty and Networks,” *Theory, Culture & Society* 28, no. 6 (November 1, 2011): 91–112; Mary Ann Doane, “Information, Crisis, Catastrophe,” in *New Media, Old Media: A History and Theory Reader*, ed. Wendy Hui Kyong Chun, Anna Watkins Fisher, and Thomas Keenan (New York: Routledge, 2004), 247–60.
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- 19 Elliott, *Algorithms of Anxiety*, 158.
- 20 Elliott, *Algorithms of Anxiety*, 20.

- 21 Koselleck, *Critique and Crisis*.
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2

COMPUTATIONAL BLUEPRINTS

Before we can hope to grasp the nature of digital modernity, we first need to understand computers. This is more difficult than it sounds, even for people with solid technical understanding. Despite the foundational work of Alan Turing during and after World War Two, until the 1960s no theory of computation considered the entire structure of computing devices.¹ Historian of software engineering Stephen Mahoney claims this was because of the “ambiguous status of the computer itself”²: “the computer is not a single device but a schema. It is indefinite. It can do anything for which we can give it instructions, but in itself it does nothing”.³ This might seem counter-intuitive given our detailed knowledge of circuit boards and programming languages, but computer science does not deal with absolutes in the same way as the natural sciences. The discipline is defined by its need to work with heterogeneous tools and infrastructure that regularly confound the design process. The need to design devices and software used by human users and communities increases uncertainty exponentially again.⁴ Our daily frustrations with computers are evidence enough of this: the digital world is a cornucopia of workarounds and kludges that become more apparent the deeper our understanding becomes.

This has considerable implications for our interpretation of digital modernity: we have yet to properly understand the nature of computers, let alone develop robust ways to understand their impact on the world.⁵ To remedy that situation, this chapter outlines the history of computing after World War Two. My goal is to demonstrate the socio-technical complexity of modern computers and provide basic technical information that will inform future chapters. The need for this kind of description is straightforward. Alan Turing’s concept of the Universal Turing Machine (UTM) informs the design and engineering

of computers, but it cannot resolve practical questions of human-computer interaction that histories of computing routinely highlight.⁶ The opening paragraph of Donald Knuth's iconic *The Art of Computer Programming* (1962–1973) speaks directly to the problem, stemming from an unavoidable tension between mathematics and engineering:

The algorithms discussed in this book deal directly with numbers; yet I believe they are properly called *seminumerical*, because they lie on the borderline between numeric and symbolic calculation. Each algorithm not only computes the desired answer to a problem, it also is intended to blend well with the internal operations of a digital computer. In many cases a person will not be able to appreciate the beauty of such an algorithm unless he or she has some knowledge of a computer's machine language; the efficiency of the corresponding machine program is a vital factor that cannot be divorced from the algorithm itself. The problem is to find the best ways to make computers deal with numbers, and this involves tactical as well as numerical considerations.⁷

Computer science deals with myriad implications of this tension between mathematics and engineering, from Boolean algebra and switching theory (used to control circuits) to automata and complexity theory. The discipline is broad enough that even ostensibly unrelated research, such as Warren McCulloch and Walter Pitt's seminal 1943 paper exploring the logical structure of neurophysiology⁸ and Noam Chomsky's classic linguistics paper of 1959 which sought to define a formal theory of grammar, has had major impacts.⁹ If we extend this towards contemporary research which seeks to understand the effect of digital devices on human behaviour and political events, our scope expands again.

This is not to sanction obscurantism but to note the complexity of the problem domain. Interpretative opacity is woven into the computational and historical blueprints of digital modernity, making it as susceptible to the "hazardous" discourse of technology as any other engineering domain.¹⁰ We simply do not understand the true nature of digital machines and their associated infrastructure, making assessment of their practical impact or existential meaning fundamentally difficult. This is a foundational truth of computing that engineers tend to be comfortable with (it defines the limits of what they can achieve), but commentators across the political spectrum gloss over. We understand how computers and associated networks and systems work at a practical level, but their interaction with complex global infrastructures, individual users, and society at large introduces enormous areas of uncertainty. Thomas Nagel might have viewed this as a reason to engage in agnostic rationalism, attempting to expand the boundaries of knowledge while acknowledging our natural limits.¹¹ The long tradition of socio-technical analysis represented in

Science and Technology Studies (STS), including the influential work of Philip Agre related to “critical technical practice” referred to in the Preface, supports this approach by confronting researchers with the engineered reality of their objects of study.¹²

Historical research augments these approaches because of its natural attention to political and cultural aspects of design and engineering. This can help us explore the complexity of computing from different angles, perhaps even enabling modes of thinking that could lead to technical and regulatory innovation. It can also lead to some new ways of thinking about computing culture, changing path dependencies outlined in later chapters. Contrary to popular opinion, for example, computer engineering has a relatively diverse gender history. The hardware design and engineering of the first electronic computers during World War Two was completed by men, but most programmers were women.¹³ Over 10,000 women were employed in the Bletchley Park code breaking complex in England. “The entire chain of information gathering and processing...” relied on women, primarily from the Women’s Royal Naval Service (WRNS).¹⁴ The WRNS later programmed Colossus “...using switches and plug boards to electronically emulate the different wheel and pin settings of the encryption machines.”¹⁵ Subsequent histories tended to focus on the contribution of the men leading the projects, and the female programmers were significantly underpaid compared to their male peers, but recent research demonstrates the centrality of women to twentieth century computing.¹⁶

There were socio-economic and cultural reasons for this, of course. Computer programming was one of the few challenging roles female mathematicians were eligible for in mid-century economies. Social norms forced them into a secondary position to men, extending even to the language used for professional development and remuneration.¹⁷ The American Grace Hopper (1906–1992) is the most well-known of these pioneering women, responsible for programming the Harvard Mark I using the first machine-independent languages and advancing to Rear Admiral in the US Navy, but she had many female colleagues.¹⁸ The more salient reality is that Hopper’s career coincided with women being pushed to the margins of the computing industry, reducing career opportunities for women and thus the creative pool available for design and engineering efforts.¹⁹ By the 1970s, engineering-focused “computer boys” dominated software and hardware production as well as the wider computing culture.²⁰ The domination of computing culture by men from the Global North (particularly in the formative decades of digital modernity) is a crucial issue that is not adequately understood, even accepting the recent critique of “tech bro” culture. As Jonathan Flowers notes, “spaces inherit the orientations of the people within them”.²¹

It is also important to recognize the fundamentally technical nature of computing history. Although dry to the uninitiated, the technical and operational

details of computer history provide the foundations for any subsequent understanding. It is questionable whether it is possible to develop robust cultural interpretations of computing without an awareness of the reality of electronic and software engineering, maintenance, and repair.²² The development of the stored program architecture was a primary watershed in the recent history of digital modernity, for example, an event that established the core paradigm for contemporary computing.²³ Detailed in John von Neumann's 1945 report on the EDVAC computer,²⁴ the approach seemed obvious to a range of people years earlier, but von Neumann's specification assured its association with his name.²⁵ The innovation marked the transition from mere calculating machines to general-purpose computers supported by programmable code and persistent storage and (perhaps more importantly) provided concrete examples of the military potential of digital computing devices.²⁶ The broad architecture of processing unit, control unit, memory, external storage, and input and output mechanisms has remained static since its definition in 1945 and provides the core systems-level architecture of digital modernity.²⁷

Post-war computers look unwieldy in hindsight (they were the size of a large room) but were a major advance on previous designs. The Electronic Numerical Integrator and Computer (ENIAC) and Electronic Discrete Variable Automatic Computer (EDVAC) were used to calculate firing tables for artillery, reducing the time spent on this task from four hours to 10 seconds. The subsequent history of computing offers fascinating insights into the human and cultural politics of Washington, D.C. and post-war Silicon Valley.²⁸ Microchip design and manufacturing (enabled by military contracts for the Minuteman missile system) were of central importance, increasingly entangled with capitalist entrepreneurialism. Competition to be first to market with new designs and capture major government contracts played an important role, resulting in the astounding corporate histories of companies such as Intel and IBM. It is too easy to forget the energy of the early years of post-war computer engineering and discount the effect they had on the computer engineering culture that powers digital modernity. The early years of microchip design and engineering were characterized by personality clashes and interpersonal competition that has characterized Silicon Valley ever since. The world's first integrated circuit, with a single transistor, was produced by Jack Kilby of Texas Instruments in 1958. The following year, Robert Noyce produced another model, allowing a movement away from the unreliable and bulky vacuum tubes used in machines such as ENIAC.²⁹ By 1965, the co-founder of Fairchild Semiconductor and Intel (with Noyce), Gordon Moore, famously observed that the number of components able to be fitted into an integrated circuit appeared to double each year, suggesting exponential increases in computing power would occur in the coming decades.³⁰

Increases in chip density experienced during the last decades of the twentieth century reflected demand from military and later space and satellite

communications companies but also,³¹ and perhaps primarily, the innovative and competitive technical culture on the West Coast of the United States.³² This complex entrepreneurial culture is perhaps the key argument against deterministic narratives of Silicon Valley dominance. The detailed history of this period provided by computer historians demonstrates the uncertain potential of emerging design and production processes and the finely balanced commercial requirements they were dependent upon. A wide-ranging design and manufacturing culture was needed to produce the new chips, complete with operational and administrative as well as intellectual assets. Integrated circuits or “systems on a chip” and their eventual mass production through the planar production process enabled more efficient computing through more efficient production methods, greater reliability, increasingly efficient information transfer (i.e. denser application of Boolean logic), and greater opportunities for architectural abstraction at the level of hardware as well as software but their development was by no means a foregone conclusion.³³

It is also important to acknowledge the importance of software engineering and data management to the development of digital modernity. E. F. Codd’s development of relational databases and an associated query language in the late 1960s represents the start of information systems as we know them today.³⁴ The development of high-level programming languages such as FORTRAN (1957), COBOL (1959), and later object-oriented languages such as C++ (1985) further contributed to the emergence of digital modernity, as did developments in relational and object-oriented database design, data modelling, expert systems, and the various components of the World Wide Web (WWW). It is this layering of technical abstraction, from basic principles of computation through to logic gates, bits, lower and higher-level programming languages, database models, networking protocols, and input-output (IO) devices of various kinds, that enabled the paradigmatic shift from post-industrial to digital modernity. The resulting architecture amounts to an interpretative Tower of Babel requiring attention to hardware, software, computation, manufacturing, politics, culture, and economics.

This conceptual complexity has led to a great degree of debate between researchers oriented towards either the technical or theoretical end of the interpretative spectrum, but this too can be viewed as a long-standing feature of digital modernity.³⁵ The intellectual tension was well established by the time of the Macy Conferences of 1941–1960, which established the cybernetics movement. The conferences were highly interdisciplinary and included literary figures such as I. A. Richards and Margaret Mead alongside scientists and people involved in the early computer science community. Conversations focused on automation and control in humans and machines, blending theories of automata with evolutionary and social theory and applying them to organizations and communities and sometimes countries.³⁶ Cybernetics cohered for a time around Norbert Wiener’s 1948 book *Cybernetics: Or, Control*

and *Communication in the Animal and the Machine*,³⁷ which sought to connect his work on mechanico-electrical systems designed for air defence during World War Two to theories of cellular automata and computation. Wiener's work led him to explore information theory independently from Claude Shannon, influenced by the theory of entropy expressed in the second law of thermodynamics.

Contrary to the utilitarian engineering research of their colleagues, cyberneticians aimed to move beyond simplistic deterministic models to account for "automata effectively coupled to the external world, not merely by their energy flow, their metabolism, but also the flow of impressions, of incoming messages, and of the actions of outgoing messages".³⁸ Bernard Geoghegan has demonstrated how the discourse of cybernetics informed a wider "cybernetic apparatus"³⁹ in the following decades, uniting "mathematical procedures, diagrammatic strategies, and technologies – that acted as material aids or guides to research" with the politics of knowledge to create "quasitranscendental" modes of not only research but also policy interventions across wide swathes of society and culture.⁴⁰ Geoghegan made a related point in earlier research, noting the importance of the wider scientific and technological milieu to the conceptualization of information technology.⁴¹ It is an important point, highlighting the effect humanists and social scientists have had on the development of digital modernity and bringing into question critiques of Silicon Valley that assume responsibility for questionable practices lies solely with engineers and business people. There has always been two-way traffic between technical and social scientific ideas in the computing industry.

To Norbert Wiener "the newer study of automata, whether in the metal or the flesh, is a branch of communication engineering, and its cardinal notions are those of the message ... quantity of information, coding technique, and so on".⁴² This was a view of complex systems as information management systems, governed by discoverable laws comparable to the world of classical physics. Our traditional focus on military-funded engineering programmes ignores these more holistic attitudes to design and engineering, and the influence of social science initiatives funded by a combination of US government agencies and "robber baron progressive philanthropists" including the Carnegie and Rockefeller foundations. According to Geoghegan:

The result was a flexible apparatus that took public and political problems from suffering to inequity and turned them into semi private and technical problems to be handled by an array of experts. This apparatus aimed to cultivate a class of entrepreneurial, rational, industrious citizens who yielded to the ministrations of experts and not to the call of radical politics. In turn, the political subjects produced by this apparatus were to become productive workers contributing to the maintenance and expansion of a rational, enlightened industrial society.⁴³

Very few contemporary academic disciplines escape complicity with the development of digital modernity, making the act of critique a delicate task.

The relationship between cybernetics and analytical philosophy has often been the primary way the relationship of Wiener to the humanities and social sciences has been explored, presenting Wiener as a computational determinist enamoured with instrumentalist philosophies, but this is wide of the mark too. Wiener famously referred to Leibniz as “the patron saint of cybernetics” for his development of “a universal symbolism and ... a calculus of reasoning”,⁴⁴ but he did not support arguments in favour of logical necessity. He publicly criticized Russell and Whitehead’s *Principia Mathematica* and took pleasure in Gödel’s refutation of their rigidly formalist approach.⁴⁵ Cybernetics’ relationship to the humanities and social sciences has a complicated legacy: problems of translation between the hard and soft sciences resulted in inadequate understanding on both sides. The movement had a direct influence on contemporary forms of surveillance and control, but it also presaged a movement beyond mathematical formalism, towards modes of engineering focused on the unpredictable relationship between humans and machines.⁴⁶

The media commentator Marshall McLuhan was well attuned to this more complex interpretation of human-machine interaction, famously noting in 1964 that:

[i]n a culture like ours, long accustomed to splitting and dividing all things as a means of control, it is sometimes a bit of a shock to be reminded that, in operational and practical fact, the medium is the message. This is merely to say that the personal and social consequences of any medium – that is, of any extension of ourselves – result from the new scale that is introduced into our affairs by each extension of ourselves, or by any new technology.⁴⁷

McLuhan assumed that twentieth century technology’s “integrated system of information handling” extended human *experience* of the world as well as merely increasing production.⁴⁸ This is quite different from industrial and even post-industrial modernity, which were characterized by sharp demarcations between nature and technology.⁴⁹ In digital modernity, humans and technology became increasingly indistinguishable, until in 2001 the cultural theorist Lev Manovich could claim that:

...just as the printing press in the fourteenth century and photography in the nineteenth century had a revolutionary impact on the development of modern society and culture, today we are in the middle of a new media revolution – the shift of all of our culture to computer-mediated forms of production, distribution and communication. This new revolution is arguably more profound than the previous ones and we are just beginning to sense its initial effects.⁵⁰

Seb Franklin has pointed out that the distributed computing systems enabled by cybernetics “must be traced not only through digital systems and media but also through nondigital forms whose social conditions of production rely on and thus aesthetically manifest the power of such systems”.⁵¹ As the next chapter demonstrates, it was these “conditions of production” that led to libertarian capitalist philosophies overriding the more holistic potential of cybernetics. This was particularly noticeable in terms of the early artificial intelligence (AI) community, which split from the cybernetics community following the 1956 workshop at Dartmouth University, unconvinced that the approach championed by Wiener would work.⁵² There were important intellectual connections between the two communities, but the AI group was mindful of the constraints of their computers and chose to define expert systems and programming languages grounded in structured grammars rather than struggle to develop artificial neural networks modelled on the human brain. Cybernetics fell into intellectual disrepute as it became clear it would not produce commercially viable systems, and the AI community gained government funding and support.⁵³ Chapter 9 explores that subject in more detail.

In the meantime, focus moved to product development oriented towards business applications, peaking with the release of the IBM System/360 mainframe computer in 1964. The System/360 was the first commercial computer to use an operating system, which dramatically increased its support for programming languages, input/output devices such as printers, and software emulation that allowed it to run a wider variety of applications. This resolved issues with hardware compatibility that had dogged the growth of the industry, but software remained stubbornly difficult to upgrade.⁵⁴ The use of accounting and payroll software designed for the IBM 1401 (1959) in 1999 suggests how intractable the problem is.⁵⁵ The technical complexity of the System/360 operating system was extreme, leading to cost overruns and concerns that it could lead to the demise of IBM, which had famously “bet the business” on its development.⁵⁶ Delivery was only achieved after the development of ground-breaking software engineering techniques described by Frederick P. Brooks in *The Mythical Man-Month* (1975).⁵⁷ The work for the IBM/360 indicated the rapidly growing complexity of digital tools and infrastructure, and the need for immense investment in labour and capital to ensure success.

This work was conducted in the shadow of massive investments in science and technology by the US government in the context of the Cold War. Efforts to gain geopolitical advantage assumed the need to leverage public-private investments to ensure innovation, resulting in profoundly important initiatives such as Bell Labs and Xerox Palo Alto Research Center (PARC). Remarkable technical breakthroughs were made in the period. A paradigmatic example of this occurred in 1968, with Doug Engelbart’s presentation of the “Mother of all Demos” at Xerox PARC. Engelbart’s system was inspired by a 1945 article in *The Atlantic* by the US Director

of Scientific Research and Development, Vannevar Bush.⁵⁸ The demo (still available online) was a defining moment in the history of computing.⁵⁹ Engelbart presented applied research conducted to better understand the potential of computers to augment human intelligence, designing new IO devices and modes of networked communication capable of maximizing the potential for what could reasonably be referred to as “cybernetic” integration.

Engelbart’s work was so advanced that it required foundational work on information networks by the US Defense Advanced Research Projects Agency (DARPA). The research was conducted at Stanford but submitted in a 1962 report to the director of information sciences of the Air Force Office of Scientific Research, before being implemented at Xerox PARC. The resulting system was conceptually complete even by the standards of twenty-first century user experience⁶⁰: Englebart demonstrated two computers connected by a network, controlled by a mouse and additional user input device, along with real-time collaboration on a word processing document and basic file creation and storage using a graphical user interface (GUI). The underlying work on information networks eventually evolved into the modern Internet. By 1971, DARPA’s ARPANET connected 19 nodes. By 1977, when the Apple II was released, there were close to 60 nodes within and outside the United States.⁶¹

The network was initially scaled out for research purposes by the US National Science Foundation, using iterative expansions of the country’s T1 network backbone, and decommissioned in 1990. In 1992, the Scientific and Technology Act opened the network to commercial use, ushering in the modern Internet.⁶² Many excellent computing histories detail the emergence of the WWW from CERN, and early community bulletin board systems (BBS) (forerunners to social media networks), which became central Internet-based services.⁶³ It is less often noted that the online platform Amazon was established the same year (1994) that the Netscape Navigator browser brought the WWW into the domestic sphere (eBay was established the following year).⁶⁴ As with other aspects of computing history, networking technology undermines the belief that computers are simplistically deterministic, creating path dependencies independent of human culture. The history of the Internet suggests a complex melange of drivers, from sheer force of personality and individual genius to commercial and military strategy.

Popularization of the theory of “the network society”, which emerged from the development of the WWW and nascent forms of online commerce, reflected a deeply felt need to understand the development of digital technology in more complex ways.⁶⁵ As well as contributing to the underlying protocols enabling the developing global Internet “super highway” envisaged by Bill Gates in the 1990s, networking helped academic commentators conceptualize the relationship between personal computers and massively distributed

computing infrastructure and information flows. In *The Rise of the Network Society* (2011), Manuel Castells claimed that

[f]or the first time in history, the basic unit of economic organization is not a subject, be it individual (such as the entrepreneur, or the entrepreneurial family) or collective (such as the capitalist class, the corporation, the state) ... *the unit is the network*, made up of a variety of subjects and organizations, relentlessly modified as networks adapt to supportive environments and market structures.⁶⁶

It is easy to forget how powerful the idea of the network was in the early years of the millennium, perhaps equivalent to the idea of the algorithm in 2023. Observing the development of Web 2.0 and social media sites such as Facebook and Twitter, Castells claimed that “informationalism” had replaced matter and energy as the driving onto-epistemological framework for self and society.⁶⁷

This is a conceit that reaches back far beyond modernity: Alexander Gallo-way has traced the idea of the network back to ancient Greece, in the tragedy *Agamemnon* by Aeschylus.⁶⁸ The concept of the information network thus extended and deepened a long-standing *cultural grammar* as well as transformative physical and informational infrastructure, enabling the transition from post-industrial to digital modernity through the sheer volume of data transfer it enables. This process (both cultural and technological) was accelerated by the release of the iPhone in 2007, which launched a new category of mobile devices, and the implementation of high-speed networks and large data centres capable of supporting online gaming and video streaming services. Statista claims 149 zettabytes (the equivalent of 3.5 trillion 4K movies) will be captured, created, copied, and consumed worldwide between 2010 and 2024⁶⁹ and estimates that 75 billion Internet of Things devices will be connected by 2025 (a nearly threefold increase from 2019).⁷⁰ This surely compares to the quantitative impact of earlier phases of modernity, whether we choose to measure that impact in railway lines or financial services activity. Digital modernity will take an equally massive toll on the environment. The University of Cambridge Centre for Alternative Finance estimates bitcoin mining alone requires 128 TWh of energy annually (close to Norway’s entire electricity generation for 2021).⁷¹ Reports estimate that training OpenAI’s GPT-3 Large Language Model (LLM) required 1,287 MWh and produced 502 tons of CO₂eq emissions.⁷²

Squaring aesthetic and physical aspects of modernity has always troubled commentators. As Marshall Berman noted in *All That is Solid Melts into Air*, the cerebral nature of modern life has consistently sought to hide a more debased material reality. Modern symbols such as the Eiffel Tower and the Brooklyn Bridge gained their power through their engineered beauty: massive

rivets and steel up close, imposing grace from a distance. Berman suggests the Crystal Palace, built in Hyde Park for the 1851 International Exhibition and designed by Joseph Paxton, evoked J. M. W. Turner's *Rain, Steam and Speed* (1844), "fusing nature and industry in a vividly chromatic and dynamic ambience" of steel and glass.⁷³ The centrality of Prince Albert to the conception and design of the exhibition suggests something of the cultural and political power dynamics at work too, positioning Victorian Britain as an international powerhouse of engineering and culture. The complexity of these iconic structures was eventually dwarfed by sprawling Large Technical Systems (LTS) of the twentieth century,⁷⁴ which symbolized the movement towards systems engineering that peaked in the 1960s and 1970s with physical marvels such as Boston's Central Artery Tunnel (CA/T), described by historian of technology Thomas Hughes as being of "surpassing complexity".⁷⁵

The techno-futuristic skylines of Shanghai, Singapore, and Tokyo provide compelling examples of this conceit for digital modernity, but the power of that physical reality elides more troubling issues. Demand from the US military informed important aspects of early computing projects, such as the 1950s SAGE (Semi-Automatic Ground Environment) air defence system, and DARPA's precursor to the Internet launched in 1969 (ARPANET).⁷⁶ The impact of such projects can be overstated, but they informed the sprawling networks of cables and data centres that power global platform capitalism and government systems of surveillance and control.⁷⁷ This extends even to the use of decommissioned Cold War bunkers to house key digital infrastructure.⁷⁸ It would be incorrect to position digital modernity as inherently militaristic or simplistically geopolitical, but those aspects have had an undeniable influence over its development and remain baked into its technical and institutional logic.

Coming to terms with the physical and engineered nature of digital modernity is difficult, especially when geopolitical issues related to the environment and digital colonialism are factored into the equation, but it needs to remain at the centre of our analysis. Computing history provides the only Archimedean point we have to produce a grounded view of contemporary digital society, avoiding lapsing into uninformed cultural or ideological critique while also enabling such work. Isolating aspects of digital modernity (software, data, algorithms, networks, platforms) for analysis is important, but positioning any of those components as the sole driving force of digital modernity skews analysis in unhelpful ways. The history of computing suggests a more nuanced reality, with technology and culture combining in often unexpected ways to produce outcomes contingent upon human society far more than technology. This argument will be taken up in subsequent chapters and has important implications for political economy and culture, reducing the power of Silicon Valley entrepreneurs and the military-industrial complex and highlighting the continued potential for human intervention in the development of information technologies. Even in an age of AI and vibe-coding, when computers can

reduce the need for detailed technical or even coding knowledge, an understanding of the history of computing highlights the social and political control that can continue to be exerted over technology development.

The primary lesson of that history is that analysis of technology needs breadth as well as depth. In a report by Harvard University in 2023, the authors presented a compelling overview of the current and possible future state of the group of technologies known collectively as Decentralized Social Technologies (DST), including Web 3.0 social media initiatives such as Mastodon (enabled by the ActivityPub protocol), and various projects either using blockchain technology independently (for authenticated storage of data) or in combination with cryptocurrencies (enabling distributed computing platforms such as Ethereum). Combined with the Internet of Things and generative AI delivered using LLMs, these projects appear to hold the promise for a sea change in our experience of digital modernity, raising profound questions for policymakers and regulatory authorities. Although exciting, the scale of personal data in the global system, combined with the potential for misinformation and other harms, suggests significant work is needed to understand the best way to manage future technologies. It is worth noting that the authors claim “the shifts identified above could produce a wholesale restructuring of the political economic order. A range of outcomes are possible, from the dystopian to the desirable”.⁷⁹ Robust analysis of these changes requires a broad interpretative approach that we are only just starting to grasp.

Notes

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- 2 Mahoney, “The Structures of Computing,” 31.
- 3 Mahoney, “The Structures of Computing,” 18.
- 4 Tony Fry and A. J. Nocek, eds., *Design in Crisis: New Worlds, Philosophies and Practices* (New York: Routledge, 2021).
- 5 Dominic Fox, “M. Beatrice Fazi, *Contingent Computation: Abstraction, Experience, and Indeterminacy in Computational Aesthetics*,” *Review* 31, <http://review31.co.uk/article/view/616/sophisticated-idiots>, accessed September 29, 2021.
- 6 Thomas Haigh and Mark Priestley, “Von Neumann Thought Turing’s Universal Machine Was ‘Simple and Neat’: But That Didn’t Tell Him How to Design a Computer,” *Communications of the ACM* 63, no. 1 (December 20, 2019): 26–32.
- 7 Donald E. Knuth, *The Art of Computer Programming*, vols. 1–4 (Reading, MA: Addison-Wesley Professional, 1962–1973), v.
- 8 Warren S. McCulloch and Walter Pitts, “A Logical Calculus of the Ideas Immanent in Nervous Activity,” *Bulletin of Mathematical Biophysics* 5 (1943): 115–33.
- 9 Noam Chomsky, “On Certain Formal Properties of Grammars,” *Information and Control* 2, no. 2 (June 1, 1959): 137–67.
- 10 Leo Marx, “Technology: The Emergence of a Hazardous Concept,” *Social Research* 64, no. 3 (1997): 965–88.
- 11 Thomas Nagel, *The View from Nowhere* (Oxford: Oxford University Press, 1986).

- 12 Philip E. Agre, "Toward a Critical Technical Practice: Lessons Learned in Trying to Reform AI," in *Social Science, Technical Systems, and Cooperative Work: Beyond the Great Divide*, ed. Geoffrey C. Bowker, Susan Leigh Star, Les Gasser, and William Turner (Mahwah, NJ: Lawrence Erlbaum Associates, 1997), 131–57. See also Matthew Fuller, *Behind the Blip: Essays on the Culture of Software* (New York: Autonomedia, 2003); Rob Kitchin and Martin Dodge, *Code/Space: Software and Everyday Life* (Cambridge, MA: MIT Press, 2011); Nick Montfort et al., *10 PRINT CHR\$(205.5+RND(1)); : GOTO 10* (Cambridge, MA: MIT Press, 2012); Trebor Scholz, ed., *Digital Labor: The Internet as Playground and Factory* (New York: Routledge, 2013); Nathan Altice, *I Am Error: The Nintendo Family Computer/Entertainment System Platform* (Cambridge, MA: MIT Press, 2015).
- 13 Janet Abbate, *Recoding Gender: Women's Changing Participation in Computing* (Cambridge, MA: MIT Press, 2012), 19–20.
- 14 Marie Hicks, *Programmed Inequality: How Britain Discarded Women Technologists and Lost Its Edge in Computing* (Cambridge, MA: MIT Press, 2017).
- 15 Hicks, *Programmed Inequality*, p.35.
- 16 Bernard Geoghegan has made a broadly similar point about the post-war cybernetics movement, led by male mathematicians and engineers but strongly influenced by women such as the anthropologist Margaret Mead.
- 17 Abbate, *Recoding Gender*, 20.
- 18 Abbate, *Recoding Gender*, 103.
- 19 Abbate, *Recoding Gender*, 74. Abbate notes that women began to disappear from the computer industry at the same time as the field of software *engineering* was defined, the assumption being that men were better suited to 'engineering' roles.
- 20 Nathan L. Ensmenger, *The Computer Boys Take Over: Computers, Programmers, and the Politics of Technical Expertise* (Cambridge, MA: MIT Press, 2010).
- 21 Jonathan Flowers in Justin Hendrix, "The Whiteness of Mastodon," *Tech Policy Press*, podcast, November 23, 2022, <https://techpolicy.press/the-whiteness-of-mastodon/>, accessed July 17, 2023. Based on Sara Ahmed, "A Phenomenology of Whiteness," *Feminist Theory* 8, no. 2 (2007): 149–68.
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- 26 The United Kingdom's Colossus machine, known for the involvement of Alan Turing, likewise received funding from military budgets, specifically for code-breaking work related to Germany's Enigma devices. See B. Jack Copeland, *Colossus: The Secrets of Bletchley Park's Codebreaking Computers* (Oxford: Oxford University Press, 2006). For an overview of British military computing, see Jon Agar, "The Military Machine?" in *The Government Machine: A Revolutionary History of the Computer* (Cambridge, MA: MIT Press, 2003), 263–92.

- 27 Martin Campbell-Kelly et al., *Computer: A History of the Information Machine* (New York: Westview Press, 2013), 77.
- 28 Paul Ceruzzi, "'Nothing New Since von Neumann': A Historian Looks at Computer Architecture, 1945–1995," in *The First Computers: History and Architectures*, ed. Raúl Rojas and Ulf Hashagen (Cambridge, MA: MIT Press, 2000), 195–217.
- 29 Paul E. Ceruzzi, *A History of Modern Computing* (Cambridge, MA: MIT Press, 2003), 182–86.
- 30 G. E. Moore, "Cramming More Components onto Integrated Circuits," *Electronics* 38, no.8 (April 19, 1965), 114–17.
- 31 Lisa Parks, *Cultures in Orbit: Satellites and the Televisual* (Durham: Duke University Press, 2005).
- 32 Paul Ceruzzi, "Moore's Law and Technological Determinism: Reflections on the History of Technology," *History and Technology* 46, no. 3 (2005): 584–93.
- 33 Campbell-Kelly et al., *Computer*, 219–25.
- 34 Yuk Hui, *On the Existence of Digital Objects* (Minneapolis: University of Minnesota Press, 2016), 172. See also E. F. Codd, "A Relational Model of Data for Large Shared Data Banks," *Communications of the ACM* 13, no. 6 (June 1, 1970): 377–87.
- 35 See, for example, Alan Liu, "Where Is Cultural Criticism in the Digital Humanities," in *Debates in the Digital Humanities* (Minneapolis: University of Minnesota Press, 2012), pp490–509.
- 36 For example, Allende's Chile, via the Cybersyn national computing system designed by British organizational theorist Stafford Beer. See Eden Medina, *Cybernetic Revolutionaries: Technology and Politics in Allende's Chile* (Cambridge, MA: MIT Press, 2011).
- 37 Norbert Wiener, *Cybernetics: Or, Control and Communication in the Animal and the Machine* [1948] 2nd ed. (Cambridge, MA: MIT Press, 1961).
- 38 Wiener, *Cybernetics*, 42.
- 39 Bernard Dionysius Geoghegan, "From Information Theory to French Theory: Jakobson, Lévi-Strauss, and the Cybernetic Apparatus," *Critical Inquiry* 38, no. 1 (September 1, 2011): 97. Geoghegan's emphasis.
- 40 Geoghegan, "From Information Theory to French Theory," 98.
- 41 Bernard Dionysius Geoghegan, "The Historiographic Conceptualization of Information: A Critical Survey," *IEEE Annals of the History of Computing* 1, no. 1 (March 31, 2008): 66–81.
- 42 Wiener, *Cybernetics*, 42.
- 43 Geoghegan, *Code: From Information Theory to French Theory* (Durham: Duke University Press, 2023), 25.
- 44 Wiener, *Cybernetics*, 12.
- 45 Robin Hill, "Norbert Wiener and the Counter-Tradition to the Dream of Mastery," *Configurations* 2, no. 1 (1994): 62.
- 46 Peter Galison, "The Ontology of the Enemy: Norbert Wiener and the Cybernetic Vision," *Critical Inquiry* 21, no. 1 (October 1, 1994): 228–66.
- 47 Marshall McLuhan, *Understanding Media: The Extensions of Man* [1964] (Cambridge, MA: MIT Press, 1994), 7.
- 48 McLuhan, *Understanding Media*, 248.
- 49 Friedrich Kittler has convincingly argued that the transition from gramophone, film, and typewriter to computing was less wrenching than the movement from 'natural' to mechanized modes of work, but that is more an elaboration of McLuhan's work than a refutation of it. See Friedrich A. Kittler, "Gramophone, Film, Typewriter," in *Literature, Media, Information Systems: Essays* (Amsterdam: G + B Arts International, 1997), 31–49.
- 50 Lev Manovich, *The Language of New Media* (Cambridge, MA: MIT Press, 2001), 43.

- 51 Seb Franklin, *Control: Digitality as Cultural Logic* (Cambridge, MA: MIT Press, 2015), 104.
- 52 Ronald R. Kline, *The Cybernetics Moment: Or Why We Call Our Age the Information Age* (Baltimore: Johns Hopkins University Press, 2015), 153–54.
- 53 Ronald R. Kline, “Cybernetics, Automata Studies, and the Dartmouth Conference on Artificial Intelligence,” *IEEE Annals of the History of Computing* 33, no. 4 (April 2010): 5–16.
- 54 Ceruzzi, “‘Nothing New Since von Neumann,’” 204.
- 55 A major reason for the so-called Y2K scare, where it was feared the change in the millennium would render countless computing systems obsolete due to code that could not account for the change to the year 2000.
- 56 For an excellent overview of the development of the IBM System/360 and associated operating system, a process which led to staff burnout and possibly the heart attack of Tom Watson Jr. (son of IBM founder Thomas J. Watson), see James W. Cortada, *IBM: The Rise and Fall and Reinvention of a Global Icon* (Cambridge, MA: MIT Press, 2019), 216–31.
- 57 Frederick P. Brooks, *The Mythical Man-Month: Essays on Software Engineering* (Boston: Addison-Wesley, 1975).
- 58 Vannevar Bush. ‘As We May Think’. *The Atlantic Monthly* 176 (July 1945): 101–108.
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- 60 Doug Engelbart, *Augmenting Human Intellect: A Conceptual Framework* (Menlo Park: Stanford Research Institute, 1962).
- 61 Paul E. Ceruzzi, *Computing: A Concise History* (Cambridge, MA: MIT Press, 2012), 121. See also Paul E. Ceruzzi, “The Internet Before Commercialization,” in *The Internet and American Business*, ed. Paul E. Ceruzzi and William Aspray (Cambridge, MA: MIT Press, 2008), 9–43.
- 62 Ceruzzi, *Computing: A Concise History*, 132; see also Paul E. Ceruzzi, *Internet Alley: High Technology in Tysons Corner, 1945–2005* (Cambridge, MA: MIT Press, 2011).
- 63 For example, Janet Abbate, *Inventing the Internet* (Cambridge, MA: MIT Press, 2000); Tim Berners-Lee and Mark Fischetti, *Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web by Its Inventor* (New York: Harper San Francisco, 1999).
- 64 Ceruzzi, *A History of Modern Computing*, 307–44; Berners-Lee and Fischetti, *Weaving the Web*.
- 65 Franklin, *Control*, xiii.
- 66 Manuel Castells, *The Rise of the Network Society: The Information Age: Economy, Society, and Culture*, vol. 1 (Hoboken: Wiley-Blackwell, 2011), 214. Castells’s emphasis.
- 67 Castells, *The Rise of the Network Society*, 18.
- 68 Alexander Galloway, *Uncomputable: Play and Politics in the Long Digital Age* (Brooklyn: Verso, 2021), 61–68.
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- 76 Thomas J. Misa, *From Leonardo to the Internet: Technology and Culture, from the Renaissance to the Present* (Baltimore: Johns Hopkins University Press, 2004), 220–21.
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3

THE DIGITAL MODERN

In a remarkably prescient analysis in 1976, the American media theorist Herbert Schiller claimed that the “[i]nability to recognize the social origins of technology explains, in large part, the sense of helplessness that pervades most advanced industrialized states today”.¹ He believed that technology introduced after World War Two had “...demonstrated an overwhelming tendency to degrade the ecosystem” and undermine Western society.² Citing a former director of the United States Information Agency, he predicted that those tendencies would only accelerate in the future, propelled by electronic networks that would “...move massive amounts of information through high-speed circuits across national boundaries” and be beyond the reach of traditional forms of censorship and control.³ This open vision of electronic networks was dominant for several decades and provided the basis for many of the strange cultural and ideological beliefs explored in this chapter.⁴ Schiller’s prediction encapsulated the ambivalent attitude of early theorists of the digital age, including postmodern theorists such as Gilles Deleuze and Félix Guattari, who were wary of the computational turn but willing to embrace its futuristic potential.⁵ Their language was anchored in the discourse of post-industrialism and globalization and feels out of place in a world of mobile phones and social media. This is because those earlier theories of computational economy and culture emerged before the ideological foundations of digital modernity were fully formed.

I began exploring cultural and ideological aspects of digital modernity in *The Digital Humanities and the Digital Modern* (2017),⁶ motivated by Scott Lash’s comment that in contemporary society “the accumulation of capital is at the same time (increasingly) the accumulation of information”.⁷ Guided by his theory of reflexive modernity, I made the mistake of conflating the aesthetic

and ideological aspects of digital modernity with its material and economic foundations. This is a category error of some importance, collapsing ideological and sociological aspects into one object of analysis. In Weberian terms, it might suggest the conflation of value spheres under digital conditions, where digital modernity refers to the material and institutional rationalization of the digital age (technical systems, capitalist infrastructures, bureaucratic and economic orders, surveillance architectures) and the digital modern refers to the cultural-ideological expression of that rationalization (aesthetic sensibilities, ideological narratives, cyberutopianism).⁸ Weber's concept of value spheres cannot support analysis of the digital modern, however, which mediates multiple domains that lack an irreducible aim.⁹ The digital modern is at once cultural, ideological, political, artistic, and economic, intermediated by shifting assemblages of data, algorithms, and computational infrastructure. If we were to attempt to capture its essence, we might refer to it as the *zeitgeist* of digital modernity, shaped by TED-style public pedagogies and platform virality. In historical terms, it represents the background cultural and intellectual patina to everyday life, inflected with the rhetoric and marketing of digital platforms and services.

This suggests the digital modern is better understood as a "form of life".¹⁰ This term was prevalent in the nineteenth century, understood as "a set of implicit, tacit know-hows that are manifested in the naturalness of people's behavior in various, often complex social contexts".¹¹ Ludwig Wittgenstein famously used the term in fleeting but highly influential contexts to refer to "the everyday shared and unreflective background of practices and know-how that is the natural environment of language, a form of agreement or consensus manifested in human activities that is presupposed by language and culture itself".¹² In this sense, a form of life provides the context for human society and community, grounded in language and common custom.¹³ Intriguingly, Anna Boncompagni suggests that Wittgenstein might have been influenced by Alan Turing in his understanding of forms of life, noting that they were in communication and "far from being a computational reductionist, as he has often been portrayed, Turing was in fact interested in and worked on the *human* foundation of logic and on machines as they can be *used* by human beings".¹⁴ If we accept this possible connection between forms of life and the foundations of computing, we can define the digital modern as the linguistic, ideological, and cultural complex that emerges from the assemblages that comprise digital modernity, grounded in computational logic but fundamentally *human* in its expression.

The relationship between the digital modern and digital modernity is orthogonal to the relationship between modernism and modernity. Modernism signalled an artistic revolution in aesthetics and cultural production that we now view quite separately from modernity proper and see clearly when it is deployed for ideological effect. Although contained within modernity,

modernism refers to culture and the life of the mind rather than its material, social, and economic foundations. Echoing Wittgenstein, Timothy Reiss notes that modernism reflected the fact that earlier ways of thinking about life experience “were simply rendered irrelevant by first understanding and then leaving behind the discourse that had earlier been dominant but whose internal contradictions and inescapable limits had now become insufficient to the development of human relations”.¹⁵ The digital modern is our equivalent, providing a new context for human society and culture in an age of global computing. As Boncompagni notes, “referring to forms of life means indicating the terrain where meanings obtain their life and hence the place where a better understanding of such meanings is achievable”.¹⁶

The 1990s were a crucial decade for the development of the digital modern, acting as a crucible for socio-technical and cultural ideas that emerged from early engagement with the Internet and World Wide Web (WWW). Gabriele Balbi has provided the most complete description, charting development from Schiller’s nascent system of computational culture into “a type of secular religion that requires trust in the future and optimism”.¹⁷ In 1995, British sociologists Richard Barbrook and Andy Cameron diagnosed the central mechanisms in precise terms. They claimed the Western world was in thrall to a Californian Ideology that had embraced “an optimistic and emancipatory form of technological determinism”¹⁸ characterized by a confused mix of New Left and New Right politics and propelled by the failure of the American counterculture and the ascendance of neoliberalism. Rather than delivering the cyberutopia promised by *Wired* magazine (established two years earlier), Barbrook and Cameron predicted Silicon Valley would produce increasing levels of dislocation and uncertainty. In their estimation, rather than heralding a new age of democratization and freedom of expression, the “information superhighway” championed by Al Gore would only produce greater polarization and inequality.¹⁹ Their analysis was based on a rejection of the “retro-utopia” at the core of Silicon Valley discourse, which promised a heady mixture of eighteenth-century libertarianism and science fiction.²⁰

Calling for Europeans to reject the *laissez-faire* capitalism of Silicon Valley and design “the next stage of modernity” for the benefit of all society, Barbrook and Cameron called for the “rebirth of the modern” according to revolutionary principles derived from the French rather than American revolution.²¹ The culture they critiqued evolved from a quite different historical, geographic, and cultural context, of course, associated with white male hacker culture in the United States.²² The community initially cohered around American brands such as Radio Shack, which had its roots in post-war home electronics culture.²³ These young men were social outsiders, more at ease with crystal radio sets than mainstream media culture and quite the opposite of the cool insiders they were later to become.²⁴ Their social status and the rudimentary nature of the personal computers they used belied their later ascent

to global cultural and financial dominance.²⁵ Machines such as the Altair 8800, released in 1974, were so unreliable and had such limited functionality that they only appealed to the most devoted and technically motivated market.²⁶ Few people at the time thought computers would be of any use outside business, and common wisdom suggested the world would only need a handful of mainframes to fulfil all possible use cases. Early computer hackers associated with initiatives such as the Homebrew Computer Club (which counted Apple's Steve Jobs and Steve Wozniak among its membership) were more interested in circuit boards than culture.

This was offset somewhat by the interventions of counterculture figures such as Stewart Brand, who had already seen the potential for computers to enhance "the richness and rigor of spontaneous creation and of human interaction", but it remained a relatively inward-looking community until the early years of the new millennium.²⁷ The discourse of this period connected computing to the central tropes of the emerging Californian Ideology in quite straightforward ways: electronics promised revolution as well as control, romanticism, futurism, and enlightenment. The 1980s and 1990s witnessed a heady mix of products and services associated with this modernist aesthetic and designed around the new affordances of hypertext and multimedia audio and video, such as the *Encarta Encyclopedia* delivered on CD-ROM and the "electronic mall" CompuServe. In 1983, *Time* magazine named the computer (not a person) "Man of the Year".²⁸ In the same decade, IBM released their personal computer with a marketing campaign that used an actor portraying Charlie Chaplin to position the machine as the ultimate symbol of "modern times". Balbi perceptively notes the association of this kind of marketing with themes of revolution and change:

Like a snake sheds its skin when the outer layer is no longer flexible, so the digital revolution must change some element when its thrust seems to wane, be aging, or is just losing its attraction. However, the change only occurs in the most superficial layer (the sexiest name or the latest and smartest device replaces the previous ones or again a new "big event" or "next big thing" that forces the redating of previous histories), while the deeper layer, the underlying arguments and narratives, the true ideological core, always seems to remain immutable.²⁹

Fred Turner has convincingly portrayed this as the inception of "digital utopianism".³⁰ Financial speculation and utopian boosterism followed, as the union of computing and culture appeared to hold the promise of new paradigms in publishing and media. Coupled to a masculine culture of autonomy and anti-intervention that the digital modern has continually gratified, a powerful rhetorical and cultural fabric was established. Cyberutopian and corporate fantasies about the end of work, electronic democracy, and the frictionless

potential of electronic commerce were integral to the earliest phases of digital culture.³¹

Douglas Rushkoff's *Cyberia: Life in the Trenches of Hyperspace* (1994) provides an example of the cultural soup, a version of Tom Wolfe's *Electric Kool-Aid Acid Test* (1968) for the electronic age. The cult book described a wacky culture populated by computer nerds influenced by psychedelics and convinced they were at the forefront of a utopian sea change that would usher in global democracy and radical new modes of creativity and work. Rushkoff's narrative was populated by leading figures in the technology industry (from Ted Nelson and Steve Jobs to senior figures in IBM), but was outlandishly uncritical. *Cyberia* unknowingly documented the lack-logic at the core of the digital modern:

Cyberians interpret the development of the datasphere as the hardwiring of a global brain. This is to be the final stage in the development of "Gaia" the living being that is the Earth, for which humans serve as the neurons. As computer programmers and psychedelic warriors together realize that "all is one," a common belief emerges that the evolution of humanity has been a willful progression toward the construction of Cyberia, the next dimensional home for consciousness.³²

The book was part of a wider culture of New Age spiritualism that infused the 1990s with pseudo-intellectual millenarianism expressed in best sellers such as James Redfield's *The Celestine Prophecy: An Adventure* (1993),³³ but Rushkoff's intellectual debts to Marshall McLuhan's *Understanding Media: The Extensions of Man* (1964) were also clear, in the focus on the cultural and political potential of electronic media. The result was ideologically blinkered prose that reads like the product of a stoned undergraduate.

The community Rushkoff described did not appear particularly intellectually or economically astute, and it was not initially clear to investors that the emerging technical infrastructure that so inspired the culture of *Cyberia* could support robust forms of global commerce. This was the case even after the release of the Netscape Navigator web browser in 1994 and Microsoft's Windows '95 operating system the following year, which greatly increased the utility of the WWW. Even after the widespread adoption of Netscape Navigator and the integration of networking technology into Windows '95, payment systems remained immature, and users were wary of making transactions online. For several years, it appeared that the web might be primarily used for its original purpose of sharing scientific research³⁴ and artistic purposes such as the creation of browser art or the dissemination of free literature and historical source documents.³⁵ It is difficult to understate the contingent and delicate nature of 1990s digital modernity, dependent on a group of cultural misfits and constrained by a distinct gap between vision and reality. Academic and

public sector experimentation and electronic art provided hope, but economic sustainability was a serious problem.

Start-up firms struggled to develop viable business models well into the 1990s. It appeared unlikely that publishing on the web would ever be profitable beyond offering supplemental marketing material for offline content. In 1999, writing about the preceding “e-decade” and dismayed by the hucksterism and financial speculation he had failed to predict, Michael Wolff wryly noted that:

Some of us who go back a ways in the Internet era now use the word as a punch line. We say “the Internet,” and then we crack up. I mean, come on, here we are in the middle of an economic miracle – a whole new culture, in fact – that is founded on a technology that (a) has no demonstrable way to pay for itself, (b) has no precise use, (c) doesn’t really work all that well, and (d) whose very existence has to do, fundamentally, with porn.³⁶

The situation was resolved in resounding fashion with the bursting of the dot-com bubble a few months later. The Nasdaq Composite index dropped 78% from its peak over a two-year period (March 2000–October 2002), forcing young companies to either find ways to produce shareholder value or collapse.³⁷ This phase in the development of the digital modern was decidedly flaky, in both cultural and economic terms.

Economic commentators were keenly aware of parallels to the Great Depression in the later years of industrial modernity.³⁸ Many were sceptical that viable business models could be found, even for companies such as Google that were beginning to dominate the Internet. Boosters waxed eloquent about open-source software and free culture, but it became increasingly apparent that established media companies were being undermined without hope of compensation.³⁹ File sharing services such as Napster were presented as the start of an alternative economy but undermined established notions of commodity exchange.⁴⁰ To cap it off, the so-called Y2K bug threatened an imminent and catastrophic entry to the twenty-first century.⁴¹ Dozens of technology companies failed in this period, many of them little more than an expensive domain name backed by the hope of a future market. Google’s discovery that data produced during searches could be used to target advertisements saved the company and provided a source of income to thousands of others,⁴² and Amazon’s successful transition to online shopping allowed for the replication and global scaling of bricks and mortar retailing, but the financial vigour of earlier periods of modernity failed to emerge.⁴³

The economic foundations of digital modernity depended on historical tragedy as much as technical innovation. Sweeping emergency powers implemented after the 9/11 attacks on New York in 2001 amplified the market position of incumbents such as Google and Amazon (and already established

companies such as Microsoft and IBM) by renewing connections between Silicon Valley firms and the American military-industrial complex. Shoshana Zuboff has also pointed out that the event resulted in the implementation of legal and political frameworks that increased the potential for public surveillance, requiring a scale-up of intelligence infrastructure.⁴⁴ Pumping investment into the carcass of Cyberia, the United States government outsourced information management and a significant amount of their intelligence gathering functions to the technology companies that had the infrastructure necessary to gather, store, and analyse global-scale data flows. Other countries followed suit, establishing a technological power dynamic that has progressively ramped up. This was a signal event in the development of the digital modern too, channelling government resources into a previously fringe male culture of hackers and nerds. Post-war suburban privilege symbolized in crystal radio sets and electronic culture gave way to a new and more forceful sense of the digital modern entangled with culture, capitalism, surveillance, and warfare.

Although imperceptible at the time, a political swing from the left to the right of the political spectrum occurred in Silicon Valley at the same time, as nerdy young men were forced to choose whether to live their dreams of electronic freedom or embrace the economics of hyper-capitalism. This tendency evolved into more full-blown commitments to reactionary modernity in later years, through figures such as Peter Thiel, but the situation was not inevitable, even accepting the political and intellectual naiveté of Cyberian culture.⁴⁵ It seems obvious in hindsight that the goofy “revenge of the nerds”⁴⁶ celebrated by Rushkoff was vulnerable to control by the State and destined to collapse under the weight of its own pretensions, but the sociopolitical and technological context was as complex as any previous era and could have produced different outcomes. Political philosopher Katrina Forrester provides a brilliant description of these dynamics in *In the Shadow of Justice*.⁴⁷ The historical parallels to previous *fin de siècle* eras are instructive too, drawing attention towards technological change, global commerce, and geopolitical power.⁴⁸ The foundations of digital capitalism were established in the period, but the development of a mature global digital economic system was far from inevitable and relied on a complex mixture of Silicon Valley culture, the military-industrial complex, and the economics of consumer marketing.⁴⁹

Whatever the balance between these components (future research will no doubt offer more nuanced interpretations), the absurdist fallacies of Cyberia were transformed over the course of the millennium into a mature version of the digital modern. The situation was forecast by Marshall McLuhan 30 years earlier.

The Greek myth of Narcissus is directly concerned with a fact of human experience, as the word *Narcissus* indicates. It is from the Greek word *narcosis*, or numbness. The youth Narcissus mistook his own reflection in the

water for another person. This extension of himself by mirror numbed his perceptions until he became the servomechanism of his own extended or repeated image. The nymph Echo tried to win his love with fragments of his own speech, but in vain. He was numb. He had adapted to his extension of himself and had become a closed system.⁵⁰

The transition from late modernism to the digital modern occurred in precisely these terms, with the young men of Cyberia playing the role of Narcissus.

The immediate post-millennial years were crucial to this process. Google's PageRank search algorithm and AdWords advertising platform were central to the transition, providing a level of infrastructural sophistication capable of supporting digital culture.⁵¹ Social media Web 2.0 products began to appear in 2003 with the establishment of Myspace (Facebook launched the following year), and Apple's release of the iPhone in 2007 heralded the start of a boom in mobile phone and app technology.⁵² The dot-com crash was soon forgotten, and the heights of optimism were regained with the IPO of Facebook in 2012, at a record-breaking market capitalization of US\$104 billion.⁵³ The wackier aspects of Cyberian culture fell away, and the fundamental components of the digital modern became culturally ascendant. The sociocultural and economic momentum gained at the turn of the century was enough to propel "Big Tech" forward, aided by increasing global reach and muted responses from governments and regulators content to trust in self-regulation.

The period from the development of Google AdWords in 2000 to the revelations of Edward Snowden in 2013 witnessed the foundational decade of the digital modern, when all of its component parts cohered and criticism was muted. It is no coincidence that this was also the period in which computational research fields such as humanities computing were rebranded as "digital" to keep up with changes in the global knowledge economy. Trenchant criticisms of the technology industry were common, but the digital modern was in the ascendancy, propelled by slick marketing and initiatives such as TED Talks that presented "thought leadership" in easily digestible forms. The new millennium revelled in post-history, post-criticism, and postmodernity in the most straightforward sense of those terms. Few robust rejoinders could be found.⁵⁴ Historical awareness reduced from centuries into months and years, and the Californian Ideology hardened into dogma.

It is worth pausing to consider the implications of this transition for humanities and social science (HASS) researchers, who have long been the most vociferous critics of the Californian Ideology. As with our connections to the "cybernetic apparatus" described by Bernard Geoghegan, the news is not all good.⁵⁵ It is of profound significance that the transition from electronic to digital culture and ideology coincided with the high point of postmodern theory espoused by leading HASS scholars over the course of the millennial turn.⁵⁶ Despite their sensitivity to hyper-rationalism, such writers often embraced

Cyberian discourse. In *The Condition of Postmodernity* (1990), David Harvey considered “[t]he work of art in an age of electronic reproduction and image banks”.⁵⁷ In their masterpiece of postmodern theory, Gilles Deleuze and Felix Guattari claimed that “[b]inary logic is the spiritual reality of the root-tree”,⁵⁸ an expression of a more fundamental reality obscured by the modern focus on rationalization and hyper-rational modes of thinking. Beatrice Fazi has noted that Deleuze retained an “overt suspicion towards the computational” and wrote very little about it, but “his metaphysical vocabulary of rhizomes, assemblages, bodies without organs, and abstract machines abound in media theory syllabi as a means of explaining the condition of living in a networked information society”.⁵⁹ The affinities with the discourse of Cyberia are striking, with rhizomes taking the place of fractal mathematics.

Postmodern attitudes to technology were famously ambivalent. Historian of technology Leo Marx has suggested that despite claiming to have broken free (or having been thrown free by the end of history), postmodern theorists continued to position technology as the “chief agent of change in an increasingly deterministic view of history”.⁶⁰ Despite claiming to have entered a fundamentally new period of modernity, writers and critics engaged with the exotica of machines and technology that coloured human experience from the guillotine to the “technological sublime” of the nineteenth and twentieth centuries.⁶¹ Jean-François Lyotard began his analysis of the postmodern condition with a description of “Knowledge in Computerized Societies”, positioning computers as a nascent form of hypermedia capable of ushering in an epistemological and material sea-change, in much the same way as the industrial revolution had purportedly fostered class-based politics through the thought of Karl Marx.⁶²

The digital modern thrived in this context, the affinities between cyberutopia, popular culture, and capitalism combining to offer the semblance of intellectual sophistication. As Alan Liu has suggested, the historical weightlessness celebrated by postmodernism can just as easily be interpreted as a failure to decide what kind of “historical sense-making”⁶³ was appropriate, making the culture particularly vulnerable to the kind of “servomechanical” transition forecast by McLuhan. It is important to read postmodern writers in context, with an awareness of their conceptual and aesthetic elegance, but they were as implicated in the emergence of the ideology of the digital modern as the structuralist theorists of earlier decades were in the rise of the cybernetic apparatus. As important as it was for the more diverse and colourful cultural world we inhabit today, the postmodern critique of hyper-rationalism and the empowerment of the avant-garde enabled the Californian Ideology – and by extension the digital modern that sits at its heart.

Barbrook and Cameron’s call in 1996 to reinvigorate the critical theory of modernity was prescient in that regard. Their warning recognized that the digital modern contained tendencies towards both the left and right of the

political spectrum; a change of economic or political weather could easily flick it into a reactionary mode. The retreat to relativism by Continental philosophers and literary and cultural critics in the United States, United Kingdom, and British Commonwealth did not release them from the modern dilemma and in fact bonded them tightly to post-Kantian forms of speculative reason (*vernunft*) that aimed to “unify the opposition between unity and difference”.⁶⁴ Their laudable openness to popular culture made them vulnerable to technological path dependencies controlled by Silicon Valley, and their unwillingness to engage productively with practical aspects of digital technology disconnected them from powerful new modes of production. More profoundly, as Jürgen Habermas pointed out at the time, claims of a radical disjuncture between modernity and postmodernity required the elision of modernity’s tradition of self-criticism.⁶⁵ In disconnecting from history, postmodernists disconnected from their traditional sources of cultural and political power.

The dangers of the digital modern appeared abruptly for people convinced of the utopian potential of new forms of community organization and socializing. In May 2013, CIA contractor Edward Snowden leaked confidential documents detailing extensive American surveillance of the public Internet, leading to five years of mounting public backlash and government investigations of the technology sector.⁶⁶ This culminated in revelations of Russian interference in the 2016 US elections, the British EU referendum,⁶⁷ and the 2018 Cambridge Analytica scandal.⁶⁸ The period was characterized by frenzied speculation about the proper role of private companies and state actors in digital culture and economics, and opinion pieces claiming that “big data” had become the “oil” of the digital economy, debasing the cyberutopian vision with targeted advertising.⁶⁹ A turning point had been reached. The European Union’s 2016 General Data Protection Regulation (GDPR) legislation was important in this context. It amounted to a backlash from governments concerned about the growing power of multinational technology companies and their control of vast amounts of personal data and suggested that a degree of public sector control was possible.⁷⁰

The implications of these events seem obvious in hindsight. By this point in the development of the digital modern, mainstream technologies could be meaningfully compared to technologies such as steam and coal that powered earlier phases of modernity. A new aesthetic and ideological framework was the natural corollary. In 2020, Microsoft, Apple, Google, Amazon, and Facebook were worth almost US\$5 trillion⁷¹ (the size of the total GDP of Japan).⁷² Those firms were being challenged for market dominance by Chinese giants Baidu, Alibaba, and Tencent.⁷³ The sense of rapid change was palpable across many sectors of society, and digital “thought-leaders” and influencers found ready audiences. Commentators often fail to mention that the global technology market was also dominated by firms delivering core tools and infrastructure, such as Samsung, Hitachi, Huawei, Cisco Systems, Foxconn, IBM, and Oracle.⁷⁴ In a further sign that digital technologies were viewed as integral to

global culture, multiple governments (including China) considered invoking antitrust legislation designed to reduce the economic and political power of the largest technology companies.⁷⁵

Rather than looking forward to a cyberutopian “information superhighway” spreading democracy and knowledge around the world, as Al Gore did in 1994,⁷⁶ in 2016 American Senator Elizabeth Warren drew parallels between her moment in time and the 1930s when the United States government acted to break up large oil companies.⁷⁷ In 2020, The Financial Times newspaper reported that, rather than enabling the “end of work”⁷⁸ and Universal Basic Income (UBI) through the generation of socialized profits, lost tax revenues from Silicon Valley’s largest companies over the preceding decade stood at \$100bn.⁷⁹ In 2021, the Biden government proposed a global corporation tax to rein in large vendors.⁸⁰ This seriously undermined the digital modern but only insofar as it took on a darker aspect, veering into the antimodern and post-liberal rhetoric of misogynists and billionaire technologists such as Peter Thiel and Elon Musk. The description of Shoshana Zuboff, author of *The Age of Surveillance Capitalism*, as “the real prophet of the internet age” by *The Financial Times* in 2018 acts as a useful symbol of this turning point.⁸¹ There had been steady opposition to the integration of digital technologies into everyday life since the 1990s, but the process gained the attention of the general public when it became clear through best-selling books like Zuboff’s that, rather than imploding, the technology industry had extended its influence into the warp and weft of global culture, politics, and finance.⁸²

The resulting backlash led to the technology industry becoming increasingly embattled and moving further towards the political right to protect their deregulated environment. The 2020 coronavirus lockdowns accelerated this process. Writing in the *New York Times* during the pandemic, in a haze of Zoom meetings and Facebook posts, cultural critic Lee Siegel claimed the disease would thrust the middle-class out of “a bubble of complacent blindness to what truly matters in life”. He noted that this was most forcefully symbolized in the return of the word “viral” to its original epidemiological associations with contagion and death, rather than the rapid transmission of cultural content around the web. To Siegel phrases such as “slow the spread” and “flatten the curve” made “going viral” and “trending” sound like “telephone” and “typewriter”.⁸³ In hindsight, this process obscured the turn of the technology industry to the right of the political spectrum. As digital technology matured and faded into the background of people’s lives (more a necessary delivery mechanism than a magical new experience), the entanglement between the digital modern and populism grew.

The Russian invasion of Ukraine in February of 2022 signalled the end of any claim to innocence held by denizens of Cyberia, or anyone waiting for the imminent onset of cyberutopia. Faith in globalization and multilateralism fell away in the face of a return to Great Power competition. Attitudes hardened.

Difficult to grasp notions of surveillance capitalism and cyberwar were augmented with the kinetic brutality of trench warfare, refugee flows, and social dislocation. There were obvious echoes of the nineteenth century *fin de siècle* ending with the trauma of World War One in that moment, a reminder of the consequences of hyper-masculine idealism and the material necessity of reinforced concrete bunkers. Douglas Rushkoff's renunciation of his youthful vision for *Cyberia* that same year, in the publication of *Survival of the Richest: Escape Fantasies of the Tech Billionaires*,⁸⁴ signalled the end of a cultural and intellectual era too, defined by his belated recognition that "the once renegade web was pushing people toward predictability and conformism".⁸⁵ It was also pushing people towards populism. The chaos surrounding Elon Musk's purchase and subsequent reorientation of Twitter as the year inched towards its close underlined this transition.⁸⁶ The commercialization of generative AI and the increasing impact of cryptocurrencies signalled yet more change. It is not unreasonable to suggest that such technologies "could produce a wholesale restructuring of the political economic order", moving the digital modern even further from a sense of youthful idealism in future decades.⁸⁷ To what degree this will shape our experience of digital modernity remains to be seen.

Notes

- 1 Herbert I. Schiller, *Communication and Cultural Domination* (White Plains: International Arts and Sciences Press, 1976), 51.
- 2 Schiller, *Communication and Cultural Domination*, 53.
- 3 Schiller, *Communication and Cultural Domination*, 47.
- 4 Nick Srnicek, *Platform Capitalism* (Cambridge: Polity Press, 2016).
- 5 Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia* (London: Athlone Press, 1988).
- 6 James Smithies, *The Digital Humanities and the Digital Modern* (London: Palgrave Macmillan, 2017).
- 7 Scott Lash, "Reflexivity and Its Doubles," in *Reflexive Modernization: Politics, Tradition and Aesthetics in the Modern Social Order*, ed. Ulrich Beck, Anthony Giddens, and Scott Lash (Cambridge: Polity Press, 1994), 129.
- 8 Max Weber, "Religious Rejections of the World and Their Directions" [1915], in *From Max Weber: Essays in Sociology*, ed. H. H. Gerth and C. Wright Mills (London: Routledge, 1946), 323–59.
- 9 Ulrich Steinworth, "Value Spheres Defined and the State," in *Rethinking the Western Understanding of the Self*, ed. Ulrich Steinworth (Cambridge: Cambridge University Press, 2009), 101–10.
- 10 Anna Boncompagni, *Wittgenstein on Forms of Life* (Cambridge: Cambridge University Press, 2022).
- 11 Boncompagni, *Wittgenstein on Forms of Life*, 6.
- 12 Boncompagni, *Wittgenstein on Forms of Life*, 13.
- 13 The canonical reference is usually made to Ludwig Wittgenstein, *Philosophical Investigations* (New York: Macmillan, 1958), Part 1 §19: "It is easy to imagine a language consisting only of orders and reports in battle. – Or a language consisting only of questions and expressions for answering yes and no. – And innumerable others. – And to imagine a language means to imagine a form of life."

- 14 Boncompagni, *Wittgenstein on Forms of Life*, 14. Boncompagni's emphasis.
- 15 Timothy J. Reiss, *The Discourse of Modernism* (Ithaca, NY: Cornell University Press, 1982), 385.
- 16 Boncompagni, *Wittgenstein on Forms of Life*, 59.
- 17 Gabriele Balbi, *The Digital Revolution: A Short History of an Ideology* (Oxford: Oxford University Press, 2023), 77. One of the benefits of Balbi's approach is his flexible attitude to terminology, noting that although he feels 'digital revolution' has the most explanatory power, "[y]ou will have noticed that all of the 'parallel expressions' to the digital revolution mentioned so far are missing the adjective 'digital,' a true keyword in the last several decades around which a number of investment streams have been generated. In fact, the sixth and final family of parallel expressions puts the emphasis on digital with phrases such as digital disruption, digital transition, and, above all, digital transformation", 27.
- 18 Richard Barbrook and Andy Cameron, "The Californian Ideology," *Science as Culture* 6, no. 1 (1996): 62.
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4

THE PUBLIC SPHERE

Modernity has produced increasingly diverse and open modes of public discourse, but this has not been a straightforward or linear process. Improvements have been socially and culturally uneven, complicated by political and economic factors, and have often gone backwards for decades at a time. Our feelings about the quality of information in our online spaces are connected to this reality, shaped by the depth of our historical consciousness. Eelco Runia might suggest that our relationship to the past determines our ability to engage with its ongoing “presence” in our lives; the longer our terms of reference, the deeper our engagement with its lessons.¹ If access to quality information increases across society, digital technology is perceived to be a valuable enabler of the positive aspects of modernity; if it is diminished, technology is cast as a harbinger of disaster.² The idea of the public sphere refuses to completely disappear but can appear inadequate next to the algorithmic challenges of the twenty-first century. Reconfiguring our understanding in the context of digital modernity is important because of this. It offers a sense of historical development over centuries rather than decades, allowing us to better gauge the impact of digital technology on discourse.

Sociologists have identified four generic interpretations of the public sphere, reaching back to the work of political theorists such as J.S. Mill in the nineteenth century, but its clearest articulation appeared over the course of the millennial turn.³ In *The Philosophical Discourse of Modernity* (1987), Frankfurt School sociologist Jürgen Habermas identified the public sphere as one of modernity’s central features, claiming it constitutes an *agora* or discursive space where social, cultural, and political ideas can be shared, tested, and refined.⁴ His argument has been contested in some of its details but his basic thesis – that post-Enlightenment society was heavily dependent on the development

of a bourgeois public sphere separate from the state and the emerging market economy – is still broadly accepted. This space, developed in the coffee houses and public squares of Europe and North America, allowed for the free exchange of ideas and the circulation of news in distinction to more hierarchically structured and tightly controlled feudal mechanisms.

The public sphere functioned as a crucial component in the development of modernity, allowing disparities in religion, wealth, and status to be bracketed in the interests of the open and free exchange of ideas. Although not articulated using the nomenclature of twentieth-century social science, belief in the importance of an open public sphere to democracy led to the First Amendment of the Constitution of the United States, adopted on December 15, 1791, as part of the Bill of Rights.⁵ Protectiveness over the public sphere is a hallmark of cultural and intellectual life in contemporary liberal societies, extending from Herbert Marcuse's critique of *One Dimensional Man* (1964)⁶ to Elon Musk's support for "free speech absolutism" on Twitter (2022).⁷ Interestingly, although such statements have become commonplace, the connection to modernity is rarely made. More frequently, the simple assumption is that the public sphere is at risk of corruption and needs protecting because (per Habermas) "...the state merely fulfils the functional imperatives of ... society and is itself an expression of its ruptured ethical dimension".⁸ If the public sphere becomes polluted, pollution of the state will inevitably follow. The disconnection between analysis of online speech, the public sphere, and modernity is thus an indication of a broader failure to connect the discourse of digital modernity with the broader discourse of modernity.

Discomfort with the theory of the public sphere and absurd cyberutopian claims about the potential of the Internet over the turn of the millennium contributed to this situation.⁹ In an influential article in *Constellations* in 2003, cultural theorist Jodi Dean claimed that "the Net is nothing like a public sphere".¹⁰ Her argument was curious, describing the ideal public sphere defined by Habermas but noting it never existed in its pure form, and that because of this, "it might be more productive to treat [it] as an ideological construct and subject it to ideology critique".¹¹ Dean concluded that the concept of the public sphere had been rendered redundant by the Internet because "the expansion and intensification of communication and entertainment networks yields not democracy but something else entirely: communicative capitalism".¹² Her rather tortured argument, at once denying the existence of the public sphere and claiming it had been polluted, is a classic example of the problems intellectuals faced as the scope and scale of the Internet and World Wide Web (WWW) expanded. Dean's analysis led to important insights, confirming the significance of Manuel Castells notion of "network society"¹³ and delineating the relationship between new media and marketing in a way that foreshadowed later articulations of surveillance capitalism,¹⁴ but in positioning Internet culture as radically different to previous modes of culture and identity, she

succumbed to much the same problems as the cyberutopians she aimed to critique.

A hint to the structure of Dean's argument can be found in her multiple uses of "cyberia" to refer to the WWW.¹⁵ This term was taken from media theorist Douglas Rushkoff's *Cyberia* (1994),¹⁶ discussed in [Chapter 3](#), an influential description of 1990s Silicon Valley that captured its spirit in a manner reminiscent of Tom Wolfe's *The Electric Kool-Aid Acid Trip* (1969).¹⁷ Dean's reflexive use of the term "cyberia" in an article rejecting many of the utopian assumptions implicit in Rushkoff's foundational text is intriguing. It is as if intellectuals were in the process of rejecting the wackier details of cyberutopianism, and especially aspects that pointed towards a future of surveillance capitalism, while wanting to hold onto a futuristic postmodern aesthetic. While on the one hand she notes that "the invocation of the public, or the territorialization of cyberia as a public, functions to authorize regulatory interventions", she often found herself:

in agreement with the view that the Net is nothing at all – that all of contemporary society should be understood as cyberia, as awash in a sea of flows and links and networks such that to isolate one communicative infrastructure on the basis of technology alone makes no sense.¹⁸

Castell's notion of network society allowed the spectacle of Cyberia and the offline world it was entangled with to be described recursively, positioning it outside the normal categories of modernity according to the architecture of the thing itself.

Dean's ambivalence about the public sphere was nothing new, however. In *The Open Society and Its Enemies* (1945), Karl Popper noted that, despite its ongoing importance to democracy and the free exchange of ideas, the modern public sphere (like its Greek antecedents) was exclusionary from the outset.¹⁹ This has been a common motif in historical sociology too. Habermas noted that in eighteenth century London women "...abandoned [by their husbands] every evening, waged a vigorous but vain struggle against the new institution..." of the coffee house.²⁰ The public sphere was a crucial element in the formation of Western liberal democracy and capitalism but instantiated many of its negative aspects. It was the central mechanism for the realization of Enlightenment ideals in society, culture, politics, and economics – an *agora* that generated the discourse and the structural foundations of modernity – but it was never homogeneous or singular in its effects on the democratic process. In 1995, John Thompson suggested that its emergence in eighteenth-century Europe "was not just an institutional development: it also had a moral-practical dimension."²¹

The reasons for this are complex. It is important not to view the public sphere as a monolithic reality existing in a binary relationship to a putative

“private sphere”. The argument that modern society can be defined in large part by the separation of public and private spheres (in distinction to mythical periods in history where public and private, sacred and profane, individual and communal, were inextricably connected) made some sense in very small enclaves of European countries from the late nineteenth century onwards but the continued influence of spiritual sentiment and morality in wider political and socio-economic culture (consider the influence of Catholicism in Italian-American culture or notions of *volk* and *Geist* in Nazism) suggests otherwise.²² The situation in non-Western and Indigenous cultures, exposed to modernity over centuries, complicates the picture further. Complaints that a putative pure public sphere has been progressively polluted since its establishment during the Enlightenment are in that sense a fiction. Dean was correct: in the Global North, the public sphere was a masculinist bourgeois construct designed to empower one section of society over others. Regulation and active efforts to widen participation have always been needed to ensure its contribution to civil society is continuously improved. As Craig Calhoun and Charles Taylor have pointed out, demagogues and elites have been able to manipulate the public sphere in low-tech ways since its inception; new media provides them with new tools but is not the reason they are motivated to manipulate it.²³

It would be “to impose a provincialism as universalism” to project the theory of the public sphere onto all communities and time-periods without caveats, therefore.²⁴ Unsurprisingly, public spheres emerged across the world at different times and places, through complex interactions between existing sociopolitical structures and modernity. The concept need not imply a single monolithic global (Western, male) public sphere, or only apply to post-Enlightenment secular society either. This is especially important to recognize in the context of digital modernity, where cyberutopian hopes for a single global public have proven to be illusory, undermined by multiple and continually fragmenting digital modernities. It is not that the digital public sphere does not exist, but that it is kaleidoscopic in nature and as much an *a priori* as a structural reality. The trolls and disinformation mills described by Nina Jankowicz in *How to Lose the Information War* (2021), who exploit the pluralistic nature of the contemporary public sphere to spread highly targeted messages, have a sophisticated understanding of this.²⁵

Feminist critics reached similar conclusions decades ago, noting that received theories of the public sphere oversimplify a complex sociopolitical reality. Nancy Fraser has questioned why sociological emphasis would be placed on a mechanism that was fundamentally limited from the outset. The eighteenth-century public sphere was a male bourgeois space, just as the *agora* had only been accessible by propertied slave owning men:

...there is a remarkable irony here, one that Habermas’s account of the rise of the public sphere fails fully to appreciate. A discourse of publicity touting

accessibility, rationality, and the suspension of status hierarchies is itself deployed as a strategy of distinction.²⁶

Fraser claimed that although the male bourgeois public sphere existed, it competed with other spheres that Habermas and later Frankfurt School commentators such as Herbert Marcuse ignored: women's institutes, working class marketplaces, ethnic and religious enclaves.²⁷ To Fraser, it seemed more accurate to view the Western public sphere as a "masculinist ideological notion that functioned to legitimate an emergent form of class rule" as much as an actual existing – and unproblematic – achievement.²⁸ Latin American feminists have come to similar conclusions, connecting "the constitution of a public sphere dominated by men" to the subjugation of the world-village (*mundo-aldea*).²⁹

The rise of digital culture has added new layers of meaning again, of course. As the columnist Laurie Penny notes, digital technology has expanded public discourse in potentially revolutionary ways:

[t]he public sphere is a whole lot more public, and a whole lot less predictable, than mid-century theorists ever anticipated ... [t]he public sphere now includes a great many people whose voices, if they were ever noted at all, were included in footnotes. Women, girls, queer people, people of colour, people living in the margins of our collective cultural script, are suddenly rewriting it.³⁰

This is the positive side of the argument, using the public sphere to measure progress towards liberal goals. Social media researchers have come to similar conclusions, noting that websites, blogs, and online forums have either dramatically expanded the scope of the public sphere or created a rival "virtual" public sphere in competition with the primary (traditional) offline public sphere.³¹ Jürgen Habermas has updated his theory to account for a "mode of semi-public, fragmented and self-enclosed communication [that] seems to be spreading among exclusive users of social media that is distorting their *perception of the political public sphere* as such".³²

Rather than rejecting the concept as inadequate, then, we would be advised to pay more attention to the public sphere's changing role in (and as an engine of) the digital modern (explored in [Chapter 3](#)) and digital modernity more broadly. Kaleidoscopic and contradictory, online and offline, the public sphere reflects and informs the development of the culture and politics of digital modernity. It is not only that the concept is fundamental to our sense of political economy, free speech, and justice, or that it is tainted with dubious origins. Something in digital modernity hides the public sphere from view. This might be the increased speed of information transfer, or its algorithmic mediation, or perhaps the increasing balkanization of the Internet by national firewalls that limit the free flow of information across borders,³³ or walled gardens such as

Twitter, Facebook, Reddit, WeChat, VKontakte, and Odnoklassniki that have fragmented communication. Messaging apps such as WhatsApp, Signal, and Telegram further complicate the public sphere by supporting closed groups that can engage in encrypted communication *across* geographic borders.³⁴ Given these examples, it is difficult to claim that the public sphere has ceased to exist (or never existed in the first place), but they raise serious definitional problems that Castell's theory of the network (as used by Jodi Dean) only partially solves.

While difficult to grasp and more difficult still to define, the public sphere is in rude health: a hybrid, pluralistic, non-dualistic, online-offline epiphenomenon entangled with multiple digital modernities that has the capacity to shift public opinion and influence current events. Complexities and contradictions abound.³⁵ During the Arab Spring of 2010–2011, social media was variously viewed as a digital *agora* capable of toppling undemocratic regimes and a paper tiger with limited ability to influence offline politics.³⁶ Zeynep Tufekci has subsequently suggested that the “networked public sphere” only acted as a tool in the service of activism, rather than fundamentally changing the nature of political dissent.³⁷ The 2016 US election Russian disinformation campaigns suggested to many commentators that digital technologies could destroy even the most mature democratic systems, but this now appears overly pessimistic.³⁸ During the coronavirus pandemic of 2020, the ensuing “perfect storm” of misinformation was expected,³⁹ but enough vaccinations were delivered to people to enable herd immunity. A 2023 paper in *Nature* concluded, while noting the difficulty of studying such phenomena, that changing the quality of information in Facebook's newsfeed did little to change the political beliefs of users.⁴⁰ The digital public sphere, with its fragmentation into “mutually incomprehensible”⁴¹ media bubbles and vast quantities of conflicting data, is as messy and inscrutable as its analogue corollary.⁴² There is reason to suspect that the appearance of “deep fake” video and images, produced *en masse* by generative AI tools, might finally tip the balance in favour of malicious actors, but that conclusion depends on a pessimistic view of human agency.⁴³

It is fallacious to assume that there has been a seamless progression from the mythical ideal public sphere of eighteenth-century Europe to the newsfeeds of contemporary platform companies, as popular discourse and research articles often suggest. This is the case even if we accept that a reduction in trust associated with the rise of digital media risks the public “compromising their critical judgment, their political knowledge, and the full exercise of democracy”.⁴⁴ Merely asserting the *possible* deleterious outcomes of misinformation does little to enhance our understanding of the public sphere. A more precise articulation of the problem lies in the perceived collapse of the public sphere's ability to support reasoned debate and democratic process. Crucially, when discussing the relationship between Enlightenment progress and public discourse, Pierre Bayle claimed that open debate enabled a transmutation of

private opinion into *opinion publique* that could then be acted upon by legislators to manage society. More pointedly, he claimed that inclusive public discussion led to insights enlightened rulers (we might now include unenlightened rulers) could not help but follow.⁴⁵

Edmund Burke famously offered a more negative perspective, claiming that the development of a radically free and open public sphere would lead to anarchy.⁴⁶ His (politically conservative, it should be noted) assumption was that increased access to information would lead to the fracturing of civil society into competing interest groups. A broadly similar line of argument has developed through social science research conducted since 2007, anchored by empirical studies exploring the role of digital technology in the polarization of public debate.⁴⁷ Concerns initially centred around the impact of the new digital economy, but widened as the impact of geopolitical rivalries became apparent and advances in technology enabled believable manipulation of video and the creation of fake personas.⁴⁸ Concern mounted as digital information grew in volume and sophistication, and signs of social dislocation proliferated. By 2016, technologists were warning of an “Infocalypse” of misinformation capable of undermining the democratic process of even the most mature governments.⁴⁹ A 2019 report by Data & Society noted that the ability of these technologies to manipulate “bodies, including one’s voice and likeness in increasingly routine ways”, was new and challenging.⁵⁰

Revealingly, however, the authors of the Data & Society report also pointed out that “...new media technologies do not inherently change how evidence works in society. What they do is provide new opportunities for the negotiation of expertise, and therefore power”.⁵¹ Pushing back on claims that AI-enabled techniques would lead to the “collapse of reality”, they pointed out that the “politics of evidence” have always been contested and “the relationship between media and truth has never been stable”.⁵² This is not to suggest that significant challenges do not exist, but that legal and cultural mechanisms have existed since at least the nineteenth century for the proper use of technology in evidence:

For example, submitting an X-ray into evidence in court in the 1890s required the testimony from an expert technician to explain how a machine could see inside a body, that certain lines were evidence of a broken bone and not an artifact of developing the image.⁵³

Similar analogies could be drawn to the use of *cinéma vérité* in the nineteenth century to terrify movie audiences with film of an approaching train, or French filmmakers in the 1960s recording live audio and shooting visual material to fit the sound. Audiences were initially taken in by the techniques but eventually accepted them as a natural part of the media production process. The integration of technology into society proceeds by degrees.⁵⁴

Following the storming of the US Capitol in 2021, the Russian invasion of Ukraine early in 2022, and the commercial release of generative AI products early the following year, such optimistic assessments have become less common.⁵⁵ The sense is that AI and algorithms have a unique ability to corrupt the public sphere and render peaceful local and global existence impossible. Although accepting historical continuity with earlier versions of the West's "epistemic operating system",⁵⁶ social psychologist Jonathan Haidt claims that the "digital public square" has become so warped by technology that it is driven by the mob.⁵⁷ Haidt's point is well made but it is difficult to disentangle his argument from modernity's discourse of crisis. Jonathan Rauch (who Haidt cites to support his argument) provides a more historicized interpretation of the public sphere and trusts in its resilience. Although accepting that "troll epistemology",⁵⁸ which recommends "flood[ing] the zone with shit"⁵⁹ to undermine the quality of debate and sow confusion, has contributed to a contentious public sphere, he points out that the "epistemic secession" of some online communities has its origins much further back than we might suppose, in increasing political partisanship that emerged in the 1970s in response to talk radio and cable television.⁶⁰

Rauch claims that the conservative media establishment has been "promoting not only conservative viewpoints but also epistemic separatism, the idea that only conservatives could reliably grasp and report the truth" for decades.⁶¹ The affordances of digital technology are less important in this sense than long-standing changes in the political economy of the United States, connected to the breakdown in the post-World War Two consensus and the rise of neoliberalism. Elon Musk's 2022 bid to buy Twitter for \$54b on the basis that it represents the "public square" of the Internet provides a good example of this.⁶² Musk's hostile takeover appears to have been predicated on a belief that the platform's influence over public discourse was profound enough that it needed to be rescued in the interests of American principles of free speech, for the benefit of the world. AI and bots, combined with network effects and platform economics, required activist intervention to protect democracy. Such claims are not new: they recall the arguments contained in Douglas Rushkoff's *Cyberia* (1994) or John Perry Barlow's "Declaration of the Independence of Cyberspace" in 1996.⁶³ The idea that it is possible to use digital technology to build "a world that all may enter without privilege or prejudice accorded by race, economic power, military force, or station of birth"⁶⁴ is a mainstay of the discourse of digital modernity and should be read as a tired trope of the twentieth century more than a clarion call for the age of AI.

There are other reasons to be wary of predictions of an imminent collapse of the public sphere. The more Twitter (later renamed X) moved away from the political centre, the more obvious Musk's troll epistemology became, reducing its ability to sway decided voters. As with *cinéma vérité*, audiences became attuned to the manipulation and tuned out its effects, even if they

continued to be engaged (either positively or negatively) with the experience. Recent studies question the practical reach of even state-sponsored disinformation campaigns.⁶⁵ A study published in *Nature Communications* in 2023 concluded that few American voters were exposed “to any posts from foreign influence accounts at all in a given week”⁶⁶ during the 2016 election campaign, despite significant concern that Donald Trump won the election with the assistance of Russian troll farms.⁶⁷ Even people who were exposed to disinformation from Russia’s Internet Research Agency (IRA) do not appear to have changed their political affiliation or their perception of political polarization in the United States.⁶⁸

This is not to minimize the serious issues associated with misinformation and disinformation, but to accept that crisis discourse is central to modernity and is often associated with the collapse of the public sphere. Such concerns reached a crescendo in the twentieth (rather than twenty-first) century. From the 1960s to the 1980s, sociologists influenced by Habermas and the Frankfurt School believed the public sphere had been polluted by mass media since its inception in the eighteenth century and was ceasing to function for the benefit of society. Herbert Marcuse claimed that its degradation through mass media, advertising, and scientific modes of management was corrupting capitalism in the West and Communism in the Soviet Union, leading to a situation where Enlightenment ideals were threatened by authoritarianism.⁶⁹ Habermas was clear about this, noting that:

[w]hen the laws of the market governing the sphere of commodity exchange and of social labour also pervaded the sphere reserved for private people as a public, rational-critical debate had a tendency to be replaced by consumption, and the web of public communication unraveled into acts of individuated reception, however uniform in mode ... Through this development the privacy that had its referent in the public as audience was turned into a travesty.⁷⁰

It is somewhat uncanny reading Habermas’ critique of the twentieth century public sphere from the perspective of the 2020s, focused as he was on the effects of scientifically targeted advertising and commercialization, the blurring of the line between news and entertainment, and the reduced capacity for the public sphere to support robust parliamentary debate.

The reduction of the liberal public sphere to one manufactured for elections by mass political parties armed with PR gurus, advertising metrics, and psychological tricks was as concerning to observers in the 1950s and 1970s as 2016.⁷¹ In this narrative, the replacement of a properly functioning bourgeois public sphere predicated on the production of actionable *opinion publique* with a “pseudo-public or sham-private world of culture consumption”⁷² developed from the middle of the nineteenth century, reaching its

height after World War Two with the advent of mass advertising. Dismay at the corruption of the public sphere dovetailed with a sense of technological determinism heightened by Cold War politics and the possibility of nuclear annihilation, producing a sense that democracy was under threat on multiple fronts.

Narratives describing the degradation of the public sphere under the pressure of universal suffrage, mass media, or digital computing are difficult to support empirically despite their cultural and emotional resonance (and, indeed, the possibility that the worst-case scenarios might eventuate). In 2023, participants at a workshop hosted by Georgetown University's Center for Security and Emerging Technology, OpenAI, and the Stanford Internet Observatory released a report detailing "emerging threats and potential mitigations" related to the general release of generative language models into the public domain and their adoption by malicious actors.⁷³ They claimed "that there is no silver bullet that will singularly dismantle the threat of language models in influence operations" and that "a whole of society approach" will be needed to mitigate the risks of pollution of the public sphere by torrents of synthetic and misleading digital content.⁷⁴ This was of a type with concerns about the pollution of the public sphere from the 1950s onwards by commentators from the Frankfurt School and elsewhere, but animated by a sense of urgency that *this time* the situation was different, because of concerns about unpredictable emergent behaviour being noticed in LLMs above a certain scale (generally 65 billion parameters).⁷⁵

This included the generation of unverifiable nonsense, as is to be expected from complex stochastic systems,⁷⁶ but also possibly a nascent Theory of Mind "or the ability to impute unobservable mental states to others".⁷⁷ Subsequent analysis suggested the appearance of such emergent behaviour may well have been an artefact of researchers' choice of metric,⁷⁸ but scientific interest in these speculations, and public fascination with the emergence of distinct LLM "personalities", provides an interesting footnote in the history of the public sphere. As Emily Bender and Alexander Koller noted in 2020, any robust analysis of the impact of LLMs depended upon "maintaining clarity around big picture notions such as *meaning* and *understanding* in task design and reporting of experimental results".⁷⁹ This extends to such foundational concepts as the public sphere and its relationship to the history of modernity. The impact on the public sphere following transference of LLM technology into production depends to a large degree on the stance we choose to take towards stochastic knowledge production and our expectations about the degree of "pollution" the public sphere can support before undermining *opinion publique*. Without a clear position on this, it is difficult to design safeguards to mitigate unintended harms and the inevitable activities of malicious actors. This applies to the production of scientific knowledge as much as public discourse.⁸⁰

The emergence of citizen journalism during the Arab Spring of 2010–2012 suggests one potential response. Zeynep Tufekci has explored how the new “networked public sphere”⁸¹ combined with grassroots community activity offline to destabilize authoritarian regimes across the region. While not as powerfully revolutionary as some optimists felt at the time, the effect was substantial and cannot be dismissed as a transitory phenomenon. One of the most powerful reasons for this impact was the growing ubiquity of mobile phones in combination with social media, which grew rapidly after the release of the iPhone in 2007.⁸² Mobile computing put a camera into the hands of billions of people worldwide and exponentially increased the amount of evidence available to journalists. The rise of “citizen journalism” bolstered cyberutopian claims for the power of digital technology at a time when cynicism about the effect of digital media on the public sphere had been mounting.⁸³ The ability of people to post real-time updates about major events to social media sites such as Twitter, Facebook, and YouTube changed the nature of public discourse in profound ways and provided paid journalists with enormous opportunities to report on current events.

Eliot Higgins has described how this activity led to the development of the online “open-source investigation” agency Bellingcat, augmenting official defence agency OPSINT (open-source intelligence) with community-driven investigations using entirely public material.⁸⁴ Bellingcat gained prominence through work exposing the downing of Flight MH17 by a Russian missile, locating ISIS supporters in Europe, and identifying neo-Nazis in Charlottesville, Virginia. Their work, now headquartered in the Hague, is likely to be made more difficult by LLM tools but demonstrates the underlying robustness of the public sphere and suggests it has an innate capacity to respond to threats to its integrity. Working in the context of a radically expanded public sphere, where the quantity of information has exploded, Bellingcat suggests a future where digital modernity enables increased transparency and democracy. This need not imply uncontested human dominance, but it does suggest the possibility of symbiosis: the continuation of dialectical interactions between communities, AI, and legal and regulatory authorities.

This optimism could be extended to renewed political agency enabled by digital tools too. Paolo Gerbaudo has documented the importance of digital platforms to political discourse, suggesting they reappropriate public space in ways that are more continuous with earlier modes of protest than cyberutopianism.⁸⁵ This has, of course, led to the rise of right-wing populism and the hardening of authoritarianism in various countries, but the potential for progressivist activism has been increased too, including rejuvenated examples of anarchism in movements such as Occupy Wall Street.⁸⁶ Environmentalists have also seen the value of digital tools for their activities.⁸⁷ These examples do not diminish the threats to the liberal public sphere posed by emerging technologies but act as a reminder that, when

viewed through the lens of digital modernity, there is more reason for optimism about the future of *opinion publique* than headlines suggest. A holistic analysis that considers long-term historical trends, the response of the public sphere to previous challenges, and a view of digital modernity that assumes it exists in tension with the non-digital world is important. The computational tools available in digital modernity have led commentators to conclude digital tools have had a “corrupting influence on public discourse”⁸⁸ out of all proportion to their initial democratizing promise and in a manner unprecedented in the history of modernity, but the history and theory of the public sphere itself suggest that propaganda and more subtle forms of manipulation have been integral to it since its inception.⁸⁹ The more important lesson to accept is that, as in previous phases of modernity, nefarious actors sometimes (usually only fleetingly but often with devastating effect) win the struggle for dominance of the public sphere – by means both foul and fair.

Notes

- 1 Eelco Runia, “Presence,” *History and Theory* 45, no. 1 (February 2006): 1–29.
- 2 Brendan Nyhan et al., “Like-Minded Sources on Facebook Are Prevalent but Not Polarizing,” *Nature* 620, no. 7972 (2023): 137–44.
- 3 Myra Ferree, William Gamson, Jürgen Gerhards, and Dieter Rucht, “Four Models of the Public Sphere in Modern Democracies,” *Theory and Society* 31 (January 2002): 289–324; Jürgen Habermas, *The Structural Transformation of the Public Sphere: An Inquiry into a Category of Bourgeois Society*, trans. Thomas Burger with the assistance of Frederick Lawrence [1962] (Cambridge, MA: MIT Press, 1991).
- 4 Jürgen Habermas, *The Philosophical Discourse of Modernity: Twelve Lectures*, trans. Frederick Lawrence (Cambridge, MA: Polity, 1987).
- 5 “Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; or abridging the freedom of speech, or of the press; or the right of the people peaceably to assemble, and to petition the government for a redress of grievances.”
- 6 Herbert Marcuse, *One-Dimensional Man: Studies in the Ideology of Advanced Industrial Society* (Boston: Beacon Press, 1964).
- 7 Dan Milmo, “How ‘Free Speech Absolutist’ Elon Musk Would Transform Twitter,” *The Guardian*, April 14, 2022, <https://www.theguardian.com/technology/2022/apr/14/how-free-speech-absolutist-elon-musk-would-transform-twitter>, accessed February 20, 2026.
- 8 Habermas, *The Philosophical Discourse of Modernity*, 62.
- 9 Richard Barbrook and Andy Cameron, “The Californian Ideology,” *Science as Culture* 6, no. 1 (1996): 44–72; Fred Turner, “How Digital Technology Found Utopian Ideology: Lessons from the First Hackers’ Conference,” in *Critical Cyber-culture Studies*, ed. David Silver and Adrienne Massanari (New York: NYU Press, 2006), 257–69.
- 10 Jodi Dean, “Why the Net Is Not a Public Sphere,” *Constellations* 10, no. 1 (2003): 97.
- 11 Dean, “Why the Net Is Not a Public Sphere,” 101.
- 12 Dean, “Why the Net Is Not a Public Sphere,” 102.
- 13 Manuel Castells, *The Rise of the Network Society* (Malden, MA: Blackwell Publishers, 1996).

- 14 Shoshana Zuboff, *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power* (New York: PublicAffairs, 2019).
- 15 Dean, "Why the Net Is Not a Public Sphere," 97, 100, 105, 107.
- 16 Douglas Rushkoff, *Cyberia: Life in the Trenches of Hyperspace* (London: Flamingo, 1994).
- 17 Tom Wolfe, *The Electric Kool-Aid Acid Test* (New York: Bantam Books, 1969).
- 18 Dean, "Why the Net Is Not a Public Sphere," 105.
- 19 It is worth noting that Popper felt the 'ideal' Greek model portrayed by Plato was not only exclusionary but also the source of modern totalitarianism.
- 20 Habermas, *The Structural Transformation of the Public Sphere*, 33.
- 21 John B. Thompson, *Media and Modernity: A Social Theory of the Media* [1995] (Cambridge: Polity Press, 2013), 259.
- 22 Charles Taylor, *A Secular Age* (Cambridge, MA: Harvard University Press, 2007), 185–96. See also Charles Taylor, *Sources of the Self: The Making of the Modern Identity* (Cambridge, MA: Harvard University Press, 1989), 415–16, 495–521.
- 23 Craig J. Calhoun and Charles Taylor, "What Is to Be Done?," in *Degenerations of Democracy*, ed. Dilip Parameshwar Gaonkar and Charles Taylor (Cambridge, MA: Harvard University Press, 2022), 213.
- 24 Anibal Quijano, "Coloniality and Modernity/Rationality," *Cultural Studies* 21, no. 2–3 (March 2007), 177: "Nothing is less rational, finally, than the pretension that the specific cosmic vision of a particular ethnies should be taken as universal rationality, even if such an ethnies is called Western Europe because this is actually [to] pretend to impose a provincialism as universalism."
- 25 Nina Jankowicz, *How to Lose the Information War: Russia, Fake News, and the Future of Conflict* (London: I.B. Tauris, 2021).
- 26 Nancy Fraser, "Rethinking the Public Sphere: A Contribution to the Critique of Actually Existing Democracy," *Social Text*, no. 25/26 (1990): 56–80.
- 27 Marcuse, *One-Dimensional Man*.
- 28 Fraser, "Rethinking the Public Sphere," 62.
- 29 Arturo Escobar, *Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds* (Durham: Duke University Press, 2018), 11.
- 30 Laurie Penny, *Bitch Doctrine: Essays for Dissenting Adults* (London: Bloomsbury, 2017), 14.
- 31 Zizi Papacharissi, "The Virtual Sphere: The Internet as a Public Sphere," *New Media & Society* 4, no. 1 (February 2002): 9–27.
- 32 Jürgen Habermas, "Reflections and Hypotheses on a Further Structural Transformation of the Political Public Sphere," *Theory, Culture & Society* 39, no. 4 (2022): 146.
- 33 The Editorial Board, "There May Soon Be Three Internets. America's Won't Necessarily Be the Best," *The New York Times*, October 19, 2018, <https://www.nytimes.com/2018/10/15/opinion/internet-google-china-balkanization.html>, accessed February 20, 2026.
- 34 Katrin Wellern, Axel Bruns, Jean Burgess, Merja Mahrt, and Cornelius Puschmann, eds., *Twitter and Society* (New York: Peter Lang, 2013).
- 35 Although see, for example: Lincoln Dahlberg, "Cyberspace and the Public Sphere: Exploring the Democratic Potential of the Net," *Convergence* 4, no. 1 (March 1998): 70–84; Peter Dahlgren, "The Internet and the Democratization of Civic Culture," *Political Communication* 17, no. 4 (October 2000): 335–40; Papacharissi, "The Virtual Sphere."
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5

COLONIALISM AND POWER

The ideology and culture of the digital modern hid modernity from view over the turn of the millennium, under a patina of slick marketing and cyberutopianism.¹ Commentary moved towards digital identity and experience, leaving less room for conversations about the human condition started in the eighteenth century. This had a related impact on the discussion of colonialism, long accepted as a key mechanism of the modernizing process.² Fascination with digital culture and identity heightened a sense of epochal change, but digital platforms, devices, and services focused attention on contemporary experience and did not initially suggest implications for the colonizing process. Academic discourse shifted towards discussion of an immaterial “cloud” and the ascendancy of global culture. This was resisted by sociologists and activists in the Global South, but it took decades for their perspectives to be proven right.³ As Western “thought leaders” declared the end of history and the emergence of the global information superhighway,⁴ intellectuals in countries colonized by Europe and the United States saw only the continuation of historical patterns started in the sixteenth century. This work filtered back to universities in the North in the new millennium, contributing to the politics of decolonization and anti-racism, but the connection to modernity studies was lost.

As [Chapter 1](#) demonstrates, a full account of digital modernity would proceed from divergent viewpoints. This would ideally include minority and Indigenous perspectives, and a range of political and epistemological perspectives.⁵ Such an argument does not necessarily imply hostility towards European modernity, which should be “admired for its many virtues” as Walter Mignolo suggests, but it does recognize the need for a genuinely pluralistic account of digital modernity. At the time of writing, it is difficult to ascertain

whether this is likely to occur. Either the idea of digital modernity will resonate with pluralistic constituencies, and the process of broadening our understanding will begin, or *Digital Modernity: Why We Need to Think Historically About the Digital Age* will represent a beginning but nothing more. Without a high-level effort to explore what digital modernity looks like in an abstract sense, subsequent activity is impossible, regardless. This attitude assumes that any attempt to make “the world an extended Euro-America is unacceptable”,⁶ but also that the process of scholarly debate proceeds through accretion.

Paola Ricaurte has noted the implications of viewing colonialism as a purely historical phenomenon, and the connection of that attitude to authoritarianism and political violence.⁷ The situation was worsened by the lack of attention paid to modernity in Western intellectual circles after the turn of the millennium, which elided its connections to colonialism. The decolonial critique of modernity that Ricaurte and others practice has its limits, but it has exposed major blind spots that confound the best intentions of scholars including Isaiah Berlin, Hannah Arendt, and Charles Taylor. The present book depends on those accounts – as decolonizing theorists do as well – but they were writing in a different era and did not have access to the insights of scholarship from either digital studies or the Global South. It is important in that context to accept the formative analysis of digital modernity/colonialism outlined below and to accept its problematic relationship to dominant historical narratives and analytical frameworks. As Margrit Pernau notes in the context of the history of ideas in the Global South, “[i]f the study of concepts teaches us anything at all, it reminds us of the historicity and changeability of all concepts; a moment of arrival, one that would take analytical concepts out of the changes of history, is not in sight”.⁸

I agree with Gurminder K. Bhambra too, “that understandings of modernity, as a largely European and/or Western phenomenon at its inception, are predicated on a deficient epistemology that is in urgent need of displacement”.⁹ The analysis of digital colonialism presented in this chapter aims to facilitate that process by highlighting alternative social and geopolitical realities.. Digital colonialism is far more distributed and relational than the linear concepts of progress and hierarchy that characterized historical interpretations of modernity allow. The Chinese Belt and Road initiative belies a simplistic narrative of European or American dominance, for example.¹⁰ This implies a way of looking at digital modernity more broadly: as a concept that can only be adequately understood from multiple vectors or lines of sight, each one projecting from different geographic, temporal, cultural, and ideological perspectives.¹¹ This acknowledges the critique of multiple modernities presented by Bhambra (discussed in [Chapter 1](#)) but claims a dispensation for *digital* modernities on the basis of the special and pressing connections between digital modernity and digital colonialism.

In their introduction to *Informational Peripheries: Rethinking the Urban in a Digital Age*, Ayona Datta and Fenna Imara Hoefsloot present a related

argument in the context of urban geographies. They note that many locations in the Global South can be viewed as “informational peripheries”¹²

marked by invisibility, exclusion and marginalisation while at the same time being targeted for incorporation into the territory of the metropolitan city. They are materially and epistemologically located in the intersections of multiple imaginaries of the urban, the desire for governability and expansion.¹³

This adds considerable nuance to the argument that follows, reminding us that digitalization (like colonialism more broadly) is always “fragmented, diffuse and dispersed and cannot be fixed or determined through simple cause-and-effect analysis”.¹⁴ As much as we need to highlight the role of global corporations, deployments are often prosecuted by local actors seeking to maximize their position and gain financial and political power.

Latin American sociologists have provided the conceptual architecture to support this mode of analysis, allowing us to view digital modernity and digital colonialism as intricately connected concepts, not separate but a hybrid of digital “modernity/colonialism”.¹⁵ Aníbal Quijano’s work is a case in point, arguing that “[d]uring the same period as European colonial domination was consolidating itself, the cultural complex known as European modernity/rationality was being constituted”.¹⁶ In this articulation, modernity/rationality can be viewed as a system of thought inaugurated in post-Enlightenment Europe that generated “specific social discriminations which later were codified as ‘racial’, ‘ethnic’, ‘anthropological’, or ‘national’, according to the times, agents, and populations involved” and such conceptualizations justified the colonization and ongoing oppression of the majority of people around the world.¹⁷

This “totality” of belief extended from religious to secular domains and, although primarily enabled by market capitalism, could be considered to include Marxism as well. Its onto-epistemological foundations lay in the subject/object split inaugurated by Descartes in his assertion of *cogito, ergo sum*, establishing firm boundaries between self, society, and world that were anathema to colonized populations but have been continually promulgated as the only appropriate mode of being-in-the-world.¹⁸ This perspective established a radical onto-epistemological stance capable of undermining the “colonial matrix of power” (CMP) that Quijano claimed functioned at the same level of society as Sigmund Freud’s unconscious or Karl Marx’s theory of surplus value.¹⁹ As noted in earlier chapters, this implied a separation of the world into the West and what has become known as the Global South (“not simply [as] a geographic location, but [as] an epistemological position”),²⁰ with the “exploited and the dominated” of Latin America and Africa being archetypal victims.²¹ This matrix of coloniality and modernity/rationality led to cultural repression and genocide on a massive scale, turning the high cultures of America into

“illiterate, peasant subcultures condemned to orality”.²² As with the indigenous communities of Africa and the Pacific, this alienation from traditional modes of being-in-the-world condemned them to ongoing subjugation by (primarily but not only) the capitalist North and removed the possibility of productive engagement with modernity.

This latter point is significant. At the turn of the millennium, as Western academics moved away from analysis of modernity in favour of digital culture and media, and postcolonial studies began to fall out of favour, Walter Dignolo claimed that “modernity and coloniality are the two sides of the modern world system” and needed to be examined in unison.²³ To Dignolo, abandoning the critique of modernity implied abandoning efforts to roll back the process of colonialism started with the Spanish invasion of America 500 years earlier. The “overarching, and necessary, concept of coloniality/modernity” was central to the empowerment of the Global South and restitution of ways of being that, contrary to Western assumptions, had not been erased by history and were fully capable of engaging with and benefiting from the opportunities offered by modernity.²⁴ As Bhabra’s work implies, this can be read as a failure of Western intellectual culture as much as an integral characteristic of colonialism. Beguiled by the blandishments of digital culture and identity, intellectuals in the Global North invested in the study of computational culture without attending to its intersection with modernity/coloniality.

Recent scholarship has begun to rectify this by identifying ideologies of “coloniality” in digital society and culture.²⁵ Seb Franklin moves from analysis of the relationship between political economy and control to the “informatics of dispossession” that drives contemporary “racial capitalism”.²⁶ Nick Couldry and Ulises Mejias present a similar argument in *The Costs of Connection* (2019), making the incisive claim that colonialism existed long before capitalism and industrial modernity.²⁷ In *The Stack*, Benjamin Bratton reminds us that in the Democratic Republic of Congo “big chunks and little pebbles of tantalum (coltan), cassiterite (tin), wolframite (tungsten), and gold are pulled by hand from cold, sludgy mountain rivers, often by children, and eventually they make their way into the device component supply chain”.²⁸ George C. Caffentzis provides an excoriating overview of the social, cultural, and environmental damage wrought in Africa by the “blood computers” we carry in our pockets every day.²⁹

Assertions that contemporary digital infrastructure produces coloniality of power leading to “digital colonization, algorithmic violence, gender violence, class divides, and racism...”³⁰ are thus well documented and robust. The act of colonial “accumulation by dispossession” can apply to digital as well as physical assets.³¹ In this articulation, digital colonialism refers to the continuation of processes of resource extraction and oppression that started with the invasion of Latin America by Spain and other Occidental powers from the sixteenth century, affecting most areas of the world and continuing to the present day.

This 500-year process has developed enormous reserves of hysteresis and touched many countries around the world, as both colonizer and colonized.

The most obvious differentiating feature of digital colonialism qua colonialism is the intensity of its conversion of human activity and identity into data.³² This occurred in earlier phases of modernity too. The dream of rationalizing society through the accumulation and scientific analysis of data was integral to post-Enlightenment thought, articulated most clearly in the positivism of Auguste Comte (1798–1857).³³ Nineteenth century empires took advantage of emerging practices of statistics and demography to control vast populations with minimal administration.³⁴ But the extractive data practices that drive digital colonialism are particularly striking, given that they enable the planetary-scale processes explored in later chapters. This chapter refers to “digital” colonialism rather than “data” colonialism to broaden the field of discussion towards human labour and the environment, but the “datafied” nature of contemporary colonialism is its distinguishing feature.

Rather than only extending power from centre to periphery through the transference of economic, human, technological, and ideological power, digital colonialism extends the assumption of *terra nullius* (uninhabited territory) to the human self, using global data infrastructure to surveil and then extract personal data about our activities on the Internet. That data is then used to enable services powered by algorithms that help us act in, and shape our perception of, the world. The Marxist critique of digital colonialism has been particularly valuable in this regard, demonstrating how digital tools and infrastructure allow owners of capital to extract “*value from life processes*, even when they are not directly productive activities, [leaving] open the prospect of new types of commodified social relations and, through them, a new social order for capitalism”.³⁵ Digital platforms and services convert identity into a harvestable product, offered in exchange for free, paid, or low-paid services. In a series of articles in *MIT Technology Review* in 2022, Karen Hao described how this works, outlining the effect of exploitative data practices on communities in South Africa, South America, and Aotearoa New Zealand, and suggesting they amounted to the establishment of “a new colonial world order” based on the implementation of a range of digital technologies from video surveillance to platforms that use insecure labour to label machine learning datasets.³⁶

Such exploitation typically occurs to enable advanced analytical techniques, resulting in sociocultural and political outcomes remarkably like those experienced by communities during the colonial era: exploitative labour conditions; profits returning to the Global North; ubiquitous, biased, and prejudicial surveillance; subjugation by entities that blur the line between government and corporate cooperation; entanglement with the military-industrial complex. Only Hao’s example of Aotearoa New Zealand offered reason for hope, with Māori communities taking control of their linguistic data so that any extractive potential can be harnessed for the common good, but even this example risks

positioning Māori in the same way they were in the nineteenth century – as an exception to the rule, despite them being demonstratively undermined by colonialism.³⁷

Aotearoa New Zealand's tangata whenua (people of the land)³⁸ are leading the way in many aspects of data sovereignty and technology development, but this is secondary to their more fundamental efforts to gain proper recognition and tino rangatiratanga (self-determination, or sovereignty) under the Treaty of Waitangi signed with the British Crown in 1840.³⁹ Couldry and Mejias' assertion that digital colonialism is different from historical forms of colonialism is important to note,⁴⁰ then, but Hao's research reminds us of obvious continuities. As with modernity, British colonialism did not simply stop with the process of formal decolonization that occurred after World War Two: it is a persistent process that has evolved over time and continues to have a demonstrable effect on the everyday lives of millions of people.⁴¹ In many ways, the retreat from formal colonialism by nineteenth century powers such as Britain and France has been replaced by different modes of American, Chinese, and Russian neo-imperialism.

We might argue over the definition of what counts as imperialism (whether it only relates to formal state control or extends to military bases and economic dominance) but the practical effect on Indigenous people, minorities, and those with fewer economic resources is broadly similar.⁴² The study of modernity makes this glaringly apparent whether analysis takes place in the Global North or South. Theories and practices of decolonization are epistemological as much as political in that sense, based on the assertion that (i) the time horizon for colonialism must extend across deep time, encompassing all countries and cultures; (ii) colonization of the mind and spirit can be more pervasive and persistent than material, governmental, and economic colonization; (iii) boundaries between, and definitions of, concepts such as sovereignty, borders, and self-determination are porous and open to interpretation; and (iv) the time-lag of hysteresis is unavoidable and applies to infrastructural as well as economic and ideological aspects of colonialism.⁴³ My position is as much Rawlsian as decolonial, grounded in the belief that modernity has instantiated deeply arbitrary and unjust distributions of wealth and power that need to be corrected.

The temptation to connect digital colonialism to the broader history of an uneven modernity is compelling; they need to be viewed as two parts of a continuing (if evolving) historical process. This viewpoint is becoming increasingly popular. In their introduction to *Data Politics: Worlds, Subjects, Rights*, the editors note that "...we need to understand [data colonialism] as part of a broader historical transformation"⁴⁴ reaching back to the emergence of statistics and associated sciences such as demography and probability in the nineteenth century. They point out that the period from 1980 to 2020 represents a distinct period in the development of data collection and analysis, but

one that needs to be situated “...in relation to social, economic, and political conditions...” of the modern state and associated subjecthood.⁴⁵ Wendy Chun’s detailed historical analysis of contemporary algorithms, some of which originated in eugenic theories designed to enable nineteenth century British imperialism, provides further evidence of this.⁴⁶

In many humanities and social science disciplines, these issues have become “entangled with the critical theories of race, feminism, law, queerness and science and technology studies”⁴⁷ but it is important to highlight their theoretical and material connections to modernity too. Ricaurte achieves this through the notion of “data assemblages” that enable “new forms of colonization through data, grounded in material infrastructures and symbolic constructions that reinforce these practices”.⁴⁸ Analogous to the networks of submarine and overground cables, telegraph offices, and newspapers that enabled nineteenth century communication networks, data assemblages constitute enabling infrastructure for the extraction, transmission, and monetization of data.⁴⁹ More research is needed, however, to properly understand the global diffusion of data infrastructure and associated monetization processes to avoid simplistic parallels with nineteenth century imperial expansion. Important differences exist, including the “reverse” diffusion of technology from China to the West through mechanisms such as the Digital Silk Road and the sale of surveillance systems and communication technology.⁵⁰

The core features of global data infrastructure are now relatively well understood. Large corporations such as Apple, Google, Facebook, and Microsoft dominate, with Chinese firms such as Alibaba, Baidu, WeChat, and Tencent providing controlling services in their region. Dominant digital platforms such as Uber, Spotify, Airbnb, Deliveroo, and Tinder control market segments by maximizing the affordances of digitization. Firms such as Cisco and Huawei, which provide the plumbing of the Internet, are important but often forgotten actors, and data brokers such as Axciom, Datalogix, eBureau, and PeekYou enable flows of personal data harvested from across the Internet to be packaged up for advertising purposes. Mechanical Turk, Scale, Appen, Hive Micro, and Spare5 provide digital labour platforms for piecework or micro-tasking (often to enable machine learning and AI) across multiple sectors. The military-industrial complexes identified by Edward Snowden, in the United States and around the world, function across the warp and weft of these infrastructures, and the dark web occupies a similarly clandestine space.⁵¹ Deep technical integration across the dominant platforms, through Software Development Kits (SDKs) designed to enable data sharing and monetization, connects these companies infrastructurally even as their underlying business models – segmentation of work packages and geographical outsourcing – discourage effective labour organization.⁵²

Digital platforms, described by Nick Srnicek as simply a “new type of firm”⁵³ that extracts and uses “a particular kind of raw material: data”, are integral sites

for digital colonialism.⁵⁴ These entities (at once business and infrastructure) use their ownership of software and hardware to monetize a circular process of service provision and data harvesting and are the primary means by which global digital colonialism is enabled. Digital platforms are surprisingly varied, ranging from Microsoft's Windows operating system to Amazon's marketplace and web services platform, Apple's App Store, the Spotify music streaming service, and Google's search engine. They often provide tools that allow the public or developers to extend their functionality through the creation of new products, services, or marketplaces.⁵⁵

The foundation models powered by Large Language Models (LLMs) are an emerging category but suggest the potential for next-generation platforms that will one day extend to services enabled by quantum computers and virtual reality. The salient point is that digital platforms are emblematic and productive symbols of contemporary digital colonialism. They are the place users gather to buy and sell goods and services (digital as well as human and material), providing data and having it harvested and returned to the system after processing.⁵⁶ The whole process is facilitated by global digital infrastructure and complicated by (largely proprietary) algorithms that provide a combination of secret sauce and obfuscation, drawing us into the experience through the operationalization of behavioural psychology and data science.⁵⁷ Their control of the large-scale tools and infrastructure needed for many of the more advanced AI methods means these platforms have started to dominate technical research as well, making it increasingly difficult for government and academic R&D teams to compete.⁵⁸

The subterranean processes governing these platforms are explored in more detail in subsequent chapters. The important point to note here is their vaporous quality. Although they often sell goods and services in the real world, they enable a form of "platform capitalism" that relies on not only bits of data but also financial arrangements based on massive injections of venture capital (VC) funding. The goal of these financial investments is to carve out monopoly market share as rapidly as possible, through massive global expansion supported through equally massive operating losses if necessary. Netflix (established in 1999, initially renting physical DVDs) achieved an annual net income for 2022 of \$4.492B USD⁵⁹ but (despite being established in 2009) the ride hailing platform Uber was still making a loss that year.⁶⁰ Any number of historical comparisons could be made to previous systems of colonial finance, from the drama of the eighteenth century "South Seas Bubble"⁶¹ to the "gentlemanly capitalism"⁶² of nineteenth century Britain, but the end results (of economic domination, unfair labour practices, and environmental damage) are broadly similar. Capital is prepared to sustain great losses if it can continue to control markets. It is no surprise that the same market dynamics underpinned the technology boom that followed the release of ChatGPT by OpenAI in 2024.

Tiziana Terranova provided an important perspective on platform capitalism early in its development, one which initially hid its status as an instrument of colonial dominance, when she pointed out its reliance on free or “immaterial” labour.⁶³ Her point was that, contrary to the marketing of big technology companies, the economy of the web was anything but free and utopian. On the contrary, a large amount of its content, from blog posts to flashing gifs, is provided by voluntary (free) labour that goes directly into the coffers of the technology companies. A significant literature has developed since then in relation to digital labour, particularly in relation to the gig economy where the “digital” economy is sometimes quite literally powered by “biopower” in the form of bike-riding humans. “When workers cannot eat enough food while riding ... the system quite literally relies on consuming the body to continue operating”.⁶⁴ This class-based analysis works just as well when the analysis is moved from the streets of New York, London, or Paris to the locations discussed by Karen Hao.

This points to another complicating factor in digital colonialism: its connection to the “colonization” of human sexuality and gender identity. As María Lugones has noted, there are connections between heterosexuality and the “modern/colonial gender system”.⁶⁵ Race, class, and sexuality intersect in our understanding of the human body, which has always been the primary resource for colonizing processes. Defining normative values allows colonizing powers to impose and maintain their power. From the sixteenth to nineteenth centuries, this usually entailed the promulgation of Christian assumptions about racial hierarchies and gender roles and identities “that are clearly intertwined with and constitutive of global capitalism and Western modernity”.⁶⁶ Sylvia Marcos gets to the deeper epistemological implications of this when she notes that Indigenous cultures in Latin America had a fluid conception of gender until after European colonization. From the available evidence, it appears their attitudes towards sexuality were also different from the West (the Christian notion of man/woman, with the associated burden of the Fall, was unknown), leading to quite different attitudes towards eroticism and its relationship to cosmology.⁶⁷ Few examples can better demonstrate the epistemological power of colonialism, and the parallel (and equally powerful) rejection of intellectual colonization by Indigenous people, than the orthodoxies of gender and sexual relations perpetrated in colonial systems.

Walter Dignolo claims such insights should be extended beyond notions of gender identity and sexuality to capitalism, Marxism, and other Western modes of thought:

...being Maori (or Aymara, or Afro-Caribbean like Aimé Césaire and Frantz Fanon) is not necessarily in smooth relation with Marxism, because of the privileged class relations over racial hierarchies and patriarchal and heterosexual normativity.⁶⁸

This represents a degree of intellectual radicalism many academics in the West, including those towards the left of the political spectrum, will find hard to accept but need to contend with if we are to fully apprehend the implications of digital modernity/colonialism. Data collection and subsequent population-level management buttressed by the imposition of alien economic systems were often used to re-educate Indigenous populations after the sixteenth century (“the naturalization of modernity that is taken for granted”),⁶⁹ but these techniques have become more ubiquitous and arguably more powerful with the emergence of digital colonialism.

As Kevin Guyan notes, historical patterns of discrimination and repression persist in the way we count and describe our communities. It is important to recognize that “decisions made about who to count, what to count, and how to count are not value neutral but bring to life a particular vision of the social world”.⁷⁰ National censuses are a primary means by which people are required to categorize themselves using one of a limited number of sexual, gender, and racial choices, resulting in overly simplistic analyses and policy decisions that tend to privilege the sectors of society that benefitted from historical colonization in the first place.

In this reading, digital colonialism is an insidious and continuing mechanization of colonial logic under the guise of using technology to provide analytical insight in support of the “good society”. The difficulty is in making the connection between historical patterns of colonization, where the Christian/capitalist dynamic prejudiced and empowered colonizers at the expense of colonized people, and the processes of *digital* colonialism, detached from state regulation and military forces, that extends through the warp and weft of societies in the Global North as well as South. The logic that enables the conceptual transition from the past to the present in this kind of decolonizing epistemology is problematic, touching on issues in historical method that have yet to be resolved. Our reading of its legitimacy will be determined to a large degree by our orientation towards positivism and idealism, and the degree to which we feel history as a discipline is a scientific or literary practice.⁷¹ Articulations of digital colonialism are unavoidably presentist, of course, conflating historically incommensurable perspectives (inter alia sixteenth and nineteenth century colonialism across different regions; pre- and postcolonial cultures; pre- and post-Cartesian epistemologies) but for our purposes in the present book it is important to recognize that those perspectives cohere in *contemporary articulations of digital colonialism whether the historical logic that supports those connections is deemed robust or not*. Digital colonialism has contemporary intellectual resonance whether we accept the details of its historical assumptions or not.

Digital colonialism, like modernity more broadly, therefore, is a dynamic and evolving reality as well as an analytical framework. Its development into a concept relevant to “illegal” immigrants living in London and Mechanical

Turk workers in Brazil, or transgendered communities in either New York or Calcutta, speaks to its position as a floating signifier for global digital modernity more generally. While there are salient methodological and epistemological issues to explore, arguments that digital colonialism is based on historical misapprehension (a failure to view the past “*wie es eigentlich gewesen*”,⁷² in the words of Leopold von Ranke) need to be conducted in a different critical register. This is another reason to rehabilitate modernity studies, acknowledging that its component parts are likely to have morphed in unexpected and sometimes challenging ways in the past decades. The guiding assumption, of course, must be that any changes and apparent inconsistencies have been enabled by the development of the web and social media, and growing awareness of the intersections between the interests of people wherever they might be physically located.

And yet even this articulation of digital colonialism, experienced as the entanglement of bits and data structures with human identity, fails to capture the essence of the phenomenon. The individual experience of being converted into biopower through the dictates of an algorithmically enabled mobile app is mirrored at scale by the complex global supply chains that stretch across the world and enable the production of physical hardware such as phones, laptops, and servers. They are related to geopolitical issues of some importance, such as the tensions between China and the United States over intellectual property rights, advanced microchip manufacturing, and (most tellingly) the profit margins and operating models of companies such as Apple that rely on outsourcing to countries with large supplies of cheap labour to manufacture their products at a price point acceptable to consumers in the Global North.⁷³ High profile cases involving labour exploitation and suicides at factories such as Foxconn are a stark reminder of continuities with earlier forms of industrial production.⁷⁴ This is modernity, and colonialism, in root and branch.

Analogies to historical modes of colonialism, such as the smokestacks of Victorian England, are not difficult to find. There are important aspects of digital colonialism in the eventual resting place of the hardware produced under the labour conditions described above, for example. Environmental damage from digital industries has become a massive problem, resulting in vast garbage piles of waste transported from Western countries to locations in Africa and Asia, where people from the lowest economic classes are either employed on minimal wages to extract valuable metals or scrounge for what they can find, often becoming sick in the process.⁷⁵ Mines, producing minerals ranging from cobalt to lithium for the production of circuits, microchips, and batteries, scar the landscape across a number of continents, and Bitcoin server farms have become renowned for requiring the energy consumption of small countries.⁷⁶ Vast data centres operated by companies such as Microsoft, Amazon, and Google claim a degree of energy efficiency or even carbon neutrality

but questions have been raised around green-washing and the real impact of their footprint on the local environment and the global climate emergency.⁷⁷

It is difficult to comprehend the full scale of the material impact of digital technologies without recourse to the historical standards for environmental degradation set during earlier phases of modernity.⁷⁸ This amounts to an almost complete inversion of the cyberutopian imaginary of the early millennium, which assumed that digital technologies would usher in an era of global equality and plenty.⁷⁹ We might note that the process of equating digital modernity with Enlightenment values had parallels in the rise of imperial liberalism in Britain and France during the nineteenth century, when eighteenth century moralizing and civilizing motivations gave way to financially driven exploitation based on *laissez-faire* economics animated by the thought of figures such as John Stuart Mill and Alexis de Tocqueville. The contexts are in important ways incommensurable, but there are similarities in the slow accretion of economic logic buttressed by racial prejudice, and an assumption that Europeans were enacting the next phase of a universalist history based on “a vantage point that was thought to grant [them] the knowledge and moral authority to impose progress on less advanced societies”.⁸⁰ Colonialism has evolved from utopian moralizing to authoritarian universalism before, albeit from a centre in Europe rather than California.

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- 69 Dignolo, *The Darker Side of Western Modernity*, 138.
- 70 Kevin Guyan, *Queer Data: Using Gender, Sex and Sexuality Data for Action* (London: Bloomsbury Academic, 2022), 1.
- 71 John Tosh, *The Pursuit of History: Aims, Methods and New Directions in the Study of History*, 2nd ed. (London: Routledge/Taylor & Francis Group, 1991), 133.
- 72 This dictum was used in 1824 by Ranke in *Geschichten der romanischen und germanischen Völker von 1494 bis 1535* (History of the Latin and Teutonic Nations, 1494–1535) to reject the common nineteenth century assumption that the past should be studied to draw moral and political lessons for the present day. For a discussion of the difficulties interpreting what Ranke meant, see Felix Gilbert, "H historiography: What Ranke Meant," *The American Scholar* 56, no. 3 (1987): 393–97.

While on the one hand (394) “Ranke implies that, whenever a historian uses the past to present his views about how people ought to behave and act, the picture of the past becomes distorted and false: the historian ought not to go beyond the limits of his task – to show how things were in fact”, he viewed historical writing as literature and believed that (395) “[i]n order to make the reader aware that the past is not fundamentally different from the present [it is often necessary to point] out the continuities between past and present”.

- 73 Bratton, *The Stack*.
- 74 Jenny Chan, Ngai Pun, and Mark Selden, “The Politics of Global Production: Apple, Foxconn and China’s New Working Class,” *New Technology, Work and Employment* 28, no. 2 (2013): 100–15; Jenny Chan, “A Suicide Survivor: The Life of a Chinese Worker,” *New Technology, Work and Employment* 28, no. 2 (2013): 84–99.
- 75 Ted Smith, David A. Sonnenfeld, and David Naguib Pellow, eds., *Challenging the Chip: Labor Rights and Environmental Justice in the Global Electronics Industry* (Philadelphia: Temple University Press, 2006).
- 76 Nicola Jones, “How to Stop Data Centres from Gobbling up the World’s Electricity,” *Nature* 561, no. 7722 (September 12, 2018): 163–66.
- 77 Natasha Bernal, “Google, Microsoft and the Strange World of Corporate Greenwashing,” *Wired UK*, January 31, 2020, <https://www.wired.co.uk/article/corporate-greenwashing>, accessed March 10, 2023.
- 78 Herbert I. Schiller, *Communication and Cultural Domination* (White Plains, NY: International Arts and Sciences Press, 1976), 53. Schiller makes a case for the environmental impact of all post-World War Two technologies. Similar cases can, of course, be made for earlier phases of modernity too.
- 79 Fred Turner, “How Digital Technology Found Utopian Ideology: Lessons from the First Hackers’ Conference,” in *Critical Cyberculture Studies*, ed. David Silver and Adrienne Massanari (New York: NYU Press, 2006), 257–69.
- 80 Jennifer Pitts, *A Turn to Empire: The Rise of Imperial Liberalism in Britain and France* (Princeton, NJ: Princeton University Press, 2006), 21.

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6

RACE, TECHNOLOGY, AND HISTORY

Critiques of technological modernity in the Global North are often negative, connecting the diffusion of new technology with civilizational decline.¹ This tradition, initiated by writers such as Thomas Carlyle and Matthew Arnold in the nineteenth century and heightened by the critique of mass media culture by the Frankfurt School after World War Two, encourages cultural paternalism. Johann P. Arnason demonstrates the depth of the fallacy, which stems from a failure to acknowledge the complex interactions between culture and modernity. The negotiation of technological modernity occurred within and across regions and “the vision of modernity as a global projection of Western power and its cultural underpinnings” has proven to be untenable.² This perspective is particularly relevant to digital modernity given the reorientation of geopolitical power since the turn of the millennium.³ The future of technology will be globally distributed and analyses that fail to take the Global South into account will be seriously flawed.

More to the point, we rarely stop to question whether negative critiques of the digital world reflect global attitudes or merely the depressive paternalism of Western elites. Commentators have long noted the inadequacy of Western accounts of modernity. Narratives that suggest modernity started in Western Europe and spread out towards the periphery in successive waves oversimplify both the process of modernization and the nature and range of its expression. Discussing S. N. Eisenstadt’s multi-civilizational perspective, Arnason has noted that:

The changing and contested relations between the different sets of global structures, as well as the scope for variation within each of them, make it impossible to establish any uniform or universal patterns of modernity, and

thus open up a historical space within which different civilizational legacies can play a more or less formative role. The plurality of civilizations is reflected in a pluralization of modernity.⁴

The interconnectedness of the contemporary world and global technology sector marketing make it easy to forget that profound local differences still exist and that digital modernity needs to be viewed through multiple lenses, not as a mere export from Silicon Valley or Europe (as a straightforward expression of digital colonialism) but as a phenomenon connected to and formed by local customs, philosophies, and aesthetics. Indeed, this chapter argues that our understanding of digital modernity should be informed by the “view from the edge” (to adapt a technical infrastructural term) far more than from the putative centres of London, Berlin, or Silicon Valley. And we can go further still: the very notion of centre and edge (in cultural and intellectual as well as technical terms) needs to be subsumed by perspectives on digital experience presented by a wide range of voices.

In many cases this will lead to conclusions as depressing as Western ones (there should hardly be an assumption that technological development will be viewed as an unalloyed good anywhere in the world, and perhaps particularly in locations subjected to the more vicious effects of digital colonialism), but interpretation needs to embrace a multiplicity of local perspectives rather than proceed from the comfort of a purported “centre”.⁵ In 1994, Homi K. Bhabha memorably claimed that critical theorists should “...represent the relations of exploitation and domination in the discursive division between the First World and Third World, the North and the South”.⁶ The advice remains sound today. Digital infrastructure englobes the world and enables an identifiably global digital culture, but it does not eliminate local culture as much as confront it with new challenges and opportunities. If we are to properly understand digital modernity, we need to decentre our understanding of it in fundamental ways: aspects of modernity that were peripheral to the Western imagination during the nineteenth and twentieth centuries need to be central in the twenty-first.

This chapter uses a case study of digital modernity in China to demonstrate how this might be achieved. The analysis is partial but is presented as an example of a decentered approach to the analysis of digital modernity, from the perspective of a country with an unparalleled depth of technological history. China presents an evocative demonstration of connections between race, technology, and history and (of particular interest in our present context) the socio-technically determined nature of digital culture. We could just as productively explore these issues using countries such as Russia or Iran (both actively working to isolate their Internet from the outside world) but China has a historical resonance well suited to my purposes.⁷ It is well known that China is enclosed in its own digital infrastructure and software ecosystem,

barring American companies such as Facebook and Google, pursuing control of technical standards that influence its core infrastructure, and expanding its influence through a “digital Silk Road” associated with its wider Belt and Road economic initiative.⁸ Differences in mobile computing, levels of Internet access, payment mechanisms, copyright laws, and language-specific content compound the situation.⁹

While being mindful of the dangers of cultural essentialism, these differences require explanation. The Sinologist Joseph Needham famously claimed that the desire to always prioritize Chinese modes of thinking, even if it meant outright rejection of ostensibly useful tools, is thousands of years old.¹⁰ S.A.M. Adshead supports this view, noting that diffusion of Western technology to China has consistently been shaped by political factors, often to an extent that the technology alone does not appear to warrant.¹¹ In April 1867 *The North China Herald* reported that Chinese mandarins viewed railways not as conveyers of enlightenment values, commerce, and wealth but “rowdiness, the overthrow of time-honored custom and tradition, disturbance and ruin.”¹² In 1877, a short line from Shanghai to Woosung was built by the foreign community with authorization to demonstrate the value of rail and was promptly bought by the governor-general and destroyed.¹³

A new phase of technological assimilation was prompted by the Chinese civil wars (1927–1937 and 1945–1950) and the cultural revolution (1966–1976), resulting in Engel’s *Dialectics of Nature* (1883) being positioned as the central text in a nascent tradition of Marxist science and technology studies, but that only undermined the development of science and engineering still further. In the twentieth century, Chairman Mao “preached technological paradise but practiced anti-technological purgatory” in a continuation of this centuries-long tradition,¹⁴ which often used restrictions on direct foreign investment to achieve its goals.¹⁵ Rather than being imported wholesale from the Global North, technological modernity in China reflects the deployment of a long-standing formula of “Chinese learning for the substance, Western learning for practical use – *Chung-hsueh wei t’i, Hsi-hsueh wei yung*.”¹⁶

The approach has always had its critics, however. Some Chinese intellectuals feel the pragmatic adoption of overseas approaches to science and technology has made it impossible to reconcile them with traditional cosmological modes of thinking, to the detriment of their culture. After World War Two the philosopher Mou Zongsan (1909–1995) elaborated a new mode of Confucianism to demonstrate how traditional Chinese philosophical approaches could be compatible with international conceptions of science and technology. His goal was to blend the “synthetic spirit of comprehending reason” with the “analytic spirit of comprehending reason.”¹⁷ Rejecting the contention that technological thinking is irreconcilable with traditional Chinese conceptions of the numinous, Zongsan claimed science and technology could have emerged without external intervention. Yuk Hui claims Zongsan’s thinking is

best articulated in terms of the ancient philosophical attempt to unite Qi (器) and Dao (道),¹⁸ or moral and cosmological thinking, and has the potential to evolve into a form of “cosmotronics” specific to China.¹⁹

Zongsan’s thought did not take root in his own era, however, overtaken by powerful government discourse uniting the Chinese Communist Party (CCP) with the growing market economy. Hui laments its abandonment, suggesting it has led to the same kind of ennui we see in the Global North:

...today we observe a kind of paradox: on one hand, there is rampant technological development in terms of scientific research, infrastructure projects, and construction ... while on the other hand there is a strong sense of loss or disorientation, in which China ceases to be China, and becomes instead capitalism with Chinese characteristics—not so different from the situation foreseen by Hu Shi, where the residue of Chinese culture serves only to inflect an otherwise triumphant Westernisation.²⁰

Hui asserts, in other words, a similar cultural disorientation in China to the Global North but one engendered through a quite different process of epistemological and ontological mediation. In seeking a pragmatic reconciliation with digital modernity in the interests of economic and geopolitical power, “the Qi-Dao unity has been completely shattered”.²¹ Efforts to repair it appear fruitless: once ruptured, mythic unity cannot be regained. Hui sets his hopes on a mode of cosmotronics that aims to position technology in the context of cosmological forces – at once subject to but capable of transcending Cartesian epistemology – but does not appear overly optimistic.

There is a more prosaic lesson to be drawn from the Chinese experience of digital modernity, however. Although the components of global digital infrastructure are broadly uniform, they are deployed in markedly different ways, reflecting deep cultural differences in motivation and intent. Similarities in hardware and software mask profound differences in the role of digital technology in political philosophy and everyday life. This heterogeneity of purpose and experience is one of the most pressing areas for future research into digital modernity.²² China merely demonstrates the differences in configuration between different modes of digital modernity most starkly because of its use by Xi Jinping to implement a techno-authoritarian state.²³ It is less often remarked upon that digital technology in the United States has been used to enable dangerous forms of economic and cultural libertarianism, but the lesson is the same: technology is shaped by society far more than is usually acknowledged.²⁴ The impulse towards techno-authoritarianism in the United States during Donald Trump’s second term merely drives this point home.²⁵

In this sense, digital modernity offers exemplary evidence for the social construction of technology: local case studies emphasize the complexity of

digital modernity and the under-determined nature of its infrastructure.²⁶ In 2025, *Wired* magazine reported that the Chinese company Geedge Networks was actively selling the technology that enables China's mass censorship regime to countries in Africa and Asia, suggesting their repressive approach has relatively widespread geopolitical appeal.²⁷ We might also note that while China is exporting its surveillance tools to autocratic regimes, they have exported equipment to Amazon to help them monitor and optimize the performance of their workforce in the United States too.²⁸ Other parts of Greater Asia, such as Singapore, Japan, India, and Jordan, have deployed digital infrastructure for quite different ends than China and could be used to provide additional nuance to the argument above. Understanding how the Global North interprets Asian technology is crucial to a proper understanding of digital modernity; however, it is difficult for outsiders to separate fantasy from reality (suggesting the importance of the region speaking for itself).

Motifs used to construct Western narratives of Asia are deeply historical, reflecting cultural and geopolitical anxieties that shift over time. The core components were established during Marco Polo's first encounters with the region in the thirteenth century and have developed into powerful discursive scripts.²⁹ Bernard Geoghegan has explored the complicated modes of alterity at work, noting the prevalence of exoticism and machinic futurism. Charting the relationships between Amazon's Mechanical Turk labour platform, where workers are paid as little as a penny per job, and the original Mechanical Turk automaton which amazed nineteenth century Western audiences by simulating an automated mechanical chess playing robot (a ruse, enabled by a human player hidden inside), Geoghegan notes that they are bound together through an "alterity script" that works across human and machine culture in a way that problematizes human reason through the counter-posing of human bodies and (sometimes merely supposed) machines. Features of alterity scripts include:

- 1 the interrogation of human reason through the counter-posing of human bodies and (supposed) machines, such that it involves a trial of rank with the human opponent;
- 2 the breaking down of human activities into discrete, serial tasks that imbue them with a machinic quality;
- 3 the presence of an interface or other obfuscation that elicits speculative thinking about the mechanisms of the performance;
- 4 the theatrical contrast or counterpoising of bodily marked difference – ethnicity, gender, class, age, species, disabilities – with supposedly unmarked logical machinery; and
- 5 the figuration of difference as inessential or supplementary to some more canonical expressions in science, machinery, or mathematics.³⁰

Geoghegan's point is that alterity scripts existed long before digital computing technology, functioning since the eighteenth century to "form a loose constellation of elements that define a conceptual problematic for thinking about reason and difference".³¹

Whether a physical "mechanical Turk" dressed in stereotypical Oriental costume, Amazon's ostensibly digital but fundamentally human mTurk labour platform, or transposed into philosopher John Searle's "Chinese Room" thought experiment, alterity scripts negotiate differences between "Oriental symbolism and symbol-processing machines".³² In doing so, they demonstrate the uncanniness at the heart of human attempts to define the ontology of computing, from eighteenth century automatons through cybernetics to more recent experiments in artificial intelligence (AI). Geoghegan's alterity scripts bind "Oriental" culture to the history of Orientalism but "only insofar as it provides a mirror for discerning (or producing) Western culture". They also point to a need "to develop conceptual models that account for the substantively heterogeneous agencies and hybrid productions in the history of informatics".³³

The conflation of high-tech futurism and Asian culture has generated less research than might be expected given the cultural prominence of the trope, usually focused on cyberpunk literature and science fiction films that position Asia and Asian characters as exemplars of exotic technological futures.³⁴ The transposition of the conceit into dystopian economic form, with Asians (whether Japanese salarymen or Foxconn employees) presented as "the very antithesis of Western liberal humanism", is equally pervasive.³⁵ Long Bui notes that

global Orientalism has shifted from one based on a logic of cultural essentialism; to one of general equivalency reflecting the postmodern logic of global capitalism which forces recognition of Asian modernity, even if there are still feelings of European superiority to Asians.³⁶

This is complicated again by the adoption of high-tech futurism by countries such as Japan, which have chosen to position it as a point of difference and source of nationalist pride. Orientalism is thus laundered in multiple directions and by multiple actors, the only constant being its retention of an "alterity script" that functions to translate between various dualisms of West and East, present and future, human and robot, and emotion and reason. Marshall McLuhan noted this process as early as 1964, when he claimed that "this transformation of the real world into science fiction is the reversal now proceeding apace, by which the Western world is going Eastern, even as the East goes Western".³⁷ Questions of agency, appropriation, and representation that seemed so straightforward with (say) the history of technology in China become malleable and contradictory when viewed in this way, highlighting

the inadequacy of the geographic dualism (East and West) so integral to the European Enlightenment and industrial modernity.

Wendy Chun provided a nuanced analysis of the situation in 2012, noting that the transition from Orientalism to techno-orientalism (including in its Asian-American forms) is complicated by the abjection of race through technology, which appears to hold the potential for “something like insubordination or creativity” to arise.³⁸ As much as the racist casting of Asian Americans as automatons (implicit in narratives reaching back to the building of United States railroads in the nineteenth century) undermines their very existence in their country, it might also offer a place “for a critical mimesis” that offers hope for creative renewal and empowerment.³⁹ The casting of Asian bodies as the default shell for the technological future grants agency over that future even as it collapses heterogeneous countries, classes, cultures, genders, and identities into an indistinguishable whole.

This ambivalence towards techno-orientalism is instructive and speaks to the potential for conceptions of digital modernity to adopt non-relational ontologies that do not seek to hypostasize difference either geographically or racially. Recent critiques of techno-orientalism, and the alterity scripts that animate it, leave open the possibility of local and personal agency even as they acknowledge the entanglement with deeply problematic historical narratives. Because of this, techno-orientalism offers a point of conceptual leverage for understanding digital modernity more broadly. Although it is tightly bound to earlier phases of modernity, techno-orientalism’s scope “is much more expansive and bidirectional, its discourses mutually constituted by the flow of trade and capital across the hemispheres”.⁴⁰ Although connected to local histories of technology in countries such as China, and post-Fordist and modernist narratives that position Asia as an alien threat to the hegemony of the Global North, the sheer weight of alterity that techno-orientalism carries undermines the narratives we have used to understand technological modernity for three centuries.

And therein lies the radical potential of digital modernity as an interpretative category, and the difficulty of adequately comprehending it from only the Global North. Techno-orientalism warns against both the Enlightenment package error that presents modernity as a linear outgrowth of Europe and naïve attempts to overcompensate for that narrative by positioning Asia as a techno-utopian or dystopian imaginary. Neither approach does justice to the multiplicity of contemporary experience and the complexity of the alterity scripts that negotiate relationships between humans and digital technologies wherever and however they are deployed. And that ignores the vast swathes of the world, of course, that lie outside the East West axis that has dominated the post-Enlightenment historical narrative. Significant digital modernities exist in Africa, the Middle East, Latin America, and the Pacific, and each of them deserves to be described from their own vantage point. As much as we might

try to identify differences between cultural and intellectual experiences of digital technology, there is no Archimedean point that will allow us to see digital modernity in its entirety.

While the Asian experience of digital modernity complicates interpretations derived from the Global North, anxieties about its pathogenetic nature (symbolized in China by the sundering of *qi* and *dao*) reveal common preoccupations. As much as we might seek to embrace cultural variation and reject the Enlightenment package error, digital modernity appears to encourage a certain uniformity of phenomenological experience. In David Berry's terms, wherever we are located on the planet, "we increasingly find a computational dimension inserted into the 'given'. Or better, that the ontology of the computational is increasingly hegemonic in forming the background presupposition for our understanding of the world".⁴¹ This experience appears to transcend geographical and cultural boundaries, overlaying demands for the recognition of difference and heterogeneity with the possibility of an emerging planetary phenomenology organized in relation to the digital.

The Chinese reception of the philosopher of technology Donald Ihde, known for his articulation of a post-phenomenological relational ontology, provides an interesting example of this process in action.⁴² Ihde is well-known for his description of four basic human-technology relations based on Husserl's *ego-cogito-cogitatum* structure of intentionality.⁴³ These states support relational interpretations of technology that focus on the entanglement of humans and tools rather than separating them into "human (natural)" and "technological (Other)". The goal is to balance phenomenological investigation with empirical analysis, rejecting post-Cartesian dualism. Ihde has been widely translated in China and made three visits (2004, 2006, 2007) to lecture at Northeastern University in Shenyang, Xi'an University of Architecture and Technology, Peking University, the Shanghai Academy of Social Sciences, and the South China University of Technology.⁴⁴ His lectures at Peking University were later published in one of his more influential works.⁴⁵ Zhang Kang has provided a useful overview of this activity. Engagement with Ihde's thought in China ranges from broad acceptance to rejection of some aspects, and modifications such as the proposal by Lin Huiyue, Xia Fan, and Chen Wanqiu that an additional human-technology relation is needed.⁴⁶

It is difficult to accept that the phenomenological experience of digital modernity might, to some degree at least, be a transcultural phenomenon, but the interest of Chinese researchers in Ihde suggests this might be the case (at least in part). At this level of reduction, the irreconcilability of mathematical formalism and human experience collide in ways that are disconcerting but surely not unexpected. As Charles Taylor has noted, "anguish about meaning is quintessentially modern" and (one could add, in that context at least) transcultural and transhistorical.⁴⁷ Jason Tuckwell's call to embrace "the pluralism and diversity of *technē*"⁴⁸ is important, but at a certain level of reduction,

whether viewed from the perspective of the Global North or South, the technological challenges to self and world have elements in common across all digital modernities.

As offensive as it might be to sensibilities attuned to respect diversity of culture and plurality of experience, a radical possibility exists that everyone everywhere with access to a digital device and the Internet can apprehend similar challenges to the human condition. Their experiences will no doubt vary wildly, from users in lower decile families in the United States accessing Facebook on a shared mobile device to software engineers in Bangalore updating system packages from their iPad, but their experience of life will be mediated to a greater or lesser degree by a universal “computational dimension” to experience. This suggests a way beyond Heidegger’s claim that technology enframes human experience in a way that alienates us from authentic experience.⁴⁹ Refracted through techno-orientalism, it is possible to conceive digital modernity as a complex and geographically dispersed assemblage of multiple technical systems, existing in unison with its human creators in a planetary ecosystem accessible to and manipulable by individuals and societies.⁵⁰ This is not to suggest that our understanding of contemporary experience can be reduced to the schematics of technical systems, though. In digital modernity, we need to admit that meaning gets lost in a deeply human experience that is resistant to axiomatic explanation.

These elements cohere in China in what Yuk Hui refers to as “the latest development of reason”,⁵¹ an externalization of *res extensa* implemented in code and running on silicon: myriad and often massive computer algorithms, running to thousands of lines of code, that control and enable digital tools, platforms, and services. Viewed this way, anxieties related to our experience of being-in-the-world result from using inadequate forms of reason to understand emergent but fundamentally natural expressions of human infrastructure. This is explored in more detail in [Chapters 8 and 9](#): it is extremely difficult to understand planetary-scale digital infrastructure in a way that retains scientific precision yet accepts the emergence of previously unencountered forms of cognition. These difficulties are compounded by the glaring *inadequacy* of that same infrastructure, which is in many ways cobbled together and in need of constant maintenance and repair.

Extrapolated to data science workflows and other complex digital systems, these inadequacies of cognitive capacity reveal themselves in events such as the tendency of global financial systems to experience the occasional “flash crash”,⁵² when automated algorithmic trading systems lose billions of dollars in seconds because they become caught in mutually reinforcing sell cycles. Our inability to control or predict such systems suggests to Hui that:

[w]e have entered the global age of catastrophe, and a global post-industrial eschatology ... seems in vain since it ignores the global technical system

that is essentially the convergence between different subsystems and different cultures. In order to unfold the concept of algorithmic catastrophe, we must reconsider the historical relation between technics and contingency in Occidental culture.⁵³

His conclusion is that algorithmic failures (to which we can add the reproducibility crisis in science) have started to perform the same function as natural catastrophes such as earthquakes and fires in ancient culture, momentarily collapsing the void between analogue and digital modes of experience and restoring mythic unity. The desire for the antediluvian unity implicit in Aristotelian and pre-modern Chinese philosophy thus emerges again *within* digital modernity, through the brittleness of its infrastructure and the limitations of its computational methods.

As compelling as the commonalities of experience between the Global North and South are in digital modernity, we should resist the urge to flatten our interpretation of human experience. In *The Question Concerning Technology in China*, Hui is adamant that profound differences in experience exist, determined by deeply ingrained conceptions of self, society, and world. His phenomenological argument would come as no surprise to sociologists. In 1988 the sociologist of religion Peter Berger suggested that East Asia was generating “a non-individualistic version of capitalist modernity”⁵⁴ based on distinctive social characteristics such as “a highly developed sense of collective solidarity” and the “enormous prestige of education” that implied that the “specific aggregate of economic and sociocultural features that we know as industrial capitalism in the West could be disaggregated, perhaps reassembled in different ways...”.⁵⁵ More recently, Ambrose King has noted that (although still needing to be interpreted as demonstrably modern in all its dimensions) the “emerging mode of social-cultural formation in East Asia is indeed different from Western modernity”. In his estimation, “it is advisable to understand Western modernity as one form of modernity, but not to define modernity as Western modernity”.⁵⁶ It is important not to overemphasize these features of Asian society, and certainly not to succumb to simplistic fallacies of Asian high-tech futurism,⁵⁷ but they are a reminder that interpretations of modernity are heavily biased towards the Global North.

There are considerable tensions between techno-orientalism and the pathogenetic negativity of the normative critique of modernity. Modernity in the Global North assumes the rise of individualism and a concomitant sense that science and technology are soulless and uncreative, whereas techno-orientalism often embraces traditional notions of community and positions technology as an emancipatory extension of human experience. The normative conceit reaches back to at least Jean Jacques Rousseau (1712–1778) and is one of the more persistent themes in the Euro-American history of ideas. In *The Open Society and Its Enemies*, Karl Popper suggested it had its origins in Heraclitus’

doctrine of the unity of opposites (c. 500 BC), transmitted via Rousseau and later Hegel's dialectics.⁵⁸ The conceit remained powerful across the twentieth and into the twenty-first centuries. In one of the founding texts of twentieth-century phenomenology, *Philosophy and the Crisis of European Man* (1935), Edmund Husserl claimed science had cut people off from their spiritual selves, undermining its benefits and decentring human life. The collapse of Cartesian dualism through algorithmic reason aligns well with the philosophical dis-course of modernity in the Global North but less well with other traditions.

The multimedia artist Lawrence Lek provides a compelling example of this.⁵⁹ Lek produces documentaries and films exploring the nature of digitally mediated life in Asia and the philosophical implications of AI. His work is grounded in a theory of Sinofuturism that positions Asia as the manifestation of emerging trends in computing, automation, gaming, addiction, and labour that do not represent the Occidental Other so much as an emerging sociopolitical, cultural, and technological reality that promises to transcend Cartesian logic.⁶⁰ In discussing his animated film *Geomancer* (2017), for example, a story about an AI satellite that decides to leave its orbit above the Earth and become an artist in Singapore, Lek noted that he assumed its art would need to be based on copying rather than originality because of its disembodied presence that made the creation of physical art impossible. This presumably informed his suggestion in *Sinofuturism* (2016) that the widespread culture of copying in China reflects an alternative and culturally meaningful mode of production. The relevance of this kind of thinking to a future dominated by generative AI needs little elaboration and casts an interesting light on anxiety about those kinds of emerging technologies in the Global North. Sinofuturism claims to reflect modes of culture and possible modes of AI more closely aligned to ancient Asian cosmology than post-Cartesian dualism.⁶¹ However successful this playful approach is, the desire to unite qi and dao (in Yuk Hui's reading of those ideas) is unmistakable and an emerging transcultural motif for future phases of digital modernity.

The struggle of the Global North to manage the emergence of digital modernity takes on new meaning in this context. The pressures on civil society and mechanisms of government, the inability of technology companies to control the quality of information circulating in the public sphere,⁶² new forms of colonialism, the growth of misogyny and hatred online, and anxiety about generative AI can be framed as evidence of pathogenetic threats but it is important to question whether our analysis is skewed by historical assumptions inherited from normative interpretations of modernity. Techno-orientalism suggests the potential for digital modernity to contribute alternative modes of experience and value construction to global culture. The art of Lawrence Lek provides a case in point, suggesting the emergence of more flexible theories of creativity and engineering capable of eroding brittle forms of scientism and computational functionalism.

Notes

- 1 I follow writers such as Walter Dignolo, Enrique Dussel, and Gurminder K. Bhambra in interpreting the term Global South (and its corollary Global North) “not simply [as] a geographic location, but [as] an epistemological position”. Gurminder K. Bhambra, *Connected Sociologies* (London: Bloomsbury Academic, 2015), 89.
- 2 Johann P. Arnason, *Civilizations in Dispute: Historical Questions and Theoretical Traditions* (Leiden: Brill, 2021), 37.
- 3 Parag Khanna, *The Future Is Asian: Global Order in the Twenty-First Century* (New York: Simon & Schuster, 2019).
- 4 Arnason, *Civilizations in Dispute*, 41.
- 5 Mark Graham and Mohammad Amir Anwar, “The Global Gig Economy: Towards a Planetary Labour Market?” *First Monday*, April 1, 2019.
- 6 Homi K. Bhabha, *The Location of Culture* (London: Routledge, 1994), 30.
- 7 See, for example, Liudmila Sivetc, “Controlling Free Expression ‘by Infrastructure’ in the Russian Internet: The Consequences of RuNet Sovereignization,” *First Monday*, April 16, 2021; Lily Hay Newman, “How Iran’s Government Shut Off the Internet,” *Wired*, November 17, 2019, <https://www.wired.com/story/iran-internet-shutoff/>.
- 8 James Kynge and Nian Liu, “From AI to Facial Recognition: How China Is Setting the Rules in New Tech,” *The Financial Times*, October 7, 2020, <https://www.ft.com/content/188d86df-6e82-47eb-a134-2e1e45c777b6>, accessed October 15, 2020; Daniel Anderson, “Splinternet Behind the Great Firewall of China: Once China Opened Its Door to the World, It Could Not Close It Again,” *ACM Queue* 10, no. 11 (November 29, 2012): 40–49.
- 9 Elisa Oreglia, “When Technology Doesn’t Fit: Information Sharing Practices Among Farmers in Rural China,” in *Proceedings of the Sixth International Conference on Information and Communication Technologies and Development: Full Papers – Volume 1, ICTD ’13* (New York: ACM, 2013), 165–76.
- 10 In his classic multi-volume history of Chinese technology, Needham suggested that China failed to develop technologies beyond its infamously early development of gunpowder, mechanical clocks, and the compass because of ingrained attitudes to social and cultural development, education, and a conception of time and space that acted against causal theorizing and the conscious manipulation of nature. See Joseph Needham, *Science and Civilisation in China: Volume 1, Introductory Orientations* (Cambridge: Cambridge University Press, 1956).
- 11 S. A. M. Adshead, *China in World History* (New York: Palgrave Macmillan, 1988), 335.
- 12 Adshead, *China in World History*, 323.
- 13 Adshead, *China in World History*, 323.
- 14 Adshead, *China in World History*, 355.
- 15 Shannon R. Brown, “The Transfer of Technology to China in the Nineteenth Century: The Role of Direct Foreign Investment,” *The Journal of Economic History* 39, no. 1 (March 1979): 181–97.
- 16 Adshead, *China in World History*, 362.
- 17 Yuk Hui, *The Question Concerning Technology in China: An Essay in Cosmotronics* (Falmouth: Urbanomic, 2018), 182.
- 18 Hui, *The Question Concerning Technology in China*, 35: “Normally technics and technology are translated in Chinese as *jishu* (技術) and *keji* (科技). The first term means ‘technique’ or ‘skill’; the second is composed of two characters, *ke* meaning ‘science’ (*ke xue*) and *ji* meaning ‘technique’ or ‘applied science’”. Hui claims this “creates the [false] illusion that Western technics have an equivalent in the Chinese tradition”.

- 19 Hui, *The Question Concerning Technology in China*, 35.
- 20 Hui, *The Question Concerning Technology in China*, 222.
- 21 Hui, *The Question Concerning Technology in China*, 241.
- 22 For example, Elisa Oreglia's major study of the digital Silk Road, *Digital Infrastructures Along the New Silk Road: A Mixed-methods Exploration of China's Digital Investments in Its Borderland Regions*, EC European Commission, 2020–2025.
- 23 Xiao Qiang, "The Road to Digital Unfreedom: President Xi's Surveillance State," *Journal of Democracy* 30, no. 1 (2019): 53–67. See Louise Matsakis, "How the West Got China's Social Credit System Wrong," *Wired*, July 29, 2019, <https://www.wired.com/story/china-social-credit-score-system/>, accessed June 9, 2021; Orville Schell, "Technology Has Abetted China's Surveillance State," *The Financial Times*, September 2, 2020, <https://www.ft.com/content/6b61aaaa-3325-44dc-8110-bf4a351185fb>, accessed February 20, 2026; Ross Andersen, "The Panopticon Is Already Here," *The Atlantic*, September 2020, <https://www.theatlantic.com/magazine/archive/2020/09/china-ai-surveillance/614197/>, accessed February 20, 2026.
- 24 Historians of technology have acknowledged the 'social construction' of technology since the 1980s. See Langdon Winner, "Upon Opening the Black Box and Finding It Empty: Social Constructivism and the Philosophy of Technology," *Science, Technology, & Human Values* 18, no. 3 (July 1, 1993): 362–78 and Wiebe E. Bijker, Thomas Parke Hughes, and Trevor J. Pinch, *The Social Construction of Technological Systems* (Cambridge, MA: MIT Press, 1987).
- 25 Johannes Späth, "The Rise of Techno-Authoritarianism and Its Impact on US Foreign Policy," *Austrian Institute for International Affairs Policy Brief* Nr. 15 (March 2025), https://zwischenraeume.co.at/wp-content/uploads/ZWISCHENRAEUME_POLICY-BRIEF_The-Rise-of-Techno-Authoritarianism-and-its-Impact-on-US-Foreign-Policy.pdf, accessed September 19, 2025.
- 26 For a classic example, see Eden Medina, *Cybernetic Revolutionaries: Technology and Politics in Allende's Chile* (Cambridge, MA: MIT Press, 2011).
- 27 Zeyi Yang, "Massive Leak Shows How a Chinese Company Is Exporting the Great Firewall to the World," *Wired*, September 8, 2025, <https://www.wired.com/story/geedee-networks-mass-censorship-leak/>, accessed September 19, 2025.
- 28 Reuters, "Amazon Buys Heat-Sensing Cameras from Blacklisted Chinese Firm," *The Guardian*, April 29, 2020, <http://www.theguardian.com/technology/2020/apr/29/amazon-thermal-cameras-china-dahua>, accessed February 20, 2026.
- 29 Daniel J. Boorstin, *The Discoverers* (New York: Random House, 1983), 134–38.
- 30 Bernard Dionysius Geoghegan, "Orientalism and Informatics: Alterity from the Chess-Playing Turk to Amazon's Mechanical Turk," *Ex-Position* 43, June (2020): 52.
- 31 Geoghegan, "Orientalism and Informatics," 53.
- 32 Geoghegan, "Orientalism and Informatics," 79.
- 33 Geoghegan, "Orientalism and Informatics," 82.
- 34 Lisa Nakamura, *Cybertypes: Race, Ethnicity, and Identity on the Internet* (New York: Routledge, 2002); David S. Roh, Jinny Huh, and Betsy Huang, "Technologizing Orientalism: An Introduction," in *Techno-Orientalism: Imagining Asia in Speculative Fiction, History, and Media*, ed. David S. Roh, Betsy Huang, and Greta A. Niu (New Brunswick: Rutgers University Press, 2015).
- 35 Roh, Huh, Huang cited in Long Bui, "Asian Roboticism: Connecting Mechanized Labor to the Automation of Work," *Perspectives on Global Development and Technology* 19, no. 1–2 (March 30, 2020): 114.
- 36 Bui, "Asian Roboticism," 113.
- 37 Marshall McLuhan, *Understanding Media: The Extensions of Man* [1964] (Cambridge, MA: MIT Press, 1994), 35.

- 38 Wendy Hui Kyong Chun, "Race and/as Technology or How to Do Things to Race," in *Race after the Internet*, ed. Lisa Nakamura and Peter Chow-White (New York: Routledge, 2012), 51.
- 39 Chun, "Race and/as Technology," 52.
- 40 Roh, Huh, Huang, "Technologizing Orientalism," 3.
- 41 David M. Berry, *The Philosophy of Software: Code and Mediation in the Digital Age* (Basingstoke: Palgrave Macmillan, 2011), 128.
- 42 For example, Don Ihde, *Technics and Praxis: A Philosophy of Technology* (Dordrecht: Springer Netherlands, 1978); *Technology and the Lifeworld: From Garden to Earth* (Bloomington: Indiana University Press, 1990); *Postphenomenology: Essays in the Postmodern Context* (Evanston, IL: Northwestern University Press, 1993); *Bodies in Technology* (Minneapolis: University of Minnesota Press, 2002).
- 43 Zhang Kang, "Let Things Speak: Don Ihde's Thought and Philosophy of Technology in China," in *Reimagining Philosophy and Technology, Reinventing Ihde*, ed. Glen Miller and Ashley Shew (Cham: Springer Nature, 2020), 199.
- 44 Kang, "Let Things Speak," 191–92.
- 45 Don Ihde, *Postphenomenology and Technoscience: The Peking University Lectures* (Albany: SUNY Press, 2009).
- 46 Lin Huiyue, Xia Fan, and Chen Wanqiu, "An Analysis of the Multiple Relationships of 'Human–Technology–World' from a Phenomenological Perspective," *Journal of Northeastern University (Social Sciences Edition)* 32, no. 5 (2011): 383–87. According to Kang, "Lin Huiyue, Xia Fan and Chen Wanqiu propose to supplement Ihde's relations with another—a replacement relation—which has a structure of '(technology-I) → world.' In the replacement relation, the human is transparent and technology takes on the dominant role. To give an example, a smoke alarm acts as a subject that has the responsibility of detecting and alerting humans about potential dangers in a space". Kang, "Let Things Speak," 199.
- 47 Charles Taylor, *A Secular Age* (Cambridge, MA: Belknap Press of Harvard University Press, 2007), 399.
- 48 Jason Tuckwell, "Technics and Agency," *Angelaki* 25, no. 4 (July 3, 2020): 81–96.
- 49 Martin Heidegger, "The Question Concerning Technology [1949]," in *Basic Writings*, 283–317 (London: Routledge and Kegan Paul, 1978).
- 50 David J. Stump, "Rethinking Modernity as the Construction of Technological Systems," in *Democratizing Technology: Andrew Feenberg's Critical Theory of Technology*, ed. Tyler J. Veak (Albany: State University of New York Press, 2006), 3–18.
- 51 Yuk Hui, "Catastrophe and Accident," *Parrhesia* 23 (2015): 125.
- 52 Neil Johnson, Guannan Zhao, Eric Hunsader et al., "Financial Black Swans Driven by Ultrafast Machine Ecology," *arXiv*, February 7, 2012, <http://arxiv.org/abs/1202.1448>.
- 53 Hui, "Catastrophe and Accident," 125.
- 54 Peter Berger, "An East Asian Development Model?" in *In Search of an East Asian Development Model*, ed. Peter Berger and Hsin-Huang Michael Hsiao (New Brunswick: Transaction Books, 1988), 6.
- 55 Berger, "An East Asian Development Model?," 5.
- 56 Ambrose Y. C. King, "The Emergence of Alternative Modernity in East Asia," in *Reflections on Multiple Modernities: European, Chinese, and Other Interpretations*, ed. Dominic Sachsenmaier, S. N. Eisenstadt, and Jens Riedel (Leiden: Brill, 2002), 148.
- 57 Chun, "Race and/as Technology or How to Do Things to Race."
- 58 Karl Popper, *The Open Society and Its Enemies* [1945] (London: Routledge, 2011), 254.

- 59 I am grateful to Paul Caton for introducing me to Lek's work. See Tom Faber, "The Futuristic Visions of Multimedia Artist Lawrence Lek," *The Financial Times*, November 18, 2020, <https://www.ft.com/content/f3c1065b-c740-47e8-b70a-80eda9094941>, accessed November 23, 2020.
- 60 Lawrence Lek, *Sinofuturism* 中华未来主义 (1839–2046 AD), 2018, <https://www.youtube.com/watch?v=ipa5xG1wPI0&t=578s>, accessed November 23, 2020.
- 61 Film and Video Umbrella, "Lawrence Lek Interview, Jerwood/FVU Awards 2017," *Film and Video Umbrella*, https://www.youtube.com/watch?v=6jeMo_Rbj1o, accessed November 23, 2020.
- 62 Kevin Roose. "On Election Day, Facebook and Twitter Did Better by Making Their Products Worse." *The New York Times*, November 5, 2020, <https://www.nytimes.com/2020/11/05/technology/facebook-twitter-election.html>, accessed 06 November 2020.

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7

INTO THE ENGINE ROOM OF HISTORY

The philosophy of history was a common topic of debate during the Cold War, because totalitarian regimes typically presented their power as a historical inevitability. Marxist historians contributed to that situation by identifying patterns in history that suggested the inexorable progression of class struggle. History came to be seen in some circles as a gigantic system governed by economic laws that could be harnessed for revolutionary purposes.¹ The spectrum of belief and activity was broad, but the underlying problem of determinism in history was a serious intellectual issue that intersected with fundamental issues in political and economic theory. Historians and political philosophers were caught in the middle of this geopolitical storm because the problem was central to their academic method. A belief in the interpretative power of class and ideology intersected with teleological issues related to the future of liberal democracy and the outcome of the Cold War, as well as more mundane questions of culture and identity. High-profile intellectuals such as Isaiah Berlin, Hannah Arendt, and Karl Popper were known for their positions on historical determinism in the same way contemporary intellectuals are known for their attitudes towards artificial intelligence (AI).² This chapter explains how those arguments are relevant to digital modernity and the continued centrality of historical analysis to a defence of liberal democracy.

Belief in historical determinism is surprisingly common in Silicon Valley, professed by billionaire technologists such as Peter Thiel, who believes digital technology will precipitate a descent into political violence and the eventual transcendence of modernity.³ This should not be surprising: the impulse to define our experience of self and world through reference to the past is a feature

of modernity. Jürgen Habermas provided a succinct explanation of this in *The Philosophical Discourse of Modernity*:

As modernity awakens to consciousness of itself, a need for self-reassurance arises, which Hegel understands as a need for philosophy. He sees philosophy confronted with the task of grasping *its own* time – and for him that means the modern age – in thought. Hegel is convinced that he cannot possibly obtain philosophy's conception of itself independently of the philosophical concept of modernity.⁴

Hegel and his heirs elaborated this insight into a philosophy of history that assumed the progressive development of individual and collective identity expressed through the dialectical unfolding of *Geist* discernible in the past.⁵ Imported, absorbed, or transmuted into various twentieth century cultural and philosophical traditions over the course of the nineteenth and twentieth centuries, this way of interpreting history provided a foil for Kantian modes of idealism that refrained from making the leap beyond subject – object dualism to potentially mystical assertions of self and world.

Alexander Galloway has noted that “[o]f all the recent revivals in recent years, the revival of Hegel is the most startling”, attributing interest in the nineteenth century philosopher to a concept that emerged during World War Two.⁶ Perhaps surprisingly, Galloway surmises that the survival of Hegelian philosophy into the twenty-first century reflects “not simply an effect of cybernetic societies but...its necessary precondition”⁷: the concept of the “black box”. There is a growing literature related to the history and purpose of the black box, but Langdon Winner provided a succinct explanation in 1993:

The term *black box* in both technical and social science parlance is a device or system that, for convenience, is described solely in terms of its inputs and outputs. One need not understand anything about what goes on inside such black boxes. One simply brackets them as instruments that perform certain valuable functions.⁸

Noting that the “black box cypher”⁹ had its roots in the philosophy of Karl Marx, Galloway suggests that it can be viewed not only as a technique to enable design and engineering processes (abstracting away complexity in high-level diagrams) but also as a central motif of modernity. The idea of the “black bloc”¹⁰ associated with left-wing direct action is as relevant to this interpretation as the black boxes included in computer networking diagrams. The “black box society” referred to by Frank Pasquale, obscured by opaque algorithms that undermine liberal democracy, reflects the union of these two tendencies.¹¹ In the parlance of early twentieth century modernity, the

metronomic action of the Hegelian dialectic approximates a Freudian death wish, hidden within the black box of technology and driving digital modernity towards its antithesis.¹²

The return of Hegelianism and associated theories of historical (dialectical) action is a curious by-product of contemporary computing culture but quite long-standing. Discussions tend to focus less on the specific relationship to Hegel and left-wing politics than on issues associated with the collection and exploitation of data, theories about the way that data informs our understanding of the past, and the degree to which it might determine future events. It is useful to distinguish between two key ideas in the philosophy of history in this regard: historicism and historism. As will be seen below, in its more virulent forms (and in distinction to historism) *historicism* was a key factor in the development of twentieth-century totalitarian ideology, and surfaces again in digital modernity in the guise of “dataism”.¹³ Both terms, and the resurgence in interest in Hegel identified by Galloway, are intimately connected to the broader philosophy of history. As surprising as it might seem in an era dominated by computer chips and TED Talks, any adequate description of digital modernity must grapple with its relationship to contemporary experience.

The philosophy of history has had a powerful influence on the development of the Global North, functioning as an intellectual substrate that informs a range of intellectual activity. As any postgraduate student of the humanities knows, it emerged in its modern form alongside scientific thought, grounded in the German tradition established by Hegel and elaborated by Leopold von Ranke (1795–1886), Wilhelm von Humboldt (1767–1835), and Friedrich Meinecke (1862–1954). François Hartog suggests its genealogy extends from Hegel to Wilhelm Dilthey (1833–1911), Martin Heidegger (1889–1976), and Paul Ricoeur (1913–2005).¹⁴ We could easily add Karl Marx (1818–1883) to that list. In simple terms, the philosophy of history assumes that a robust understanding of culture and society needs to acknowledge our position in time and space, and the difficulty of stepping outside of that frame of reference to fully objective knowledge. In a deeper sense, such a commitment expresses the ineluctable relationship between our sense of Being and our experience of time. Whether conceived as a mode of analysis or a position defining how “individuals or groups situate themselves and develop in time”,¹⁵ our relationship to the past defines our status as “moderns”.

Bruno Latour undercut simplistic interpretations of this relationship when he noted in *We Have Never Been Modern* that there has never been an “archaic and stable past”.¹⁶ Human experience has always been in flux and measured by what came before. “No one can forget Being, since there has never been a modern world, or, by the same token, metaphysics. We have always remained pre-Socratic, pre-Cartesian, pre-Kantian, pre-Nietzschean”.¹⁷ The boundary between Ancient and Modern in that sense is illusory, an artefact of our need to construct narratives about our position in time and space. This gets to the

crux of the philosophy of history but remains paradoxical; our experience of modernity survives critical analysis of it:

So is modernity an illusion? No, it is much more than an illusion and much less than an essence. It is a force added to others that for a long time it had the power to represent, to accelerate, or to summarize – a power that it no longer entirely holds.¹⁸

This paradox of history sits at the core of the discourse of modernity, influencing the rise of Western science and providing connective tissue across nineteenth and twentieth century scholarship.¹⁹

This sense that our experience of Being is grounded in our relationship to the past, but also that we actively construct our understanding of the past in narratives to ease our anxiety, evolved into *historicism*. Historicism “offers up both its past and its present for ideological scrutiny” in an attempt to heighten critical awareness.²⁰ Karl Popper’s contribution to this tradition during the Cold War is useful for understanding digital modernity. His views were presented in *The Open Society and Its Enemies* (1945) and later *The Poverty of Historicism* (1957).²¹ Mid-twentieth century discussions were dogged by terminological confusion because of his intervention, leading many commentators to distinguish *historism* (the simple assertion that each past is unique and needs to be understood on its own terms) with *historicism* (the belief that the past coheres to system-like laws that produce deterministic if not teleological effects), so we will shift into that register for the remainder of this chapter. The important point to note is that Popper’s critique of totalitarianism did not imply a subsidiary defence of *laissez-faire* capitalism or minimal government. His argument was consistent with support for social democratic forms of liberal democracy and can be applied to deterministic arguments across the political spectrum.

Hegelian dialectics were at the core of Popper’s critique of historicism, a purposive mechanism that proceeds in a “three-beat rhythm”:

First a *thesis* is proffered; but it will produce criticism, it will be contradicted by opponents who assert its opposite, an *antithesis*; and in the conflict of these views, a *synthesis* is attained, that is to say, a kind of unity of the opposites, a compromise or a reconciliation on a higher level. The synthesis absorbs, as it were, the original two opposite positions, by superseding them; it reduces them to components of itself, thereby negating, elevating, and preserving them. And once the synthesis has been established, the whole process can repeat itself...²²

Historical events provide historicism with its motive power: the energy by which the dialectic is transformed into *Geist* (world spirit).

In this reading of the past, modernity is a Hegelian synthesis, realized but not stabilized. By studying the past, Hegelian philosophers and their heirs believed they could tap into powerful sociocultural and economic patterns, defining the essence of a nation's culture and identity and potentially even benefiting from laws comparable to the "mathematically formulated causal laws of physics".²³ This search for laws of history was connected to human experience not only through alignment with *Geist* but also in the dialectical interaction of subject and object central to post-Cartesian theories of self. This was, indeed, the crux of Popper's critique of historicism: faith in the dialectical interpenetration of history and identity generated a self-reinforcing system defined by fallacious laws of history. The individual and the society were believed to march together in a three-beat rhythm discernible in traces from the past. This had a polarizing effect on political debate, undermining positions compatible with the growth of social democracy and increasing the chance that authoritarian tendencies would emerge in the public sphere.

The work of humanists such as von Ranke, Alexander von Humboldt (1769–1859), Leopold von Ranke (1795–1886), Wilhelm Dilthey (1833–1911), and Friedrich Meinecke (1862–1954) transmitted the more ameliorative tradition of historicism into nineteenth- and twentieth-century humanities research through narratives of cultural and national development (and sometimes decline).²⁴ After over a century of such activity, it seems superfluous to note that they grounded their writing in an assumption that "an adequate understanding of the nature of any phenomenon and an adequate assessment of its value are to be gained through considering it in terms of the place it occupied and the role it played within a process of development", but it signalled an intellectual sea-change that allowed for the development of modern humanistic and sociological criticism.²⁵ Ranke's famous dictum that the goal of historical writing is "...merely to show how things really were (*wie es eigentlich gewesen*)"²⁶ is often used to exemplify this perspective, symbolizing a commitment to empiricism and respect for the autonomy of the past (the avoidance of anachronism) but historicism could also lead to historical scepticism, as the critiques of modernity undertaken by Friedrich Wilhelm Nietzsche (1844–1900) and Sigmund Freud (1856–1939) demonstrate.²⁷

In addition to justifying historical research as a professional discipline (aspiring to, if not perfectly enacting, the principles of scientific *wissenschaftlich*), Rankean historicism "articulates a research logic that allows combining academic purity via objectivistic research with political engagement" across the humanities as a whole.²⁸ This movement from history as a discipline across to other humanities fields was explained by the historian Marc Bloch (1886–1944), founder of the Annales School of social history, when he claimed that our understanding of the past is "constantly transforming and perfecting itself"²⁹ and needs to be rewritten by each subsequent generation. Over time, this resulted in the emergence of multiple competing understandings of truth across ideological and disciplinary boundaries, and the development of new

fields such as cultural studies where gaps in the fabric of knowledge emerged (or were perceived). This reached a fever pitch in the 1980s and 1990s with the development of postmodern approaches to research and practices such as New Historicism.³⁰

The primary points to note are the centrality of historicism to modern humanities scholarship and the broad commitment contemporary researchers have to questioning the historical assumptions we bring to our analyses. It is easy to forget, because it seems so obvious to the modern mind, the foundational importance history holds to our understanding of self and world. In previous generations, knowledge might have been organized around religion or myth. Historical consciousness (theorized and operationalized in methodology as historicism) acted as one of the key pistons in the engine room of intellectual culture from the nineteenth through to the twentieth century, transcending disciplines and enjoying “a long tradition of influence upon many disciplines of thought.”³¹ Significant spillover to cognate fields such as sociology, political science, and economics occurred too. We might surmise that this fascination with history and historical narrative sits at the core of our commitment to “facts” and the methodologies that allow us to have confidence in them.³²

Donna Haraway’s “A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century” (1985) can be considered a foundational text in the history of *digital* historicism. To rehabilitate her sense of self in the face of rapid technological change, Haraway located a “technological polis”³³ in “the late twentieth century, our time, a mythic time”, where people had become “chimeras, theorized and fabricated hybrids of machine and organism”. Her writing used the notion of the cyborg to collapse the post-Cartesian dualism that “structured the dialogue between materialism and idealism that was settled by dialectical progeny, called spirit or history, according to taste”³⁴ in the nineteenth century by a violently patriarchal society inherited by the twentieth century and transmuted into a hybrid “caricature of that masculinist reproductive dream” in her present.³⁵ As with later writing in the humanities, Haraway’s historicism was hidden in plain sight, oscillating between a vivid sense of post-Enlightenment epistemology and confrontation with the computational Other.

Haraway was not writing history in the conventional sense, of course. Rather, she was making a larger epistemological claim that the ubiquity of microelectronic devices “mediating a new scientific revolution”³⁶ and oriented towards the “final appropriation of women’s bodies in a masculinist orgy of war”³⁷ had produced a disturbing sense of self best explained through the myth of the cyborg. Inherited from a violent and misogynistic past, Western science and technology assumed dualisms of “self/other, mind/body, culture/nature, male/female, civilized/primitive, reality/appearance, whole/part, agent-resource, maker/made, active/passive, right/wrong, truth/illusion, total/partial, God/man” that high-tech futurism denied.³⁸ Her ironic

stance dissolved Cartesian dualism but depended on the technological complex for its identity.

“A Cyborg Manifesto” should not be viewed as the foundational text in the development of digital historism – it was an expression of a wider milieu – but it anticipated a search for what Jonathan Lamb described in another context as an “extended and uncontrolled *je ne sais quoi*” capable of explaining the sense of history and self, engendered by (and required by) technological modernity.³⁹ The confounding relationship with the past that this search prompted in many intellectuals (especially those suspicious of grand narratives) was conveyed by David Golumbia (citing Alexander Galloway) years later:

...Alex Galloway suggests that “the more one begins to think that *Civilization* is about a certain ideologically interpretation of history (neo-conservative, reactionary, or what have you), or even that it creates a computer-generated ‘history effect,’ the more one realizes that it is about the absence of history altogether, or rather, the transcoding of history into specific mathematical models”.⁴⁰

This combination of skepticism toward historical narratives, their ongoing production, and awareness that the past is increasingly rendered in mathematical and computational terms reflects the complexity of the milieu identified by Haraway and the sense of powerlessness experienced by those who grasp its implications.⁴¹

Katherine Hayles’ contributions to digital historism point to ways out of that bind.⁴² Extending Haraway’s deconstruction of Cartesian dualism, Hayles identified a “historically specific construction” that emerged after World War Two based on the separation of information from the material forms it was embedded in. This prompted the emergence of “a different construction called the posthuman”⁴³ characterized by “a collection of heterogeneous components, and material-informational entity, whose boundaries undergo continuous construction and reconstruction”.⁴⁴ Tellingly, Hayles refused to mourn the loss of a “concept [liberal humanism] so deeply entwined with projects of domination and oppression”.⁴⁵ Her presentation of the history of liberal humanism in the light of new digital technologies of patriarchal domination and control was incisive and profoundly influential. Hayles continued her critique of Cartesian dualism in subsequent work, most effectively in *Unthought: The Power of the Cognitive Nonconscious* (2017), where she coined the term “non-conscious cognition”⁴⁶ to refer to “technical as well as human cognizers”.⁴⁷ She claimed that, rather than being outside digital infrastructure, “the embodied subject is embedded and immersed in environments that function as distributed cognitive systems”.⁴⁸ As [Chapter 9](#) demonstrates, this offered a way to simultaneously collapse the dualisms responsible for post-Enlightenment

trauma and articulate new modes of Being predicated on the entanglement of people with computational infrastructure.

Alan Liu's claim in *The Laws of Cool: Knowledge Work and the Culture of Information* (2004) that "...the new corporatism is an end-of-history vision of civilization that throws into the dustbin of history not only all its predecessors but also the very notion of relevant history" can be read as an early manifesto for a more conscious and activist mode of digital historicism.⁴⁹ In *The Laws of Cool* and later work, his goal is to recover "a sense of the past in the digital age":

A demiurge calls us to descend to lower registers of our speaking—into the substrates of matter, energy, agency, and process (actual infrastructures of apparatuses, channels, instruments, devices, operations, practices, protocols, and formats) through which the regime *communication-information-media-network* today surges and may, or may not, carry—as a signal on top of its carrier wave—a sense of history.⁵⁰

The urgency of the plea for greater historical consciousness in this passage is striking, suggesting a sense of cultural and intellectual dislocation and "crisis-consciousness" not dissimilar to that experienced in Germany from 1880 to 1930 when technology and rapidly developing ideas threw long-standing assumptions into stark relief and prompted the first articulations of historicism in figures such as Hegel and Ranke.⁵¹ Rather than questioning the political legitimacy of historical writing or connecting it to emerging computational infrastructure in wholly negative ways, Liu aimed to consciously deploy it in an effort to offset the anomie attendant upon the culture of flashing GIFs and social media that characterized post-millennial digital modernity.

The cultural drift and sense of anomie experienced in the early years of the new millennium made the substitution of theory with history understandable, although the shift in register was rarely acknowledged. Efforts to preserve the self in times of crisis are often supported by recourse to the past, even when that process is "destined to find evidence only of its own enchantment."⁵² Postmodern rejection of grand narratives made writers wary of openly advocating a return to historicism, but the rapid growth of digital technologies confounded twentieth century theory and led them to reach for the past for understanding, nevertheless. It is no coincidence that Liu's historicism emerged from his articulation of "postmodern historicism"⁵³:

...history both emerges from the buzzing, blooming swarm of events caught in the great matrix of detail and escapes in the noise of that detail. Similarly, history both manifests and sublimates in databases, both emerges in the tables, records, fields, and joins that are the structure of the modern relational database (implemented in SQL, or Structured Query Language)

and escapes all such holding structures. Whether in the form of the New Historicism or of a database, contemporary postmodern historicism is an escape structure. As they say, it is the “end of history”.⁵⁴

The emergence of digital historism in the discourse of post-millennial digital modernity points to a dawning awareness of the need for new ways to connect contemporary culture and society to the past.

This has been especially striking with writing that explores the intersection of technology and race. Lisa Nakamura’s *Cybertypes: Race, Ethnicity, and Identity on the Internet* (2002) is emblematic of this work, noting that (contrary to the myth of a posthuman, post-racial cyberutopia promulgated by the technology industry) the digital world “preserves hierarchical distributions of privilege and oppression” inherited from the past.⁵⁵ This conceit was explored in the volume of essays *Race after the Internet* (2012), where Wendy Chun suggested that race, rather than being either cultural or biological, could be interpreted as a “historically inflected set of tools” (technology) that in turn builds history and identity.⁵⁶ This kind of revisionism is at the core of digital historism as both a scholarly form and a mode of activism,⁵⁷ but its reliance on the past is hiding in plain sight, hidden behind what many readers will perceive (in this case) as critical race theory. Historism and modernity fall out of conscious awareness but continue to drive historical development: in Liu’s formulation, we no longer have history, “but we have [historism]”.⁵⁸ A similar exhortation to historicize our understanding of data science, in its guise as AI, was made by Rita Raley in her introduction to a 2023 special issue of *American Literature* exploring the development of “critical AI”.⁵⁹

It is important to acknowledge the depth of anxiety about the past embedded in Liu’s “substrates” of digital modernity. When extrapolated into the warp and weft of global cyberinfrastructure and understood in the context of historical philosophy, the past takes on menacing characteristics that threaten to overwhelm individuals and society with an unstoppable tide of technological and cultural change. This is the only way to explain the urgency of writing by figures such as Haraway, Golumbia, Galloway, Hayles, and Liu (and before them, writers such as Lewis Mumford⁶⁰ and Jacques Ellul⁶¹). They were tapping into intellectual anxieties related to the impact of technology on the functioning of not only our sense of the past *but also historical development* (i.e., the future). Hayles’ analysis of the flash crash of 2010 is a case in point. The event was caused by malfunctioning high frequency trading algorithms that wiped a trillion dollars off the United States stock market before it was diagnosed and brought under control, providing one of the first indications that uncontrolled algorithmic processes could cause significant damage in the real world.

Tellingly for our purposes, however, Hayles saw the event as more than an anomaly in the history of economics and an indication of the need for greater regulation of algorithms. Rather, she perceived the emergence of strange new

forms of culture and society and “politico-historico affects” created by cognitive assemblages that create linkages between disparate phenomena, facilitate or block information flows between sites, make choices at multiple levels of human and technical cognitions, and morph as the assemblage gains or loses parts and undergoes systemic transformations in its dynamics.⁶² Rather than being mere elements in her historical narrative, the assemblages appeared to produce complex socio-technical and cognitive effects that tied together past, present, and future in a system of indeterminate scope and power. The implication is that technology companies are summoning Hegel’s ghost, embedding enough historical data in their systems to produce outcomes that are beyond the reach of human analysis. This is the definition of digital *historicism* explored below: the operationalization of historical facts in global infrastructural systems for the purposes of marketing, surveillance, and the manipulation of individuals and communities based on predictive statistics.

We are now able to present a tentative description of digital historicism. This chapter takes much the same line as Popper in *The Poverty of Historicism*, describing the history of digital *historicism* positively and agreeing with writers who move from there to stark warnings about the dangers implicit in what I refer to as (nomothetic, or strong) digital *historicism*. Digital technology powered by data science and planetary-scale digital networks can be viewed as the technological realization of Popper’s worst nightmare, amplifying authoritarian tendencies in society and encouraging the twin discourses of antimodernism and Counter-Enlightenment.⁶³ Such is the complexity of this situation, and the importance of developing robust approaches to debunk wilder conclusions that can be drawn from it, that the next chapter is devoted to the problem. It is important not to underestimate the conceptual and political complexity of the situation. Digital historicism carries a similar weight to discussions that emerged after World War Two in the context of the Cold War and threat of nuclear annihilation. Indeed, much of the writing discussed below echoes warnings made by Hannah Arendt in *The Origins of Totalitarianism* (1951), in passages that make life under totalitarian regimes sound like living in a hellish computer programme.⁶⁴

Warning bells were rung years ago, in work from American writers such as David Golumbia that claimed hyper-rationalism was endemic to information systems.⁶⁵ Wendy Chun made an essential additional contribution in *Discriminating Data: Correlation, Neighborhoods, and the New Politics of Recognition* (2021), a historical analysis of the infrastructural system that emerged after World War Two and led to the development of the contemporary global technological complex.⁶⁶ Building on her contribution to software studies in *Programmed Visions: Software and Memory* (2011),⁶⁷ Chun explained how contemporary data science and social media platforms are powered by statistics and algorithms entwined with structures of oppression, race, and power that developed after the Enlightenment. Her work is

part of a broad literature that expanded after 2010, charting the relationship of Silicon Valley methods to the history of technology and mathematics in increasing detail.⁶⁸ The literature developed in concert with initiatives such as digital humanities intended to deploy digital methods for the betterment of society.

Chun's description of the origin of Ronald A. Fisher's "linear discriminant analysis" (LDA) and its tight connection to his work in *Annals of Eugenics* is emblematic of her approach.⁶⁹ Early twentieth century statisticians such as Fisher, Karl Pearson, and Francis Galton were all eugenicists, and their statistical methods were inspired by overtly racist data, including efforts to exert increased social control in British colonial India. In Fisher's case, his development of LDA was explicitly derived from work to analyse and discriminate between people of different races:

At the heart of linear discriminants lies craniometry and taxonomy: the measurement of jawlines to discriminate between genders ... and the measurement of Egyptian skulls, from predynastic to Ptolemaic, to understand the changing nature of civilizations. Fisher's 1936 *Journal of the Royal Anthropological Institute* study moved craniometry away from Pearson's "coefficient of racial likeness," which compared the means and standard deviations of different populations, toward functions that maximized the distance between them.⁷⁰

By creating statistical models of racial difference based on crude measures of physical difference, Fisher developed a method that could be applied within information systems in the following century to foster homophily, or the tendency of like-minded people to seek out other like-minded people.⁷¹

This is more profound than the oft-cited echo-chamber and filter-bubble effects,⁷² or even the deep emotional triggering explored by Anthony Elliott.⁷³ Technology companies are choosing to use polarizing statistical methods over alternatives to increase click-through rates because doing so increases advertising revenue; they are "operationalizing probabilities" using statistical techniques tried and tested during periods of profoundly discriminatory history. "The move from 'mass media' or mass society, marked by ambivalence and neutrality, to polarized networks, marked by angry resistant clusters, is fundamental to the history and design of social networks" and in many ways represents the importation of applied eugenics into the very heart of our contemporary information space.⁷⁴ This is not to say that contemporary statistical methods are inherently racist (or, indeed, hyper-rational), but that an awareness of their history provides essential context for their regulation and use. It is theoretically possible, for example, as Chun notes, to use contemporary data science to promote heterophily – or the peaceful co-existence of people with opposing views – ahead of homophily.⁷⁵

This has significance for not only social science and policy development but also the philosophy of history. Chun's startling point (obvious to a statistician but alarming to humanists) is that contemporary data science and the machine learning and AI models used to operationalize it are based on nothing more or less than crude historical facts. Advanced computational models predict (and in doing so influence) human behaviour by extrapolating future probabilities from historical data, allowing analysts and marketers to target advertising and nudge us towards their preferred product. This is the only way probabilistic models dependent on large amounts of data can *possibly* function. Whether supervised or unsupervised, such models are derived from selections from (usually vast) pools of existing data.⁷⁶ This is the reason, of course, for the much-publicized failures of algorithms that spew racist and sexist bile they have learnt from their training data,⁷⁷ or inadequacies in the protections supporting chatbots based on Large Language Models (LLMs) that allow users to "jail-break" them to expose the darker side of their stochastic logic.⁷⁸ In profound ways, the philosophy of history lies at the core of global computational systems. Far too little work has been conducted to chart connections between the socio-technical (data-driven) heart of digital modernity and the philosophical discourse of *historical* modernity.

This does not imply a retreat from empiricism or the principles of scientific method, especially if we assume that the negative calibration of algorithms is a design choice that could be altered, but the process is complex:

Science doesn't disappear in a dataist world. What matters is the hierarchy: which groups are driving the discussion and, most importantly, seen as possessing the most important knowledge. In a theocracy or a totalitarian state, science is subordinated to religious or political knowledge.⁷⁹

Computers and their enabling infrastructure and statistical models are profoundly implicated in the unfolding of the contemporary scientific worldview, requiring constant vigilance about possible biases inherited from the fabric of the historical data they use for training and the human prejudices embedded in that data, and an awareness that the design choices that inform "algorithmic modernity"⁸⁰ could (theoretically) be changed to better support the foundations of liberal democracy. Although currently configured in ways that promote discord, the underlying technology does not determine subsequent design decisions as much as present a range of opportunities along a spectrum from post-liberal capitalism to Communism. There are strong arguments that the socio-economic drivers of these events are more important than technical aspects.

It is worth considering Q-Anon in this context, and carnivals of outrage such as the storming of the United States Capitol building in January 2021. The disorder and lack-logic of that event suggest it was influenced by deeply

compromised lakes of historical data and equally compromised algorithms. Those socio-technical elements combined with far more mundane historical and sociological issues to produce the parody of democracy that the world watched live as it unfolded. Social media and misinformation (and probably disinformation by state actors) played a major role but the driving forces were anchored in far more mundane issues. Any interpretation should emphasize social alienation and economic inequality, reduced spending on universal education and healthcare, the manipulation of vulnerable people by hostile state actors and fifth columnists, and the simple human reality of naïveté and mental illness rather than laying the blame entirely on components of digital modernity such as algorithms or networks. We need to return to large-scale multivariant analyses grounded in the philosophy of history and sociology to understand these problems and accept that our systems of government still provide the bedrock upon which our technologies are deployed.

These issues are explored in more detail in the next chapters, underpinned by an assumption that we can change the course of history in positive directions through active intervention and critical technical practice. As dangerous as our new technologies are, well-meaning analyses that emphasize the power of computational rationalism without a concomitant belief in the ability of humans to design and deploy technology in ways that can support just forms of government need to be rejected. Karl Popper claimed that historicism led to the horrors of twentieth century totalitarianism for broadly the same reasons, with ideologies locked into a sense of systemic inevitability.⁸¹ Other political philosophers came to broadly the same conclusion, despite making ever finer distinctions.⁸² In an indictment of human reason and our will to power, it became clear to many commentators during the Cold War that a belief in historicism is more determinative than the economic or technological systems that give rise to that belief. While the nomenclature of historism/historicism is counter-intuitive and not likely to enter widespread academic use, we need to take much the same approach today, embracing interpretations of digital modernity that undermine narratives of computational determinism. The next chapter contributes to that process through an exploration of emergence theory.

Notes

- 1 Isaiah Berlin, "The Concept of Scientific History." *History and Theory* 1, no. 1 (1960): 1–31.
- 2 Karl Popper, *The Open Society and Its Enemies* [1945] (London: Routledge, 2011); Hannah Arendt, *The Origins of Totalitarianism* [1951] (London: Penguin, 2017).
- 3 Peter Thiel, "The Straussian Moment," in *Politics & Apocalypse*, ed. Robert Hamerton-Kelly (East Lansing: Michigan State University Press, 2007), 189–218.

- 4 Jürgen Habermas, *The Philosophical Discourse of Modernity: Twelve Lectures* (Cambridge: Polity in association with Basil Blackwell, 1987), 16. Habermas' emphasis.
- 5 G. W. F. Hegel, *Phenomenology of Spirit* [1807], trans. A. V. Miller (Oxford: Oxford University Press, 1977), 492: "But the other side of [Nature's] Becoming, *History*, is a *conscious*, self-mediating process – Spirit emptied out into Time; but this externalization, this kenosis, is equally an externalization of itself; the negative is the negative of itself" (Hegel's emphasis).
- 6 Alexander Galloway, *Uncomputable: Play and Politics in the Long Digital Age* (Brooklyn: Verso, 2021), 215.
- 7 Galloway, *Uncomputable*, 217.
- 8 Langdon Winner, "Upon Opening the Black Box and Finding It Empty: Social Constructivism and the Philosophy of Technology," *Science, Technology, & Human Values* 18, no. 3 (July 1, 1993): 365. Winner's emphasis.
- 9 Galloway, *Uncomputable*, 218.
- 10 Galloway, *Uncomputable*, 217.
- 11 Frank Pasquale, *The Black Box Society: The Secret Algorithms That Control Money and Information* (Cambridge, MA: Harvard University Press, 2015).
- 12 Anthony Elliott, *Algorithms of Anxiety: Fear in the Digital Age* (Cambridge: Polity Press, 2024).
- 13 danah boyd and Kate Crawford, "Critical Questions for Big Data," *Information, Communication & Society* 15, no. 5 (June 1, 2012): 662–79; José van Dijck, "Datafication, Dataism and Dataveillance: Big Data between Scientific Paradigm and Ideology," *Surveillance & Society* 12, no. 2 (May 9, 2014): 197–208.
- 14 François Hartog, *Regimes of Historicity: Presentism and Experiences of Time*, trans. Saskia Brown (New York: Columbia University Press, 2015), xv.
- 15 Hartog, *Regimes of Historicity*, xv.
- 16 Bruno Latour, *We Have Never Been Modern* (Cambridge, MA: Harvard University Press, 1993), 10.
- 17 Latour, *We Have Never Been Modern*, 67.
- 18 Latour, *We Have Never Been Modern*, 40.
- 19 Habermas, *The Philosophical Discourse of Modernity*, 16–19. A deeper analysis of historicism would include its relevance to almost all societies, from Ancient Greece to India and China, but its relevance to digital modernity is more tightly connected to its post-Enlightenment forms.
- 20 Paul Hamilton, *Historicism* (London: Routledge, 1996), 3.
- 21 Popper, *The Open Society and Its Enemies*.
- 22 Popper, *The Open Society and Its Enemies*, 253.
- 23 Karl Popper, *The Poverty of Historicism* (London: Routledge & Kegan Paul, 1957), 22 (Popper's emphasis).
- 24 Edward Gibbon's *The History of the Decline and Fall of the Roman Empire*. 6 vols. (London: Strahan and Cadell, 1776–1789) is a representative example.
- 25 Maurice Mandelbaum, cited in F. R. Ankersmit, *Meaning, Truth, and Reference in Historical Representation* (Ithaca: Cornell University Press, 2012), 2.
- 26 Leopold von Ranke, *Histories of the Latin and German Nations from 1494–1514* (1887), cited in John Tosh, *The Pursuit of History: Aims, Methods and New Directions in the Study of History*, 2nd ed. (London: Longman, 1991), 14.
- 27 Hamilton, *Historicism*, 5.
- 28 Vincent Gengnagel and Julian Hamann, "The Making and Persisting of Modern German Humanities: Balancing Acts between Autonomy and Social Relevance," in *The Making of the Humanities Volume III*, ed. Rens Bod, Thijs Weststeijn, and Jaap Maat (Amsterdam: Amsterdam University Press, 2014), 646.

- 29 Marc Bloch, *The Historian's Craft* [1952] (Manchester: Manchester University Press, 2015), 48.
- 30 In an earlier foray in historicism, Alan Liu suggested that "The New Historicism is our most embarrassed 'safe' enactment of the forces once mobilizing the old historicist Spirit. In its very motive (not to mention critical vocabulary and often style), it is our newest version of the movement that first taught criticism how to be embarrassed by history: formalism". "The Power of Formalism: The New Historicism," *ELH* 56, no. 4 (1989): 740.
- 31 Hamilton, *Historicism*, 2.
- 32 E. H. Carr, *What Is History?* (New York: Alfred A. Knopf, 1962), 3–35.
- 33 Donna Haraway, "A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century" [1985], in *Simians, Cyborgs and Women: The Reinvention of Nature* (New York: Routledge, 1991), 151.
- 34 Haraway, "A Cyborg Manifesto," 152.
- 35 Haraway, "A Cyborg Manifesto," 152.
- 36 Haraway, "A Cyborg Manifesto," 153.
- 37 Haraway, "A Cyborg Manifesto," 154.
- 38 Haraway, "A Cyborg Manifesto," 177.
- 39 Jonathan Lamb, *Preserving the Self in the South Seas 1680–1840* (Chicago and London: University of Chicago Press, 2001), 23.
- 40 Alexander Galloway, cited in David Golumbia, *The Cultural Logic of Computation* (Cambridge, MA: Harvard University Press, 2009), 143. Galloway's emphasis.
- 41 Golumbia's *Culture of Computation* is exemplary in this regard: a fascinating example of post-Frankfurt School technological critique alive to the twentieth century legacy of Enlightenment rationalism. My 2017 book, *The Digital Humanities and the Digital Modern*, struggled to parse the implications of Golumbia's perspective for Digital Humanities.
- 42 For example, Katherine Hayles *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago: University of Chicago Press, 1999); *Writing Machines* (Cambridge, MA: MIT Press, 2002); *How We Think: Digital Media and Contemporary Technogenesis* (Chicago: University of Chicago Press, 2012); *Unthought: The Power of the Cognitive Nonconscious* (Chicago: University of Chicago Press, 2017); *Postprint: Books and Becoming Computational* (New York: Columbia University Press, 2021).
- 43 Hayles, *How We Became Posthuman*, 2. Hayles' emphasis.
- 44 Hayles, *How We Became Posthuman*, 3.
- 45 Hayles, *How We Became Posthuman*, 5.
- 46 Hayles, *How We Became Posthuman*, 3.
- 47 Hayles, *Unthought: The Power of the Cognitive Nonconscious*, 2.
- 48 Hayles, *Unthought: The Power of the Cognitive Nonconscious*, 2.
- 49 Alan Liu, *The Laws of Cool: Knowledge Work and the Culture of Information* (Chicago: University of Chicago Press, 2004), 68–69. Liu's deployment of digital tools and methods in the service of this historicizing mission can be read in similar terms.
- 50 Alan Liu, *Friending the Past: The Sense of History in the Digital Age* (Chicago: University of Chicago Press, 2018), 6. Liu's emphasis.
- 51 Charles R. Bambach, *Heidegger, Dilthey, and the Crisis of Historicism* (Ithaca: Cornell University Press, 1995), 3.
- 52 Lamb, *Preserving the Self in the South Seas*, 22.
- 53 Liu, "The Power of Formalism: The New Historicism."
- 54 Alan Liu. *Local Transcendence: Essays on Postmodern Historicism and the Database* (Chicago: University of Chicago Press, 2008), 240.

- 55 Lisa Nakamura, *Cybertypes: Race, Ethnicity, and Identity on the Internet* (New York: Routledge, 2002), 24.
- 56 Wendy Hui Kyong Chun, "Race and/as Technology, or How to Do Things to Race," in *Race after the Internet*, ed. Lisa Nakamura and Peter Chow-White (New York: Routledge, 2012), 38.
- 57 For example, Safiya Umoja Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism* (New York: NYU Press, 2018).
- 58 Liu, *Local Transcendence*, 4.
- 59 Rita Raley and Jennifer Rhee, "Critical AI: A Field in Formation," *American Literature* 95, no. 2 (2023): 185–204.
- 60 Lewis Mumford, *Technics and Civilization* (Chicago: University of Chicago Press, 1934).
- 61 Jacques Ellul, *The Technological Society* (New York: Knopf, 1964).
- 62 Hayles, *Unthought*, 178–201.
- 63 The concept of Counter-Enlightenment was articulated in Isaiah Berlin, "The Counter-Enlightenment," in *Against the Current: Essays in the History of Ideas* [1979] (London: Pimlico, 1997), 1–24.
- 64 For example, Arendt, *The Origins of Totalitarianism*, 620–21.
- 65 Golumbia, *The Cultural Logic of Computation*; Pasquale, *The Black Box Society*.
- 66 Wendy Hui Kyong Chun, *Discriminating Data: Correlation, Neighborhoods, and the New Politics of Recognition* (Cambridge, MA: MIT Press, 2021).
- 67 Wendy Hui Kyong Chun, *Programmed Visions: Software and Memory* (Cambridge, MA: MIT Press, 2011).
- 68 For example, Pasquale, *The Black Box Society*; Seb Franklin, *Control: Digitality as Cultural Logic* (Cambridge, MA: MIT Press, 2015); Safiya Umoja Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism* (New York: NYU Press, 2018).
- 69 R. A. Fisher, "The Use of Multiple Measurements in Taxonomic Problems," *Annals of Eugenics* 7, no. 2 (September 1936): 179–88.
- 70 Chun, *Discriminating Data*, 203.
- 71 "Homophily," *OED Online* (Oxford: Oxford University Press, March 2022), https://www.oed.com/dictionary/homophily_n2, accessed February 20, 2026.
- 72 Eli Pariser, *The Filter Bubble: What the Internet Is Hiding from You* (New York: Penguin Press, 2011).
- 73 Elliott, *Algorithms of Anxiety* (Hoboken, Cambridge: Polity Press, 2024).
- 74 Chun, *Discriminating Data*, 27.
- 75 Chun, *Discriminating Data*, 72.
- 76 Adrian Mackenzie, *Machine Learners: Archaeology of a Data Practice* (Cambridge, MA: MIT Press, 2017).
- 77 Kris McGuffie and Alex Newhouse, "The Radicalization Risks of GPT-3 and Advanced Neural Language Models," *arXiv* 2009.06807 [cs] (September 14, 2020); Luciano Floridi and Massimo Chiriatti, "GPT-3: Its Nature, Scope, Limits, and Consequences," *Minds and Machines* 30, no. 4 (December 2020): 681–94.
- 78 OpenAI, "GPT-4 System Card" (OpenAI, March 15, 2023), 3, <https://cdn.openai.com/papers/gpt-4-system-card.pdf>, accessed February 20, 2026.
- 79 Blayne Haggart, "ChatGPT Strikes at the Heart of the Scientific World View," *Centre for International Governance Innovation*, <https://www.cigionline.org/articles/chatgpt-strikes-at-the-heart-of-the-scientific-world-view/>, accessed February 17, 2023.
- 80 Elliott, *Algorithms of Anxiety*, 17ff.
- 81 Popper, *The Open Society and Its Enemies*, 270.
- 82 See, for example, Ernest Nagel, "Determinism in History," *Philosophy and Phenomenological Research* XX, no. 3 (1960): 291–317.

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8

EMERGENT INFRASTRUCTURE

The theory of emergence at the centre of this chapter helps us explore the impact of global digital infrastructure on historical reality. This has considerable philosophical implications, offering what Philip Clayton claims is a third option for ontological commitment next to physicalism and dualism.¹ Such speculations are not central to this chapter but are worth keeping in mind in the context of the possible development of digital modernity in future decades. Emergence theory speaks to foundational assumptions that have guided our attitudes and relationship to science and technology since the eighteenth century. It is particularly useful in the context of advanced technology because of its ability to bracket areas of uncertainty for the future, remaining within the limits of scientific naturalism while still pressing hard against the boundaries of knowledge. When used incorrectly, it can support all kinds of wild confabulations, particularly in the context of artificial intelligence (AI), but the basic theory has proven useful over several millennia of intellectual activity. Perhaps most importantly, it offers a way to push back on historicist claims presented in the previous chapter, which position digital technology as a component of a larger deterministic system.²

Emergence theory has deep intellectual roots, being used by ancient Indian and Greek philosophers including Aristotle,³ and has contributed to an extremely broad intellectual tradition, from the philosophy of mind to biology and quantum physics. Strongly influenced by the British tradition initiated by John Stuart Mill in his *System of Logic* (1843), the theory was further developed in Alexander Bain's *Logic* (1870), George Henry Lewes's *Problems of Life and Mind* (1875), Samuel Alexander's *Space, Time, and Deity* (1920), Lloyd Morgan's *Emergent Evolution* (1923), and C. D. Broad's *The Mind and Its Place in Nature* (1925).⁴ It experienced a resurgence in the 1990s to explain

strange phenomena in science related to quantum physics and complexity theory⁵ and has been used again more recently to account for unusual behaviour in Large Language Models (LLMs) but is not a mainstream philosophical or scientific concept.⁶

The theory also has challenging characteristics.⁷ In some ways, it can be viewed as a bracketing tool, used to facilitate analysis of complex analytical domains suffering from epistemological and ontological gaps. Some measurable thresholds beyond which emergent behaviours tend to occur have been identified in some fields, but there is little sense, as the noun “theory” suggests, in which emergence can begin to approach what could be considered a natural law.⁸ Undermined by the weight of positivist empiricism, the theory disappeared from intellectual discourse from the 1930s to the 1970s (briefly resurfacing in the writing of Michael Polanyi in the 1960s), before being applied to a wide range of fields from the hard sciences to sociology in the latter decades of the twentieth century.

Emergence theory has proven useful in periods of epistemological uncertainty, facilitating intellectual work in the absence of clear pathways. More recently, for example, its application to quantum theory and philosophy of mind has exposed gaps in purely physicalist interpretations of reality.⁹ In simple terms, “[E]mergence relates to phenomena that arise from and depend on some more basic phenomena yet are simultaneously autonomous from that base”.¹⁰ The classic example offered is water, which has characteristics such as transparency and liquidity (and an ability to quench thirst) that emerge from its constituent parts (hydrogen and oxygen) in unpredictable ways. Philosopher of cognition John Searle extends this analogy to consciousness by noting that it:

is an emergent feature of certain systems of neurons in the same way that solidity and liquidity are emergent features of systems of molecules. The existence of consciousness can be explained by the causal interactions between elements of the brain at the micro level, but consciousness cannot itself be deduced or calculated from the sheer physical structure of the neurons without some additional account of the causal relations between them.¹¹

To Searle, consciousness is thus supervenient upon the component parts of the human brain, from molecules to tissue, to neurons.

That is not to make a simplistic claim that the relationship between the human brain and consciousness is fully understood – much less that it could be reproduced mechanically with our current state of knowledge – but that in the absence of appropriately powerful scientific theories demonstrating the detailed way that consciousness emerges from grey matter, it is quite reasonable to assume that it does however “emerge” from it. In much the same way, this book claims that digital modernity is supervenient upon its

material and conceptual (its technological) infrastructure. This book claims that digital modernity results from “weak emergence” where “a system’s macro properties can be explained by its micro properties but only in an especially complicated way”.¹² Strong or “ontological” emergence is vastly different from weak emergence, producing features that “are neither reducible to nor determined by more basic features”.¹³ The requirements for strong emergence are so high that many philosophers doubt its existence and others suspect it only applies to consciousness.¹⁴ Philip Clayton has made a compelling case for the role of strong emergence in the production of human consciousness, but our understanding of global digital infrastructure is so formative (and the problem space so distributed and difficult to study) that such a claim would be overreaching in the context of digital modernity.¹⁵ Weak emergence demonstrates what Mark Bedau describes as explanatory incompressibility, meaning macro phenomena are “causally reducible to the micro *in principle*, but the reductive micro-explanation is *especially complex*”.¹⁶

It is important to note that (nomological, as opposed to logical) supervenience does not necessarily imply straightforward or hard (in our case technological) determinism. David Chalmers describes the philosophical technicalities well, commenting on the relationship between “A-properties” (micro, physical, in our case computational devices) aspects of the world and B-properties (macro properties, in our case digital modernity):

With mere natural supervenience, the ontology is not so straightforward. Contingent lawful connections connect distinct features of the world. In general, if B-properties are merely naturally supervenient on A-properties in our world, then there could have been a world in which our A-facts held without the B-facts. As we saw before, once God fixed all the A-facts, in order to fix the B-facts he had more work to do. The B-facts are something over and above the A-facts, and their satisfaction implies that there is something new in the world.¹⁷

Jaegwon Kim elaborated on this perspective in 2006 in his discussion of conflicting versions of emergence theory:

I am not insisting here that the dependence of an emergent property on its “basal” condition [need] be deterministic; I believe there may well be a viable concept of *statistical* or *stochastic* emergence, which assigns a stable objective chance of the emergence of a property given that an appropriate basal condition is present. But stochastic emergence in this sense must be based on statistical laws with nomological force, and these laws can warrant talk of stochastic supervenience and stochastic necessitation.¹⁸

Kim goes on to note that emergence theory therefore implies supervenient relationships between basal (in technological terms, perhaps “micro”) conditions and epiphenomena related to them:

If property M emerges from properties $N_1, \dots, N_n$, then M supervenes on $N_1, \dots, N_n$. That is to say, systems that are alike in respect of basal conditions, $N_1, \dots, N_n$ must be alike in respect of their emergent properties.¹⁹

Digital modernity’s “basal” components are obvious, anchored in microchips and their associated circuit operations (AND, XOR, NOR gates) and (at a higher level of abstraction) in the von Neumann hardware architecture and connective networks.

This incompressibility is generated from the remarkable complexity and range of unpredictable phenomena that even simplistic computing systems can generate. The canonical example offered is usually Cambridge mathematician John Conway’s Game of Life (GOL), comprising simple automata that propagate within a grid pattern according to simple rules.²⁰ The little game generates a range of complex behaviour, with “the majority of sufficiently large patterns explod[ing] quadratically” to fill most of the 2D plane.²¹ The supervenient relationship of GOL to its computational infrastructure is self-evident, but even at this modest scale it remains incompressible given current computing resources and human constraints on time and effort.²² Expanding our analysis outwards to global digital infrastructure, as we need to in our analysis of digital modernity, produces a Cambrian explosion of complexity that confounds our current explanatory capacity.

It is important to note that this does not necessarily imply that digital modernity’s more complex phenomena will forever defy explanation. Emergence theory was popular in the nineteenth century for its ability to expose similarly complex problems to scientific examination, allowing scientists to design experiments to explore why magnetism “emerges” from metals held near electrical currents before the theory of electromagnetism existed to explain it properly, for example. It was then used to explain gaps in classical physics, before quantum mechanics offered new perspectives.²³ Now the assumptions underlying emergence theory are being used to understand unexpected behaviour in LLMs²⁴ and gaps in our understanding of the quantum universe.²⁵ The present book assumes a similar process will occur in our understanding of the relationship between the infrastructural foundations and epiphenomena of digital modernity, allowing us to improve the effectiveness of our analysis over time: “emergence of a characteristic is not an ontological trait inherent in some phenomena; rather it is indicative of the scope of our knowledge at a given time; thus it has no absolute, but a relative character; and what is emergent with respect to the theories available today may lose its emergent status tomorrow”.²⁶ The challenge is to maintain an empirical mindset, assuming

future explainability rather than lapsing into “techno-supernaturalism” or vitalism.²⁷

Manuel DeLanda presents a similar perspective in his discussion of assemblages, noting the importance of the theory of emergence and claiming that – like the molecular components of water – agglomerations of artefacts, people, and societies are not reducible to their component parts. Indeed, “the whole exists alongside the parts on the same ontological plane. In other words, the whole is immanent, not transcendent”.²⁸ In the present study, therefore, digital infrastructure and digital modernity interpenetrate each other, and each is *always-already present within the other*. Digital modernities do not emerge from their foundational infrastructure as transcendent outputs of it but are entangled with it. Seeking robust and testable ways to explain these processes is a pressing task for computer scientists, sociologists, and humanists alike. Following Nagel, it is conceivable that precise limits to our understanding will eventually be found, but it is premature to define those limits only a matter of decades after the establishment of the Internet.

Early work in the philosophy of technology offers useful starting points. Martin Heidegger might have suggested digital modernity emerged in a process of unconcealing, revealing, or *bestand*: “Unlocking, transforming, storing, distributing, and switching about are ways of revealing”.²⁹ In his early writing about technology, Heidegger claimed that this tendency concealed more than it revealed, never running off “into the indeterminate”,³⁰ and therefore enframing our experience of the world with a mode of rationalism that alienates us from meditative thinking or *Gelassenheit*. This need not be the case. The concept of emergence implies the possibility of progressive unfolding of human understanding in symbiosis with complex systems, in a post-phenomenological relationship of considerable promise.³¹ My optimism is founded upon the conceptual and material complexity described above and below and the ontological irreducibility of the problem. In epistemological terms, this suggests not a foreclosing of human potential, but its perpetual expansion.

This is not to suggest that emergent behaviour is without risk, of course. Early assessments of emergent behaviour in LLMs suggest the potential for a range of negative impacts, from an increase in disinformation to mass unemployment, geopolitical instability, and issues with cybersecurity.³² There is good reason to surmise, moreover, that it will be difficult to adequately align AI to human values in a way that protects human interests even if we can identify the primary risks.³³ There is also reason to suggest that the reinforcement learning from human feedback (RLHF) used to train LLMs tends to naturally *misalign* LLM technology from human values,³⁴ for example, by prompting the emergence of a dark opposite to the intended AI persona that will always need to be suppressed. Rather than increasing alignment to human values, “RLHF is an irreparably inadequate solution to the AI alignment problem, and RLHF is probably increasing the likelihood of a misalignment

catastrophe”.³⁵ These are problems that are more relevant to the next phase of digital modernity, and subject to considerable debate, but they have important implications for the theory of computational emergence more broadly. In their most dramatic form, they tap into anxieties about the nature of rationality and human identity that reach back to Old Testament stories about the Golem³⁶ and forward to the possibility that human or super-human level cognitive capacity might emerge from computational infrastructure.³⁷

Those issues are explored more fully in [Chapter 9](#). Before entering that problem space, it is sensible to look backwards, to gain a better sense of the developments that led us to this point and perhaps resist the anxiety produced by Heideggerian *bestand*. By bracketing currently incompressible aspects of digital phenomena, emergence theory increases our purchase over the problem space, encouraging us to consider paths less trodden and historical oddities. In this sense, rather than defining clear thresholds after which unexplained phenomena will always arise, emergence theory can act as a design principle, encouraging us to pause and consider the myriad different behaviours or effects that might emerge (and might be able to be optimized to emerge, or restricted from emerging) within digital modernity.³⁸ This is easier said than done, of course. As a distributed and dynamic complex system, the conceptual roots of global digital infrastructure extend into the deep past and intersect with fundamental issues in the ontology of mathematics and engineering, making the range of potential emergent behaviours radically difficult to predict. As Benjamin Bratton has noted, “[s]ometimes the emergent defines the archaic by opposition, and sometimes it is an essential collaborator”.³⁹ Because of this, it is not enough to only consider developments in the history of twentieth-century computing as we did in [Chapter 2](#): it is also important to defamiliarize digital infrastructure and consider what alternatives theoretically exist, to reduce (however subtly) the incompressibility of the problem space.

To understand the deep roots of computational thinking, it is helpful to consider the deep technological past. It is not widely known, for example, that Ancient Egyptians resorted to binary representations of their number system for multiplication, using the same technique implemented in modern computers for shift and multiplication functions.⁴⁰ The eventual adoption of the Hindu-Arabic system across the Western world, using base-10, a strict positional system, and a zero to use as a placeholder, made manual computing much easier but led people aiming to automate computing towards dead ends.⁴¹ The conceptual evolution from the use of objects such as sticks and stones for counting to abstract representations of those objects and finally abstract representations that facilitated basic operations (plus, minus, division, multiplication) took thousands of years. As the example of Egyptian multiplication shows, moreover, the process of development was by no means simplistically iterative, with one solution rendering others extinct. Some approaches died out, but many remained in the background or merged into

cognate approaches, sometimes to resurface when required (as with the binary number system and infinitesimal calculus). Cultural variations have also emerged, such as the use of different number systems for different contexts in the Japanese language.

These examples are not disconnected from our contemporary situation: flexibility and limits seen in number theory also limit the potential of digital infrastructure, from the physics of information transfer via silicon chips and fibre-optic cables to cryptography, information theory, and the behaviour of LLMs. Breakthroughs in engineering and physics were undoubtedly important too, but the ability to convert abstract conceptions of numbers into counting sticks and use them to perform arithmetic symbolizes perhaps the most fundamental conceptual basis for digital modernity. The process of abstraction that paved the way for the eventual reduction of mathematics to symbolic manipulation only advanced far enough to enable digital computing in the nineteenth and twentieth centuries, but the conceptual experimentation that brought us to that point is ancient.

Other ancient examples defamiliarize contemporary technology more powerfully still. The so-called Antikythera Mechanism is a good example. The device was built c. 150–200 BCE and discovered in a first century BCE shipwreck near the island of Antikythera, inside the hold of a ship that sank on its way to Rome.⁴² The mechanical device, with clock-like front and back and an intricate system of cogs, surprises people who assume computation is a prerogative of the twentieth and twenty-first centuries. In 2021, a team from University College London backward engineered the remains of the device to reveal its full purpose, as “a computational instrument for mathematical astronomy, incorporating cycles from Babylonian astronomy and the Greek flair for geometry”.⁴³

Hand-cranked and undoubtedly inaccurate, the Antikythera Mechanism calculated the ecliptic longitudes of the Moon, Sun, and planets; the phase of the Moon; the Age of the Moon; the synodic phases of the planets; the excluded days of the Metonic Calendar; eclipses (possibilities, times, characteristics, years, and seasons), the heliacal risings and settings of prominent stars and constellations; and the Olympiad cycle.⁴⁴ Rather than sitting outside the conceptual world of Ancient Greece, however, like an alien artefact deposited from the far reaches of the universe, the mathematical principles that enable the mechanism were relatively widely known and documented in ancient texts including Plato’s dialogues – one of which describes Parmenides Proposition which informed the computation of the planetary cycles for Venus and Saturn. It was unlikely to be the only such device in circulation.

Gilbert Simondon suggests that ancient technology such as the Antikythera Mechanism demonstrates the emergence of technicity from magic and superstition, leading to the development of two contradictory attitudes towards technical objects that persist in the modern world: “on the one hand, it treats

them as pure *assemblages of matter*, devoid of true signification, and merely presenting a utility. On the other hand, it supposes that these objects are also robots and that they are animated by hostile *intentions* toward man...”.⁴⁵ We can only speculate how contemporaries viewed the Antikythera Mechanism, but the prevalence of narratives about AI in the ancient world suggests interpretations would have been various and lively.⁴⁶ The epistemological problem space is remarkably similar to discussions about LLMs and generative AI, veering between purely functional descriptions of “stochastic parrots” and claims that even early examples of generative chatbots exhibit signs of sentience.⁴⁷ This constellation of problems is explored in the final chapter of the present book, through the concept of exosomatic nonconscious cognition. Regardless of our position, the issue is of deep historical interest.

This is not the place for an overview of the history of technology, but it is worth mentioning the incredible depth of the field to get a sense of the proper analytical scope for any history of digital modernity. Works such as Charles Singer’s *A History of Technology* (5 volumes, 1954–1958) and Joseph Needham’s *Science and Civilization in China* (7 volumes, 1954–present) provide the voluminous context necessary to properly understand the infrastructure of digital modernity, allowing us to view it as a historically contingent expression of human society and culture. In his history of computing technology, Michael Williams notes the conceptual importance of such simple devices as knotted cords (used for record keeping across Asia, the Middle East, and Europe for centuries) and tally sticks (sticks or bones cut with notches) found in Zaire that appear to be 8000 years old.⁴⁸ Combined with the development of written media, long acknowledged as fundamental to the development of contemporary digital culture, the evolution of abstract thinking and the ability to operationalize symbolic representations of abstract concepts in utilitarian mechanisms lies at the core of what digital infrastructure is.⁴⁹ Stories about early modern merchants seeking out “the tools and techniques of handicraft producers and the computation methods used by their commercial rivals” in Asia and Africa convey a richness and continuity to our infrastructural present that narratives about digital culture and society often fail to convey.⁵⁰

Deep technological history allows us to step back and consider the range of potential phenomena that could emerge from global digital infrastructure. Consider a thought-experiment: the digital infrastructure that enables digital modernity disappears overnight and emerges anew from the fabric of reality (the void of the ancient Greeks), built by a new generation of mathematicians and engineers.⁵¹ Would the motivation to automate computation even arise? What would the new infrastructure look like? How would it perform and what would it be capable of? Would it be identical to the infrastructure we have now or unrecognizable? Would it be embedded with the same biases and inadequacies of contemporary infrastructure? Would it be oriented towards business or pleasure, or spirituality? Would we have desktop computers and mobile

phones with CPU, RAM, and storage, or strange (perhaps even organic) devices? Would binary logic be important? The problem is intractable, touching on fundamental problems in mathematics, logic, and engineering as well as canonical problems in history and philosophy such as determinism and the social construction of technology.⁵²

Our thought experiment is a reminder that our computational infrastructure is far from ideal. There is a wide margin between the mathematical methods that enable contemporary computing and the politically and economically mediated products, services, and platforms that we interact with.⁵³ This is not to deny the wonder of contemporary digital infrastructure; it is a marvel of human ingenuity and engineering. The point is more subtle than that and has a bearing on the culture and political economy of digital modernity. As Beatrice Fazi notes, we can either view the boundary conditions identified by early twentieth century mathematicians as evidence of the failure of formal systems or surmise that “the incomplete and uncomputable are not errors or stopping points for axiomatics. Rather, they show that indeterminacy pertains not only to the empirical realm but the formal too”.⁵⁴ The computational infrastructure of digital modernity is a function of human failings in design and engineering (and sociocultural politics and economics) rather than being inherent in computational methods in and of themselves. This creates many opportunities for socio-technical intervention, and the design of policies and regulations in keeping with community norms.

The history of mathematics demonstrates these interdependencies well, suggesting it is time to reconsider the deterministic critique of computing common to humanities (and to a lesser extent social science) writing. Conceptual milestones in computing connect contemporary digital infrastructure to the deep past, but it is the increasing abstraction of those methods and especially the development of probabilistic statistical methods that signal the sea-change this book is most concerned with. As with the basic conceptual breakthroughs outlined above, the statistical methods used in complex computing systems evolved over several centuries. Michael Williams perceptively notes that the invention of logarithm tables by John Napier (1550–1617) in sixteenth century Scotland signalled a major turning point in this sense. Such was their value to people requiring computational shortcuts that logarithms came to be used extensively “in all trades and professions that required calculations to be done. It is hard to imagine an invention which has helped the process of computation more dramatically than has logarithms, the one exception being the modern digital computer”.⁵⁵ Scientists from Johannes Kepler (1571–1630) to Charles Babbage (1791–1871) published their own tables over time, and they were used alongside slide rules (an iteration of “Napier Bones”) and a range of mechanical computing devices until well into the twentieth century.

Tools such as these are easily viewed as tools of socio-technical rationalism, an inheritance from Enlightenment positivism, but they were always more

than utilitarian. They echoed contemporary belief in a Deistic and deterministic universe established by philosophers such as Gottfried Wilhelm Leibniz (1646–1716). Leibniz famously believed God had created the best possible universe, according to laws that mathematics could formalize and operationalize. This led to a parallel belief that the world was a deterministic and computable system, allowing for the possibility that manual calculations could be automated using mechanical devices, leading him to design a calculating machine known as the Step Reckoner. Simon-Pierre Laplace's (1749–1827) hypothetical demon, able to predict the future and ask any question because of its perfect knowledge of the structure of the universe from the largest to the smallest degree, provides the quintessential symbol of the attitude. The mechanistic view of the universe was ultimately undermined by Henri Poincaré (1854–1912) at the end of the nineteenth century, but two centuries of intensive experimentation, from the late eighteenth to the early twentieth century, was conducted on the assumption that the universe was mechanically knowable and – ultimately – programmable. The belief persists today in pancomputationalism.⁵⁶

The history of computing machinery informed by this general outlook is remarkably rich, reaching from Jacquard looms to Hollerith machines. It demonstrates widespread faith in “the new physics of knowledge” and its potential benefits for science and business.⁵⁷ Charles Babbage's nineteenth century designs for the Difference Engine, and later designs for the Turing-complete Analytical Engine (which included an algorithm designed by the mathematician Ada Lovelace),⁵⁸ provide archetypal examples of this work. The machines neatly encapsulate the connections between digital modernity, mathematical formalism, and the utilitarian spirit of industrial modernity.⁵⁹ And yet this narrative is incomplete. As I noted in [Chapter 2](#) in the context of cybernetics, it is easy to assume continuity between computational and mathematical formalism, extend that mode of thinking towards the machines designed by Babbage in the nineteenth century, and extrapolate from there to the deployment of digital infrastructure for neoliberal or other nefarious purposes, but the reality was more complex. The post-Enlightenment history of ideas was rich and contradictory, machines were generally built from a spirit of practical experimentation rather than deistic commitment, and less analytically rigid theories (such as emergentism, but also neo-Lamarckianism) existed alongside expressions of mathematical and computational formalism.⁶⁰

The career of George Boole (1815–1864), who developed Boolean predicate logic, provides a good example. Boolean logic is integral to switching in integrated circuits, and fundamentally related to mathematical formalism, but was developed by Boole to prove the existence of God in opposition to the philosophy of David Hume. Boole's innovation existed within a wider matrix of belief of signal importance. The method's formal rigour undoubtedly facilitates the implementation of fully deterministic systems (in the hardest sense

of technological determinism), but the nature of computational complexity means that higher levels in the infrastructural architecture (machine, programming language, user, society) collapse into profoundly indeterministic and ultimately inscrutable processes. The need to find ways to robustly (if speculatively) traverse micro and macro aspects of digital modernity is therefore pressing.

We have work that describes the implications of computational indeterminism at the level of effective methods and single computing devices, but few that speak to the cascading levels of interpretative complexity implied by their relationship to mathematics and statistics and (more problematically still) the relationship of the entire assemblage to global cyberinfrastructure. Warnings about the emergence of a global hyper-rational system, popular in the latter half of the twentieth century, went some way to conveying the brute mechanistic power of digital infrastructure but were too anchored in nineteenth-century formalism to be of use⁶¹. Adrian Mackenzie's *Machine Learners* (2017) provides a remarkable example of the blend of critical theory and mathematics that is needed to understand the complex processes in play, but the understanding required to produce work of that quality is exceedingly rare.⁶²

This mode of research assumes that myopic focus on mathematical determinism is unproductive, and that human control over planetary digital infrastructure is possible with the right critical perspectives. Wendy Chun's description of contemporary data science and AI in *Discriminating Data* adopts an optimistic tone despite highlighting the sometimes-egregious history of infrastructure development. Alexander Galloway demonstrates the importance of broadening our understanding of algorithms to include practices such as weaving.⁶³ Katherine Hayles' reference to an emerging planetary cognitive ecosystem⁶⁴ and Yuk Hui's reference to cosmotechnics⁶⁵ gesture towards the possibility of planetary flourishing too. Shannon Vallor's description of the *Technological Virtues*⁶⁶ and Bernard Stiegler's analysis of the neganthropocene occupy much the same space.⁶⁷ This level of cross-fertilization should not come as a surprise. In *Code: From Information Theory to French Theory*, Bernard Geoghegan points out the deep intellectual connections between the humanities and informatics, pushing back on claims that the two domains are irreconcilable. On the contrary, the connections between the history of colonialism and eugenics in and across both knowledge domains suggest they share common infrastructural origins and contributed to the development of contemporary digital infrastructure together.⁶⁸ If we want to influence the direction of digital modernity, we need to embrace those synergies for the common good.

Handled carefully, emergence theory offers a way to achieve this.⁶⁹ Rather than aiming for inductive rigour, or leaning on ideological critique, emergence theory allows us to pull focus depending on the state of scientific knowledge. This is less arbitrary than it sounds. Weak modes of emergence theory assume a supervenient relationship between part and whole that, although incompressible, assumes nomological relationships shaped by probabilistic and stochastic rather than simplistically deterministic processes.⁷⁰ Rather than attempting to

implement rigorously inductive methods or deterministic frameworks such as historical materialism, the approach accepts that systemic relationships between micro components and macro phenomena are demonstrable and in some cases readily observable, but too complex to be formulated in a logically precise manner. The most significant truth of contemporary society and identity is that much of our experience (although by no means all) is supervenient upon logical manipulation of electronic circuits connected by a single (if contested and evolving) communication network. Difficulties of interpretation and analysis exist because the global relationships between components and phenomena are incompressible and productive of unpredictable (emergent) behaviour, but there is no reason to suggest that *all* such relationships and phenomena are incompressible and unpredictable. As with effective methods, it is important to distinguish between theoretical and actual-existing behaviour.

We even have a mathematical measure that defines the limits of global digital infrastructure: Shannon entropy. The measure quantifies uncertainty in a system of communication, expressed in the minimum number of bits required to encode a message.⁷¹ Claude Shannon devised the concept after his 1940 master's thesis at the Massachusetts Institute of Technology, which applied Boolean logic to electronic relay switches.⁷² In his 1948 paper *A Mathematical Theory of Communication* (MTC), he demonstrated that the ideal of perfectly deterministic one-to-one transmission is less important than designing for probabilistic reliability so that a message remains intelligible even when some information is inevitably lost.⁷³ In doing so, Shannon gave engineers a way to design systems that approach the theoretical limits of efficient information transfer. Because this principle underlies the encoding, storage, and transmission of electronic information in contemporary computing infrastructure, it can be considered the conceptual lifeblood of digital modernity, functioning within engineering practice much like a law that defines the relationship between information, noise, and the architectures of Universal Turing Machines (UTMs).⁷⁴

This is a radically reductive view of digital infrastructure, to be sure, and does little to resolve the methodological problem of moving from there to the collective human experience of digital modernity, but it suggests that even the most confounding aspects of digital infrastructure are susceptible to rational enquiry. Emergence theory offers an epistemological perspective attuned to computational complexity, but mindful of the boundaries of knowledge. As Thomas Nagel noted in 1986, in pursuit of objective reality “something will inevitably be lost” even at its most successful.⁷⁵ This, of course, is the essence of the humanistic worldview and is in no way antithetical to scientific rationalism. Emergence theory represents a powerful expression of that broad spirit of inquiry. Yet many more perspectives are needed. That is especially the case in relation to problems of AI explored in the next chapter. An adequate understanding of the more advanced modalities of digital modernity can only be gained by rethinking our assumptions about the boundaries of knowledge and the relationship between science, technology, and the humanities.

Notes

- 1 Philip Clayton, *Mind and Emergence: From Quantum to Consciousness* (Oxford: Oxford University Press, 2006), 2.
- 2 Ray Kurzweil, *The Singularity Is Near: When Humans Transcend Biology* (New York: Viking, 2005).
- 3 J. Ganeri, "Emergentisms, Ancient and Modern," *Mind* 120, no. 479 (July 1, 2011): 671–703.
- 4 Brian P. McLaughlan, "Emergence and Supervenience," in *Emergence: Contemporary Readings in Philosophy and Science*, eds. Mark A. Bedau and Paul Humphreys (Cambridge, MA: MIT Press, 2008), 81.
- 5 For overviews, see Philip Clayton and Paul Davies, eds., *The Re-Emergence of Emergence: The Emergentist Hypothesis from Science to Religion* (Oxford: Oxford University Press, 2006); Mark A. Bedau and Paul Humphreys, eds., *Emergence: Contemporary Readings in Philosophy and Science* (Cambridge, MA: MIT Press, 2008).
- 6 Sébastien Bubeck et al., "Sparks of Artificial General Intelligence: Early Experiments with GPT-4," *arXiv*, March 22, 2023, <http://arxiv.org/abs/2303.12712>, 94–95; Wei Guo and Aylin Caliskan, "Detecting Emergent Intersectional Biases: Contextualized Word Embeddings Contain a Distribution of Human-like Biases," *arXiv*, June 06, 2020, <https://arxiv.org/abs/2006.03955>; Michal Kosinski, "Theory of Mind May Have Spontaneously Emerged in Large Language Models," *arXiv*, February 3, 2023, <https://arxiv.org/abs/2302.02083v1>; Jason Wei et al., "Emergent Abilities of Large Language Models," *arXiv*, June 15, 2022, <https://arxiv.org/abs/2206.07682>.
- 7 Jaegwon Kim, "Emergence: Core Ideas and Issues," *Synthese* 151, no. 3 (August 2006): 547–48.
- 8 In a 1972 paper, Nobel prize-winning physicist Philip Anderson defined emergence as "a general theory of just how [the] shift from quantitative to qualitative differentiation takes place". P. W. Anderson, "More Is Different: Broken Symmetry and the Nature of the Hierarchical Structure of Science," *Science* 177, no. 4047 (August 1972): 393. Anderson's paper was subsequently cited in Wei et al.'s 'Emergent Abilities of Large Language Models'.
- 9 Philip Clayton, "Conceptual Foundations of Emergence Theory," in *The Re-Emergence of Emergence: The Emergentist Hypothesis from Science to Religion*, eds. Philip Clayton and Paul Davies (Oxford: Oxford University Press, 2006), 1–31.
- 10 Mark A. Bedau and Paul Humphreys, "Introduction," in *Emergence: Contemporary Readings in Philosophy and Science*, 1.
- 11 John Searle, "Reductionism and the Irreducibility of Consciousness," in *Emergence: Contemporary Readings in Philosophy and Science*, 65.
- 12 Mark A. Bedau, "Is Weak Emergence Just in the Mind?" *Minds and Machines* 18, no. 4 (December 2008): 443 (abstract).
- 13 Silberstein and McGreever, cited in Philip Clayton, "Conceptual Foundations of Emergence Theory," in *The Re-Emergence of Emergence: The Emergentist Hypothesis from Science to Religion*, ed. Philip Clayton and Paul Davies (Oxford: Oxford University Press, 2006), 8.
- 14 David Chalmers, "Supervenience," in *Emergence: Contemporary Readings in Philosophy and Science*, 411–25.
- 15 Clayton, *Mind and Emergence*, 10. Clayton's description of the difference between weak and strong emergence is worth quoting in full: "Weak emergentists grant that different sorts of causal interactions seem to dominate 'higher' levels of reality. They agree with strong emergentists, for example, that evolution forms structures which, as emergent wholes, constrain the motions of their parts. But our inability to

recognize in these emerging patterns new manifestations of the same fundamental causal processes is due primarily to our ignorance. For this reason weak emergence is sometimes called ‘epistemological emergence’, in contrast to strong or ‘ontological’ emergence”.

- 16 Bedau, “Is Weak Emergence Just in the Mind?,” 445. Bedau’s emphasis.
- 17 Chalmers, “Supervenience,” 419.
- 18 Jaegwon Kim, “Emergence: Core Ideas and Issues,” *Synthese* 151, no. 3 (August 2006): 550. Kim’s emphasis.
- 19 Kim, “Emergence: Core Ideas and Issues,” 550.
- 20 Mark Bedau provides a compact description in his important 1997 article on weak emergence. See Mark Bedau, “Weak Emergence,” *Philosophical Perspectives* 11 (1997), 379: “Time is discrete. A cell’s state at a given time is determined by the states of its eight neighboring cells at the preceding moment, according to the birth-death rule: A dead cell becomes alive iff 3 neighbors were just alive, and a living cell dies iff fewer than 2 or more than 3 neighbors were just alive. (Living cells with fewer than two living neighbors die of ‘loneliness’, those with more than three living neighbors die of ‘overcrowding’, and a dead cell becomes populated by a living cell if it has the three living neighbors needed to ‘breed’ a new living cell.)”
- 21 Nathaniel Johnston, “Some Beautiful and Difficult Questions About Cellular Automata,” in *Emergence, Complexity and Computation*, ed. Andrew Adamatzky and Genaro J. Martinez (Cham: Springer International Publishing, 2016), 59.
- 22 Quantum computing may well change this situation for some classes of problems.
- 23 I position digital modernity as both ontological reality and epistemological framework in much the same way as Karen Barad approaches quantum physics, acknowledging “the roles of human and nonhuman, material and discursive, and natural and cultural factors in scientific and other practices” in our experience and understanding of it. Intriguing as the problem is I do not aim to demonstrate the entanglement of digital modernity with quantum reality, though. See Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (Durham: Duke University Press Books, 2007), 25.
- 24 For example, Neel Nanda et al., “Progress Measures for Grokking via Mechanistic Interpretability,” *arXiv*, January 13, 2023, <https://arxiv.org/abs/2301.05217>.
- 25 For example, Stewart Clark and Iorwerth Thomas, “Emergence in Non-relativistic Quantum Mechanics,” in *The Routledge Handbook of Emergence*, ed. S. C. Gibb (New York: Routledge, 2019), 265–74.
- 26 Carl Hempel and Paul Oppenheim, “On the Idea of Emergence,” in *Emergence: Contemporary Readings in Philosophy and Science*, 64.
- 27 Diane Proudfoot, “Software Immortals: Science or Faith?” in *Singularity Hypotheses: A Scientific and Philosophical Assessment*, ed. A. H. Eden et al. (Berlin: Springer-Verlag, 2012), 367–93.
- 28 Manuel DeLanda, *Assemblage Theory* (Edinburgh: Edinburgh University Press, 2016), 12–13.
- 29 Martin Heidegger, *The Question Concerning Technology: And Other Essays*, reissue ed. (New York: Harper Perennial, 2013), 16.
- 30 Heidegger, *The Question Concerning Technology*, 16.
- 31 Robert Rosenberger and Peter-Paul Verbeek, eds., *Postphenomenological Investigations: Essays on Human-Technology Relations* (Lanham: Lexington Books, 2015).
- 32 OpenAI, “GPT-4 System Card” (OpenAI, March 15, 2023), <https://cdn.openai.com/papers/gpt-4-system-card.pdf>, accessed February 20, 2026.
- 33 For a discussion of AI alignment, see Iason Gabriel, “Artificial Intelligence, Values, and Alignment,” *Minds and Machines* 30, no. 3 (September 1, 2020): 411–37.

- 34 Paul Christiano et al., “Deep Reinforcement Learning from Human Preferences,” *arXiv*, February 17, 2023, <https://arxiv.org/abs/1706.03741>.
- 35 Cleo Nardo, “The Waluigi Effect (Mega-Post),” *LessWrong*, <https://www.lesswrong.com/posts/D7PumeYTDpFBTp3i7/the-waluigi-effect-mega-post>, accessed March 6, 2023.
- 36 Peter Kroes, *Technical Artefacts: Creations of Mind and Matter* (Dordrecht: Springer, 2012), 166.
- 37 Michal Kosinski, “Theory of Mind May Have Spontaneously Emerged in Large Language Models,” *arXiv*, February 3, 2023, <https://arxiv.org/abs/2302.02083v1>.
- 38 Benjamin Bratton uses his analysis of “the stack” that enables “planetary-scale computation” for similar, although more extensive, purposes. The approach is an example of convergence between the philosophy of technology and coteremporary computing. See Benjamin H. Bratton, *The Stack: On Software and Sovereignty* (Cambridge, MA: MIT Press, 2016).
- 39 Bratton, *The Stack*, 9.
- 40 Michael R. Williams, *A History of Computing Technology* (Los Alamitos: IEEE Computer Society Press, 1997), 11–13.
- 41 A good example of historical contingency in the history of mathematics is demonstrated by the transmission of the use of zero from Hindu to Arabic and then European culture via Al-Khwarizmi, whose primary text was translated to Latin by Adelard of Bath in 1120 with the opening words Dixit Algorismi. This led to arithmetical manipulation of Hindu-Arabic notation being known as “algorism”, eventually evolving into the word “algorithm”. See Williams, *A History of Computing Technology*, 24.
- 42 Xenophon Moussas, “The Antikythera Mechanism: The Oldest Mechanical Universe in Its Scientific Milieu,” *Proceedings of the International Astronomical Union* 5, no. S260 (January 2009): 135–48.
- 43 Tony Freeth et al., “A Model of the Cosmos in the Ancient Greek Antikythera Mechanism,” *Nature Scientific Reports* 11, no. 1 (March 12, 2021): 5821.
- 44 Freeth et al., “A Model of the Cosmos,” 5821.
- 45 Gilbert Simondon, *On the Mode of Existence of Technical Objects* [1958], trans. Cecile Malaspina and John Rogove (Minneapolis: University of Minnesota Press, 2017), 17. Simondon’s emphasis.
- 46 Stephen Cave, Kanta Dihal, and Sarah Dillon, eds., *AI Narratives: A History of Imaginative Thinking about Intelligent Machines* (Oxford: Oxford University Press, 2020).
- 47 Emily M. Bender et al., “On the Dangers of Stochastic Parrots: Can Language Models Be Too Big? 🦜” in *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency* (FAccT ‘21) (New York: Association for Computing Machinery, 2021), 610–23; Leonardo De Cosmo, “Google Engineer Claims AI Chatbot Is Sentient: Why That Matters,” *Scientific American*, July 12, 2022, <https://www.scientificamerican.com/article/google-engineer-claims-ai-chatbot-is-sentient-why-that-matters/>, accessed March 20, 2023.
- 48 Williams, *A History of Computing Technology*, 33–37.
- 49 The classic articulation of this perspective is presented in Friedrich A. Kittler’s *Gramophone, Film, Typewriter* (Stanford: Stanford University Press, 1999) and *Literature, Media, Information Systems: Essays, Critical Voices in Art, Theory and Culture* (Amsterdam: G + B Arts International, 1997).
- 50 Michael Adas, *Machines as the Measure of Men: Science, Technology, and Ideologies of Western Dominance* (Ithaca: Cornell University Press, 2015), 26.
- 51 This thought experiment is inspired by Stephen J. Gould’s “evolutionary tape” described in Stephen Jay Gould, *Wonderful Life: The Burgess Shale and the Nature of History* (New York: W. W. Norton, 1989).

- 52 For an accessible overview of the very large literature on this topic, see Merritt Roe Smith and Leo Marx, eds., *Does Technology Drive History? The Dilemma of Technological Determinism* (Cambridge, MA: MIT Press, 1994).
- 53 Douglas R. Hofstadter, *Gödel, Escher, Bach: An Eternal Golden Braid* (Hassocks: Harvester Press, 1979).
- 54 M. Beatrice Fazi, *Contingent Computation: Abstraction, Experience, and Indeterminacy in Computational Aesthetics* (Lanham: Rowman & Littlefield International, 2018), 5.
- 55 Williams, *A History of Computing Technology*, 105.
- 56 Sometimes known as “info-computationalism”. See Gordana Dodig-Crnkovic, “Modeling Life as Cognitive Info-Computation,” *arXiv*, January 28, 2014, <https://arxiv.org/abs/1401.7191>.
- 57 Luciano Floridi, *Philosophy and Computing: An Introduction* (London and New York: Routledge, 1999), 13.
- 58 J. Fuegi and J. Francis, “Lovelace Babbage and the Creation of the 1843 ‘Notes,’” *IEEE Annals of the History of Computing* 25, no. 4 (October 2003): 16–26.
- 59 See Charles Babbage, *On the Economy of Machinery and Manufactures* (London: Charles Knight, Pall Mall East, 1832); and Martin Campbell-Kelly et al., *Computer: A History of the Information Machine* (New York: Westview Press, 2013), 4–11.
- 60 James Smithies, “Return Migration and the Mechanical Age: Samuel Butler in New Zealand 1860–1864,” *Journal of Victorian Culture* 12, no. 2 (2007): 203–24.
- 61 For example, Jacques Ellul, *The Technological Society* (New York: Knopf, 1964); Lewis Mumford, *The Myth of the Machine – The Pentagon of Power* (New York: Harcourt Brace Jovanovich, 1970).
- 62 Mackenzie, Adrian. *Machine Learners: Archaeology of a Data Practice* (Cambridge, MA: MIT Press, 2017).
- 63 Alexander Galloway, *Uncomputable: Play and Politics in the Long Digital Age* (Brooklyn: Verso, 2021).
- 64 Katherine Hayles, *Unthought: The Power of the Cognitive Nonconscious* (Chicago: University of Chicago Press, 2017).
- 65 Yuk Hui, *The Question Concerning Technology in China: An Essay in Cosmotronics* (Cambridge, MA: Urbanomic, 2018).
- 66 Shannon Vallor, *Technology and the Virtues: A Philosophical Guide to a Future Worth Wanting* (New York: Oxford University Press, 2016).
- 67 Bernard Stiegler, *The Neganthropocene* (Open Humanities Press, 2018).
- 68 Bernard Dionysius Geoghegan, *Code: From Information Theory to French Theory* (Durham: Duke University Press, 2023).
- 69 See also C. P. Snow, *The Two Cultures and the Scientific Revolution* (Cambridge: Cambridge University Press, 1959).
- 70 Resembling natural laws but lacking logical necessity.
- 71 For a standard introduction, see John R. Pierce, *An Introduction to Information Theory: Symbols, Signals & Noise* (New York: Dover Publications, 1980).
- 72 Claude Elwood Shannon, “A Symbolic Analysis of Relay and Switching Circuits” (master’s thesis, Massachusetts Institute of Technology, 1940).
- 73 Luciano Floridi notes that Shannon’s “information theory” is better referred to as the “mathematical theory of data communication” (MTC). Luciano Floridi, “Information,” in *The Blackwell Guide to the Philosophy of Computing and Information*, ed. Luciano Floridi (Chichester: John Wiley & Sons, 2003), 52.
- 74 For a fascinating example of the application of Shannon entropy to humanities work, see Simon DeDeo et al., “Bootstrap Methods for the Empirical Study of Decision-Making and Information Flows in Social Systems,” *Entropy* 15, no. 6 (June 5, 2013): 2246–76.
- 75 Thomas Nagel, *The View from Nowhere* (New York: Oxford University Press, 1986), 25.

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9

INDUSTRIALIZED COGNITION

The discourse of artificial intelligence (AI) suffers from an enormous amount of cultural and intellectual baggage and risks skewing our understanding of complex computing systems and cognitive science. This chapter coins the concept of Industrialized Cognition (IC) to connect technological developments with the critical theory of modernity, adhering to articulations of nonconscious cognition derived from research in psychology and neuroscience. The goal is to avoid perspectives that oversimplify our understanding of cognition and complex systems, leaving us unable to connect technological developments to received theories of society and government. There are philosophical drivers to consider too. Stepping aside from the discourse of AI in favour of IC allows us to remain within the constraints of naturalism, as Thomas Nagel does with his articulation of agnostic rationalism, while pushing against those same boundaries.¹ This is especially important in the context of claims that Large Language Models (LLMs) show signs of sentient behaviour, distracting us from more immediate sociological and political concerns.² The goal is to avoid measuring the outputs of advanced computing against human intelligence, consciousness, or sentience and engage in modes of analysis better able to contribute to the critical theory of modernity.³

The concept of IC is not intended to define a new or emergent mode of computing, but rather to clear conceptual space for more robust analysis of our existing infrastructure. The term refers to the behaviour (and the associated platforms, services, and tools that monetize that behaviour) resulting from the assemblages of hardware, programming languages, data models, algorithms, and statistical methods we interact with daily. The idea of IC pushes against the “digital component error” discussed in [Chapter 1](#): the assumption that one or more of the components of digital technology (software, networks,

interfaces, algorithms, infrastructure) are so powerful as to determine our experience of digital modernity as a whole. In our present context, this relates to the impulse to prosecute analysis through the lens of either AI (which requires engagement with the opaque technical and discursive power structures we aim to critique) or machine learning (ML) (the brace of statistical and algorithmic tools that power cognitive products and are primarily operationalized from within the technology sector). Although both modes of analysis are powerful and necessary, neither fully alienates us from the discourse of the digital modern explored in [Chapter 3](#), leaving a sense that criticism is occurring within the terms set by the technology industry.

The concept of IC, therefore, aims to reshape our perception of global digital infrastructure and connect otherwise disconnected notions of infrastructure, cognition, and modernity. Morally, IC highlights the dark side of modernity, including but not limited to industrial pollution and unfair labour practices explored in [Chapter 5](#). My goal is to engage in analysis that avoids the Charybdis and Scylla of overly ideological or technical critique, opening terrain that supports the continuation of the critical theory of modernity (across all its vectors) into the twenty-first century. Computers demand to be interpreted in a holistic socio-technical manner, opening global technology firms to the full range of humanities and social science critique *from the outside*. This should be grounded in their technical functionality but also attend to their impact on material, environmental, cultural, political, and economic life.

The concept of IC is not enough on its own, however. It needs to be articulated in a way that bridges the gap between computational determinism and indeterminism and from there the larger canvas of digital modernity and its various systems of culture and government. There is little point in coining a new term if it reproduces the technological determinism inherent in concepts such as AI; it needs to enable cultural and political change. During the 1970s, Karl Popper worked in a similar mode to combat threats to the open society generated by the Cold War, rejecting hard determinism in the analysis of both machine intelligence and political economy.⁴ He felt that the interpretation of complex systems required a broadly evolutionary rather than simplistically deterministic mindset.⁵ The problem for *contemporary* liberal democracies is the difficulty the public has in interpreting the output of complex systems.⁶ This has been amply demonstrated through problems with social media but is increasing with the appearance of products enabled by LLMs. Finding a way to bridge the work of writers such as Popper, Hannah Arendt, and Isaiah Berlin in an age of IC is more complex than it might seem.

The canonical example to demonstrate the difficulty users have interpreting the output of computing systems is Joseph Weizenbaum's Eliza program, built at the MIT Artificial Intelligence Laboratory in the 1960s. Although only a very basic system, with the ability to present users with hard-coded prompts to engage them in psycho-therapeutic "conversation", Eliza evoked

remarkable responses from users. Some people confessed to deep personal issues and developed an emotional attachment to the program despite its mechanical simplicity.⁷ A more recent example of this cognitive slippage occurred in July 2022, when Google fired software engineer Blake Lemoine for claiming an early version of an LLM chatbot was sentient.⁸ We can use this date as a useful marker for the transition of digital modernity into a new phase that will require complex discussions about the nature of machine cognition. This chapter leaves that discussion for the future, focussing on perspectives that can be applied to the period of digital modernity discussed in previous chapters, but I agree with commentators who warn that complex moral and philosophical issues exist.⁹

Critical theorists and philosophers have long recognized the strange effects technology can have. This is related to what Frederick Nietzsche described as the “weightless” nature of modern experience, a sense that life has become unmoored from traditional anchors and risks spinning out of control.¹⁰ Max Nordau described a similar fear during the nineteenth century *fin de siècle* when occultists were fascinated by the strange effects of electricity, suggesting to them the possibility of communication with the dead.¹¹ This long-standing fascination with the intersection of technology and the uncanny suggests it wields significant impact, beyond the algorithmic effects described by Anthony Elliott.¹² There are many ways to interpret the phenomenon, from Bernard Geoghegan’s notion of “alterity scripts”¹³ to Ciano Aydin’s Lacanian interpretation that advanced technology intensifies the “uncanny within”.¹⁴ At base, however, the sense of alterity generated by complex technological systems stems from the unsettling sense that the machines we are interacting with might have crossed a threshold from merely simulating human consciousness to expressing or surpassing it,¹⁵ as if they have come alive in the manner of stories from the Old Testament.¹⁶

This compounds the gravity of the political decisions we need to make about IC. The intuition that even minimal levels of cognition imply a potential for intentionality, and thus self-directed action that is likely to be hyper-rational (and because of that focused on its own evolutionary success), suggests to commentators such as Nick Bostrom that a sufficiently powerful system might view humankind as little more than an anthill to be swept aside in its quest for dominance.¹⁷ This might seem like a fringe philosophical theory, but it has had a direct effect on the mechanisms of government. In 2023 over 30,000 people, including prominent business people and researchers, signed an open letter organized by the Future of Life Institute recommending a pause in the development of advanced systems to allow policymaking to catch up.¹⁸ IC (understood as AI) has in this sense become the *deus ex machina* of digital modernity, threatening to appear from stage left to resolve the human dilemma in a miasma of superhuman intelligence. Whether we interpret this as mere “techno-supernaturalism”¹⁹ or even as a marketing ploy, it has serious

implications given its contribution to the discourse of “pathogenesis” referred to in earlier chapters.²⁰

This has moral implications for critical theory. As earlier chapters have demonstrated, a sense of technological malaise increases the potential for reactionary populism to emerge in the cultural and political spheres. Rapid technological change encourages mystical and teleological belief systems that are easily harnessed to political extremes by disaffected politicians and entrepreneurs. Liberal democracies can be undermined when this occurs, as power brokers and the public struggle to reconcile countervailing sentiments. This has been demonstrated multiple times across the history of modernity, with technology accentuating deeply negative sensibilities across the political spectrum.²¹ We need to ensure our analysis of IC is technically and philosophically accurate, but also capable of supporting healthy forms of government.

A more nuanced understanding of the Enlightenment history of ideas can help in this regard; our concerns about powerful computational methods are by no means new. The post-Enlightenment statisticians (or, more accurately, proto-statisticians) who developed modern statistics were inventive and even radical in their approach. Rather than developing a systematic philosophy capable of formalizing the Real as was expected in the Euclidean tradition, mathematicians such as Abraham De Moivre (1667–1754), François Quesnay (1694–1774), Jean-Baptiste Moheau (1745–1794), and Johann Peter Süssmilch (1707–1767) aimed to manage “formation of the social body” through population statistics that accepted gaps and inadequacies in datasets.²² They built on work in observational science by Leonhard Euler (1707–1783) and Tobias Mayer (1723–1762), who realized large datasets had to be normalized to account for inconsistencies (such as data captured in different locations by different people, or at periods spanning hundreds of years). Their goal was to understand the movement of planets or the size and shape of the Earth, not to define axiomatic principles, to precisely measure reality in all its dimensions, or to automate mathematical operations.²³ The opaqueness of the new techniques so concerned mathematicians in Naples in the eighteenth century that they rejected them and returned to the safety of Euclidean geometry, objecting to their lack of methodological transparency.²⁴

It is simplistic to assume that computational methods are derived from efforts to promote a hyper-rational capitalistic world, therefore. Although they have often been used for that purpose, statistical methods initially reflected cultural and even theological aspirations.²⁵ Thomas Bayes (1701–1761) provides a case in point. An English statistician, philosopher, and Nonconformist minister, Bayes only published two works in his lifetime (one theological, one mathematical). His famous probabilistic theorem was published by his friend and fellow mathematician Richard Price posthumously in 1763 in “An Essay Towards Solving a Problem in the Doctrine of Chances” but was ignored for several years in favour of simpler but less powerful approaches.²⁶ Laplace

eventually recognized its applications and operationalized it in *Théorie Analytique des Probabilités* in 1812.²⁷ Rather than aiming to enable advanced statistical analysis of the world, Bayes sought to deploy new methods of probability calculus in defence of Christianity.²⁸

In its cultural, rather than hyper-rational motivation, this was not dissimilar to the eugenic motivations for the development of nineteenth century algorithms described in Chapter 7. Calculating Bayes' theorem for larger datasets remained too computationally expensive to be used for centuries, though. In 1975, historian of statistics Ian Hacking noted that the theorem had only "recently become very well known".²⁹ The technique was not widely used until the development of methods such as Markov Chain Monte Carlo (MCMC) in the 1980s and 1990s, when more computationally intensive techniques of ML appeared. Other approaches established in the early twentieth century (such as frequentist statistics) have had a similar impact, but when brought together with powerful computers and large datasets, Bayesian statistics have a claim to being one of the most impactful technologies of post-Enlightenment history. Announcing "a new Bayesian age"³⁰ in *The Times Literary Supplement* in 2018, David Papineau claimed that the method had enabled a "contemporary revolution in statistical theory" through massive increases in computing power.³¹ Adrian Mackenzie provides a brilliant description of this history in *Machine Learners* (2017), uniting a remarkable understanding of mathematics and statistics with critical theory.³²

However difficult to grasp for humanities researchers, the history of statistics serves as a reminder of the historically contingent and socio-technically determined nature of machine cognition. Contemporary IC products represent complex feats of engineering, pieced together from a remarkable array of research disciplines. It is inadequate to view them as merely algorithmic (the statistical methods that comprise their algorithms are wide-ranging and enabling of different effects) or even more broadly "computational". Critiques of ML demonstrate the importance of that mode of analysis, but they often fail to capture the wide-ranging sociopolitical impacts of the methods. The products and services enabled by IC demand to be interpreted as complex systems that depend on all their components (software, networks, interfaces, algorithms, infrastructure) working in unison with their human users. At this higher level of abstraction, even powerful ML techniques fade into the background, becoming components within components. Their configuration is dependent upon design choices informed by a remarkable array of disciplines. The recent history of IC presents a roll call of major innovations in post-World War Two science and engineering, from advanced mathematics to neuroscience and interface design.

This is not the place for another history of ML or a high-level description of stochastic LLM technology, however.³³ This chapter attempts to reduce the idea of IC to its fundamentals and connect its cognitive aspects to the broader trends in political economy that interested Popper. The *technical* ground is not difficult to find. As Katherine Hayles has noted, higher-level abstractions

such as transformers are analytically interesting but “...all commands must be translated downward to the logic gates to be processed (either line by line as needed in interpreted languages, or in prepared batches in compiled languages) and then translated upward again to the high-level languages to communicate their results”.³⁴ Although probabilistic at higher levels, IC products and services remain fundamentally binary. At the end of the day, they are enabled by computing machines grounded in twentieth century technologies and sometimes centuries-old statistical techniques. This raises interesting questions about how we square the circle between technological and philosophical analysis.

An understanding of how IC relates to the philosophical and scientific discourse of modernity is central to this. It is difficult to articulate the technical and philosophical complexity and range of this problem domain, and the inadequacy of accounts that adopt a prescriptive approach to their analysis. This chapter looks towards computational indeterminism for inspiration. This might seem contrary to the humanistic critique of modernity, which has a long tradition of emphasizing the hyper-rational nature of computing,³⁵ but it is an empowering approach to adopt if we believe in the socio-technical malleability of computers.³⁶ There are legitimate ways to conceive of computational complexity in deterministic terms, but they are difficult to square with effective political action. The more evidence we can gather for indeterminism and social constructivism in computing, the more we can undermine narratives of computational (and from there political) determinism.³⁷

It is well accepted, across large areas of theoretical computer science, that complex computing systems exhibit indeterminate behaviour. This is different from the probabilistic methods used in Bayesian statistics and refers to indeterministic behaviour generated from randomness designed into algorithms, inconsistencies in hardware execution, or advanced cryptographic functions. “[F]or very complicated computers, despite having an exact description of the intention of the program, we cannot exactly determine the behavior of the program”.³⁸ This is a function of physics rather than mysticism, given that computers are fundamentally material objects and “it turns out that much of classical physics, even much Newtonian physics, is indeterministic”.³⁹ Beatrice Fazi has demonstrated the implications for aesthetics through a speculative analysis of computational processes⁴⁰ and David Bates has demonstrated that advanced scientific thinking in the nineteenth century prefigured “the appearance of indeterminacy or uncertainty” in technical devices.⁴¹ If we consider the problem in socio-technical terms, factoring designers and end users into the technological system, the possibility for indeterministic outcomes clearly begins to cascade.

It is important not to run with these ideas beyond reasonable epistemological boundaries and important to recognize the complexity of the scientific and philosophical debates.⁴² None of these examples negate the description of

computers in [Chapter 2](#) (they are straightforward data processing machines organized around a von Neumann architecture) or imply that they are not binary devices (they operate through 0s and 1s and are constrained by the formal definition of a Turing machine), but it does force us to reconsider their epistemological status. As Bernard Stiegler notes in a discussion of Heidegger's philosophy of technology, "[t]he instrumental conception of technics is correct [*exacte*], but it reveals nothing of the essence of technics. So, the 'correct' conception of technics does not go far enough".⁴³ If we move beyond classical conceptions of engineering and design, we reach a point described by Gilbert Simondon as a place where "the technical mentality successfully completes itself and rejoins nature by turning itself into a thought-network, into the material and conceptual synthesis of particularity and concentration, individuality and collectivity...".⁴⁴ This is a much more productive space for humanistic inquiry than modes of negative critique that reduce computers to technical objects productive of only hyper-rationalism.

Post-classical perspectives on science and technology also help connect machine cognition and political economy. As we will see below, by positioning IC as an "exosomatic"⁴⁵ extension of the human body operating through processes of "nonconscious cognition",⁴⁶ we can problematize the boundaries between humans and the tools we use without being drawn into debates about sentient machines. The goal is precisely to *avoid* measuring the outputs of advanced computing against human intelligence or consciousness.⁴⁷ In doing so, we can start to explore connections between machine cognition and political economy in a grounded manner. The approach is speculative and presented as a thought experiment that can help us think through the political implications of IC rather than a strong philosophical claim, but this sort of preparatory conceptual work is sorely needed. The field of Critical AI takes an allied approach, contributing to our understanding by treating machine intelligence "metonymically and engaging AI as an assemblage of technological arrangements and sociotechnical practices, as concept, ideology, and *dispositive*".⁴⁸

The idea of technology as an exosomatic system deserves more space than is available in this chapter but is beautifully described by David Bates in *An Artificial History of Natural Intelligence* (2024). The fundamental idea is that rather than being estranged from technology, humans have co-evolved with it.⁴⁹ The claim is based on a scientific view of the world. Bates notes that the approach stemmed from a wider effort to "disentangle biological evolution from culture" over the course of the post-war period. In the 1950s, the British biologist and transplant pioneer Peter Medawar claimed that all animals use material objects as well as their bodies to survive, suggesting the need to distinguish between *endosomatic* organs that we are born with (brain, eyes, kidneys) and *exosomatic* organs (telescopes, toothpicks, scalpels) we appropriate from nature or manufacture.⁵⁰ Exosomatic instruments are clearly in a different category from the organs we are born with, but they extend and support

those organs and are deeply entangled with the evolutionary process. Viewed as exosomatic systems, IC products thus become extensions of the human self.

There are strong synergies with feminist approaches to science and technology here, reminiscent of Annemarie Moll's claim that "*ontologies* are brought into being, sustained, or allowed to wither away in common, day-to-day, sociomaterial practices".⁵¹ This aligns with the theory of multiple digital modernities outlined in [Chapter 1](#), with algorithms and IC systems evolving alongside individuals and society in an evolutionary dance. Nick Seaver has suggested something similar (following Moll) in his presentation of algorithms as "heterogeneous and diffuse sociotechnical systems, with entanglements beyond the boundaries of proprietary software".⁵² The idea is to view complex sociotechnical systems not only in their full dimensionality – as aggregations of multiple components – but also as evolving and indeed evolutionary in their relationship to humankind. This requires modes of interpretation capable of connecting technology to self and society in a manner (for our purposes here) consistent with the critical theory of modernity.

Scientists and philosophers have done much of this work for us already. Over the course of the twentieth century, neuroscientists came to view technical artefacts as central to the development of the human mind as well as our bodies, providing not only basic tools for cutting and hammering but also eventually tools (such as clay tablets and later paper) for "the *artificial exteriorization of memory*".⁵³ Subsequent theorists began to realize that it was unreasonable to assume that the mere *use* of tools led to the cognitive development of homo sapiens, but rather that the process was integral to our neurological evolution:

Technology is what initiates a never before seen process of nongenetic evolution that will "permanently" alter the relationship between the organic society of humans and their environment. Both will leave nature behind as they are transformed into cultural and technical *systems*.⁵⁴

Technology (in the first instance, stone tools) thrust humankind out of Nature into the realm of self-awareness and culture rather than Cartesian dualism.⁵⁵

Understanding IC in exosomatic terms is difficult without a parallel re-orientation of our attitudes to human cognition. Katherine Hayles demonstrates how this can be achieved. Hayles uses scientific research in biology and computing to inform her argument but recommends against "using [the word] 'intelligence' for nonhuman (and technical) cognitions".⁵⁶ This might seem like a minor semantic commitment, but it has significant implications. Using research by plant biologists to build her case, Hayles prefers the word "cognition" to "intelligence" because it refers to "a process that interprets information within contexts that connect it with meaning" but does not imply

higher-order thinking normally associated with human consciousness.⁵⁷ It also connects analysis to the natural world while remaining within the boundaries of scientific naturalism. Plants respond to changes in their environment, for example, in much the same way as basic machines and computational systems.

This is not to suggest plants and machines are conscious but that, in a meaningful and empirically observable way, they respond to and impact their environment in quite complex ways. We can even refer to them interacting through an *Umwelt* (a world-horizon) of some description.⁵⁸ This approach allows Hayles to analyse what could be termed nonconscious exosomatic systems without becoming mired in the problem of “life itself”.⁵⁹ Her approach ensures a scientific approach to the problem domain that reduces the phenomena under investigation to empirically observable behaviour but avoids dependence on definitions of intelligence for its explanatory power, or simplistic reference to the post-Cartesian subject/object divide. This does not preclude the movement from micro to macro analysis, or entirely separate “the cognitive nonconscious” from human consciousness, but it remains within the realms of naturalistic observation and ensures an agnostic stance towards emergent behaviour that is beyond the capacity of contemporary science to explain.⁶⁰

In later work, Hayles has extended these ideas into an Integrated Cognitive Framework (ICF) that compares human, nonhuman, and computational cognitions and explains how they are shaping modernity.⁶¹ There are rich threads to follow if we adopt this approach, including ways to conceptualize the relationship between machine cognition and political economy. We can start by noting the common point of reference in both political and computing literature to individual (and from there community) experience. This is natural enough, given Western theories of political economy are rooted in theories of individual behaviour, certainly in the classical tradition, and critiques are often conducted from the perspective of capitalistic societies.⁶² As Shannon Vallor has noted, any threat necessarily “threatens us from *within* our humanity”, given that the technology is human designed, making the role of the individual paramount. If we consider the narrow range of people who have been involved in the design and development of IC systems, it becomes clear that they are deeply individualistic tools.

The individualistic orientation is not necessarily a concern (Rawlsian modes of political economy suggest cultures grounded in individualism can still deliver just societies), but it increases the chances that IC products will amplify the biases of a small group of insiders. The more immediate issue is whether people feel there is any hope of designing machine cognition to support more socially oriented modes of liberal democracy. Karl Popper’s work suggests that our response to this will hinge on our attitude towards determinism and indeterminism. If we believe computer systems are governed by hard determinism, we are likely to assume that biased design processes will lead to increasingly

hyper-rational systems that will benefit already privileged individuals. If we believe complex computer systems evolve in more indeterministic ways, we are more likely to lobby for regulation of IC systems and experiment with ways we can design them to support different modes of cultural and economic development.

There is something deeper at work in the synergies between IC and political economy that Karl Popper's work illuminates, however. His rejection of determinism in the analysis of historical and scientific systems implied acceptance of indeterminism in human cognition, and a parallel argument for the inadequacy of any purely inductive design for machine cognition. He was adamant that human evolution was largely exosomatic, involving a degree of co-evolution with technical artefacts, and that the human brain was far more than a mechanistic computer.⁶³ Popper claimed that a purely deterministic system could never attain human levels of intelligence because it could only ever refer to the contents of its own system; it would be constrained in its understanding of self and world and unable to evolve through error. An error in inductive knowledge could cause a fatal system error, rather than providing the basis for evolutionary growth. This suggested a startling level of consistency with Popper's theory of political economy, rejecting the notion of hard determinism in advanced machine intelligence *or* historical or ideological systems.

Popper's thought suggests we need to augment our critique of AI and ML with a parallel critique of IC and perhaps other concepts too. Such a move acknowledges the incompressibility of the problem space related to machine cognition discussed in [Chapter 8](#) in the context of emergent infrastructure. The scope of analysis required to make connections between AI and ML and the larger canvas of political economy and geopolitical manoeuvring is enormous, with philosophical implications (explored in [Chapter 8](#)) that descend towards the very roots of epistemology. By balancing ideological and technical critique, IC resonates with the critical theory of modernity, bringing all its conceptual power into our frame of reference. We should not be so arrogant as to suggest that research into the critical theory of AI and ML needs to stop (quite the contrary), but we might need to develop a typology of cognitive computing capable of supporting multiple modes of analysis depending on the object of enquiry.

This is something for us to consider in the coming decades as IC systems become more powerful and more deeply embedded in our systems of culture and politics. The concepts we use to analyse technological and political systems are separated at our peril, and there is a pressing need for critical theories capable of addressing the full socio-technical complexity of computational systems. There are good reasons to jettison approaches that overemphasize the role of determinism in advanced digital systems, just as there are good reasons for rejecting deterministic interpretations of our political and economic systems. Analysis that conforms to Silicon Valley marketing campaigns, or indeed overly narrow interpretations of twentieth century ideological and cultural

critique, often fails to account for the complex evolutionary relationships between humans, technology, and our political systems.

Notes

- 1 Philip Clayton, *Mind and Emergence: From Quantum to Consciousness* (Oxford: Oxford University Press, 2006), 184.
- 2 Ian Hogarth, "We Must Slow Down the Race to God-like AI," *The Financial Times*, April 13, 2023, <https://www.ft.com/content/03895dc4-a3b7-481e-95cc-336a524f2ac2>, accessed May 22, 2023.
- 3 Katherine Hayles *Unthought: The Power of the Cognitive Nonconscious* (Chicago: University of Chicago Press, 2017); Katherine Hayles "Can Computers Create Meanings? A Cyber/Bio/Semiotic Perspective," *Critical Inquiry* 46, no. 1 (2019): 32–55.
- 4 Karl Popper, *The Open Society and Its Enemies* [1945] (London: Routledge, 2011); Karl Popper, "Of Clouds and Clocks" [1965], in *Objective Knowledge: An Evolutionary Approach* [1972] (Oxford: Oxford University Press, 1994), 222. For discussion of this writing, see David W. Bates, *An Artificial History of Natural Intelligence: Thinking with Machines from Descartes to the Digital Age* (Chicago: University of Chicago Press, 2024); Peter Skagstad, "Thinking with Machines: Intelligence Augmentation, Evolutionary Epistemology, and Semiotic," *Journal of Social and Evolutionary Systems* 16, no. 2 (January 1, 1993): 157–80.
- 5 Bates, *An Artificial History of Natural Intelligence*, 295–96.
- 6 Hayles, *Unthought*.
- 7 Joseph Weizenbaum, *Computer Power and Human Reason: From Judgment to Calculation* (San Francisco: W. H. Freeman, 1976), 2–11.
- 8 Tiffany Wertheimer, "Blake Lemoine: Google Fires Engineer Who Said AI Tech Has Feelings," *BBC News*, July 23, 2022, <https://www.bbc.com/news/technology-62275326>, accessed February 20, 2026.
- 9 Robert Long et al., "Taking AI Welfare Seriously," *arXiv*, November 4, 2024, <https://arxiv.org/abs/2411.00986>.
- 10 T. J. Jackson Lears, *No Place of Grace: Antimodernism and the Transformation of American Culture 1880–1920* (New York: Pantheon Books, 1981), 41.
- 11 Max Simon Nordau, *Degeneration* (New York: Appleton, 1895), 218.
- 12 Anthony Elliott, *Algorithms of Anxiety: Fear in the Digital Age* (Cambridge: Polity Press, 2024).
- 13 Bernard Dionysius Geoghegan, "Orientalism and Informatics: Alterity from the Chess-Playing Turk to Amazon's Mechanical Turk," *Ex-position* 43, June (2020): 45–90.
- 14 Ciano Aydin, "The Technological Uncanny as a Permanent Dimension of Selfhood," in *The Oxford Handbook of Philosophy of Technology*, ed. Shannon Vallor (New York: Oxford University Press, 2022), 313.
- 15 For example, interest in defining the thresholds at which emergent behaviour (not necessarily conscious but "intelligent" in a broad sense) arises from LLMs occurred when they began being commercialized in 2022–2023. See Jason Wei et al., "Emergent Abilities of Large Language Models," *arXiv*, June 15, 2022, <https://arxiv.org/abs/2206.07682>; Michal Kosinski, "Theory of Mind May Have Spontaneously Emerged in Large Language Models," *arXiv*, February 3, 2023, <https://arxiv.org/abs/2302.02083v1>.
- 16 Stephen Cave, Kanta Dihal, and Sarah Dillon, eds., *AI Narratives: A History of Imaginative Thinking about Intelligent Machines* (Oxford: Oxford University Press, 2020), 105–07.
- 17 Nick Bostrom, *Superintelligence: Paths, Dangers, Strategies* (Oxford: Oxford University Press, 2014).

- 18 Future of Life Institute, "Pause Giant AI Experiments: An Open Letter," Future of Life Institute, March 22, 2023, <https://futureoflife.org/open-letter/pause-giant-ai-experiments/>, accessed May 5, 2023; see also Future of Life Institute, *Policymaking in the Pause: What Can Policymakers Do Now to Combat Risks from Advanced AI Systems* (Future of Life Institute, April 12, 2023), 4, https://futureoflife.org/wp-content/uploads/2023/04/FLI_Policymaking_In_The_Pause.pdf, accessed February 20, 2026.
- 19 Diane Proudfoot, "Software Immortals: Science or Faith?" in *Singularity Hypotheses – A Scientific and Philosophical Assessment*, ed. A. H. Eden et al. (Berlin: Springer-Verlag, 2012), 367–93.
- 20 Reinhardt Koselleck, *Critique and Crisis: Enlightenment and the Pathogenesis of Modern Society* [1988] (Cambridge, MA: MIT Press, 2015).
- 21 T. Rohkramer, "Antimodernism, Reactionary Modernism and National Socialism: Technocratic Tendencies in Germany, 1890–1945," *Contemporary European History* 8, no. 1 (1999): 29–50.
- 22 Michel Foucault, *The History of Sexuality*, vol. 1 (New York: Pantheon Books, 1978), 140.
- 23 Stephen M. Stigler, *The History of Statistics: The Measurement of Uncertainty before 1900* (Cambridge, MA: Belknap Press of Harvard University Press, 1986), 31–39.
- 24 Massimo Mazzotti, *Reactionary Mathematics: A Genealogy of Purity* (Chicago: University of Chicago Press, 2023).
- 25 Jacqueline Wernimont, *Numbered Lives: Life and Death in Quantum Media* (Cambridge, MA: MIT Press, 2019); Wendy Hui Kyong Chun, *Discriminating Data: Correlation, Neighborhoods, and the New Politics of Recognition* (Cambridge, MA: MIT Press, 2021).
- 26 Thomas Bayes, "An Essay towards Solving a Problem in the Doctrine of Chances. By the Late Rev. Mr. Bayes, F.R.S. Communicated by Mr. Price, in a Letter to John Canton, A.M.F.R.S.," *Philosophical Transactions of the Royal Society of London* 53 (January 1, 1763): 370–418.
- 27 Stigler, *The History of Statistics*, 99–138.
- 28 Price posthumously applied the theorem to refute David Hume's argument against miracles. See John Earman, "Bayes, Hume, Price, and Miracles," in *Bayes's Theorem*, ed. Richard Swinburne (London: British Academy, 2005), 91–109.
- 29 Ian Hacking, *The Emergence of Probability: A Philosophical Study of Early Ideas about Probability, Induction and Statistical Inference* (London: Cambridge University Press, 1975) 159. For earlier commentary by Hacking about Bayes, see Ian Hacking, *Logic of Statistical Inference* [1965] (Cambridge: Cambridge University Press, 2016), 175–91.
- 30 David Papineau, "Thomas Bayes and the Crisis in Science," *The Times Literary Supplement*, June 28, 2018, <https://www.the-tls.co.uk/articles/public/thomas-bayes-science-crisis/>, accessed October 23, 2020. See also Bernhard Rieder, "Scrutinizing an Algorithmic Technique: The Bayes Classifier as Interested Reading of Reality," *Information, Communication & Society* (April 28, 2016): 1–18.
- 31 Papineau, "Thomas Bayes and the Crisis in Science."
- 32 Mackenzie, Adrian. *Machine Learners: Archaeology of a Data Practice*. Cambridge, MA: MIT Press, 2017.
- 33 Emily M. Bender et al., "On the Dangers of Stochastic Parrots: Can Language Models Be Too Big? 🐦" in *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency* (FAccT '21), FAccT '21 (New York: Association for Computing Machinery, 2021), 610–23.
- 34 Katherine Hayles, "Can Computers Create Meanings? A Cyber/Bio/Semiotic Perspective," *Critical Inquiry* 46, no. 1 (September 2019): 45.
- 35 For example, Theodore Roszak, *Cult of Information: A Neo-Luddite Treatise on High-Tech, Artificial Intelligence, and the True Art of Thinking* (Berkeley, CA: University of California Press, 1986); Neil Postman, *Technopoly: The Surrender of Culture to Technology* (New York: Vintage Books, 1993); Evgeny Morozov, *To Save Everything, Click Here: The Folly of Technological Solutionism* (New York: PublicAffairs, 2013).

- 36 Philip E. Agre, "Toward a Critical Technical Practice: Lessons Learned in Trying to Reform AI," in *Social Science, Technical Systems, and Cooperative Work: Beyond the Great Divide*, ed. Geoffrey C. Bowker, Susan Leigh Star, Les Gasser, and William Turner (Mahwah, NJ: Lawrence Erlbaum Associates, 1997), 131–57.
- 37 For a defence of this attitude, see John Dewey, "The Pragmatic Acquiescence" (1927), in *The Essential Dewey*, vol. 1, ed. Larry A. Hickman and Thomas M. Alexander (Bloomington: Indiana University Press, 1998), 33–36.
- 38 Bertil Ekdahl, "Indeterministic Behavior in Computing Systems and Its Possible Impact on the Digital Society," in *2009 Third International Conference on Digital Society*, Cancun, Mexico, 2009, 328, doi: [10.1109/ICDS.2009.63](https://doi.org/10.1109/ICDS.2009.63).
- 39 Jeremy Butterfield, "Determinism and Indeterminism," in *Routledge Encyclopedia of Philosophy* (London: Routledge, 2016).
- 40 M. Beatrice Fazi, "Digital Aesthetics: The Discrete and the Continuous," *Theory, Culture & Society* 36, no. 1 (January 1, 2019): 3–26.
- 41 David W. Bates, *An Artificial History of Natural Intelligence: Thinking with Machines from Descartes to the Digital Age* (Chicago: University of Chicago Press, 2024), 125.
- 42 Thomas Müller, Antje Rumberg, and Verena Wagner, "An Introduction to Real Possibilities, Indeterminism, and Free Will: Three Contingencies of the Debate," *Synthese* 196, no. 1 (January 1, 2019): 1–10, <https://doi.org/10.1007/s11229-018-1842-4>.
- 43 Bernard Stiegler, *Technics and Time, 1: The Fault of Epimetheus*, trans. Richard Beardsworth and George Collins (Stanford: Stanford University Press, 1998), 8.
- 44 Gilbert Simondon, "Technical Mentality," trans. Arne De Boever, in *Gilbert Simondon: Being and Technology*, ed. Arne De Boever et al. (Edinburgh: Edinburgh University Press, 2012), 9.
- 45 Bates, *An Artificial History of Natural Intelligence*, 291.
- 46 Hayles, *Unthought*; Hayles, "Can Computers Create Meanings?"
- 47 This issue has been explored from several angles. See, for example, Bernard Dionysius Geoghegan, "Orientalism and Informatics: Alterity from the Chess-Playing Turk to Amazon's Mechanical Turk," *Ex-position* 43, no. June (2020): 45–90; Ciano Aydin, "The Technological Uncanny as a Permanent Dimension of Selfhood," in *The Oxford Handbook of Philosophy of Technology*, ed. Shannon Vallor (New York: Oxford University Press, 2022), 299–317.
- 48 Rita Raley and Jennifer Rhee, "Critical AI: A Field in Formation," *American Literature* 95, no. 2 (2023): 185–204. Raley and Rhee's emphasis. See also Katherine Bode and Lauren M. E. Goodlad, "Data Worlds: An Introduction," *Critical AI* 1, no. 1–2 (October 1, 2023).
- 49 The theory is closely related to post-phenomenology. See *Postphenomenological Methodologies: New Ways in Mediating Techno-Human Relationships*, eds. Jesper Aagaard et al. (Lanham, MD: Lexington Books, 2018).
- 50 Peter Medawar, *Uniqueness of the Individual* (New York: Basic Books, 1958), cited in Bates, *An Artificial History of Natural Intelligence*, 291.
- 51 Annemarie Mol, *The Body Multiple: Ontology in Medical Practice* (Durham: Duke University Press, 2002), 6. Mol's emphasis.
- 52 Nick Seaver, "Algorithms as Culture: Some Tactics for the Ethnography of Algorithmic Systems," *Big Data & Society* 4, no. 2 (December 1, 2017): 10.
- 53 Bates, *An Artificial History of Natural Intelligence*, 336. Bates' emphasis.
- 54 Bates, *An Artificial History of Natural Intelligence*, 337. Bates' emphasis.
- 55 This is in keeping with critical theory from Jean-François Lyotard to Bruno Latour, rather than being a particularly radical perspective for the humanities and social sciences. See Jean-François Lyotard, *The Postmodern Condition: A Report on Knowledge*

- [1984] (Manchester: Manchester University Press, 2005); Bruno Latour, *We Have Never Been Modern* (Cambridge, MA: Harvard University Press, 1993).
- 56 Hayles, *Unthought*, 18.
- 57 Hayles, *Unthought*, 22. Hayles' emphasis.
- 58 Hayles, "Can Computers Create Meanings?," 49.
- 59 Robert Rosen, *Life Itself: A Comprehensive Inquiry into the Nature, Origin, and Fabrication of Life* (New York: Columbia University Press, 1991), cited in Hayles, *Unthought*, 22.
- 60 Hayles, *Unthought*, 11.
- 61 Katherine Hayles *Bacteria to AI: Human Futures with Our Nonhuman Symbionts* (Chicago: University of Chicago Press, 2025).
- 62 Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations* (London: W. Strahan and T. Cadell, 1776); John Rawls, *A Theory of Justice* (Cambridge, MA: Belknap Press of Harvard University Press, 1971), 22–27.
- 63 Popper, "Of Clouds and Clocks."

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CONCLUSION

The Future of Digital Modernity

Modernity is not a topic for the faint-hearted, and there are good reasons why many intellectuals resist engaging with it. Post-enlightenment history is replete with disastrous stories about the folly of modernity and its tendency towards evil. Genocide and colonialism are the most obvious manifestations of this, along with the guillotine, total war, environmental degradation, and the threat of nuclear annihilation. The logic of modernity has for centuries been an existential risk to humankind and the planet, brutal in its efficiency and capable of a frightening level of amorality. The contrast with the futuristic sheen of Silicon Valley marketing could not be more profound, but we should not allow the dissonance to distract us from their essential connections. As Zygmunt Bauman noted in his analysis of the Holocaust, the evils of modernity are innate. Even genocide “is not an uncontrolled outburst of passions, and hardly ever a purposeless, totally irrational act. It is, on the contrary, an exercise in rational social engineering, in bringing about, by artificial means, that ambivalence-free homogeneity that messy and opaque social reality failed to produce”.¹ Modernity is at once frighteningly rational and terrifyingly irrational. Similar logic helps explain the horrors of digital modernity, from surveillance capitalism and techno-authoritarianism, to drone warfare and semi-autonomous weapons. It is curious, then, that a critical theory of digital modernity has not developed. Many commentators have acted for the last three decades as if the end of history was real, and that the only legitimate target of critique is the technology industry and its hyper-capitalist logic.

This assumption is being undermined with each new electoral and geopolitical cycle, but defining digital modernity is an extremely difficult task. When I started exploring the idea of digital modernity, there was no clear end to the phase I felt had started in the early 1990s. I tried to be careful with my identification of

historical analogies because parallels to Nazi Germany or the Soviet Union felt overblown and insulting to the millions of people who suffered under the yoke of those regimes. My training as a historian had taught me the fallacy of drawing precise comparisons with the past, and my intuition suggested such analogies were brittle at best. I was toying with the idea of describing an “electronic *fin de siècle*” that ran from the 1990s into the early years of the new millennium, paralleling the Gilded Age of the late nineteenth century and characterized by increasing disparities in wealth and the resurgence of great power politics. Work by authors such as Thomas Piketty convinced me I was on to something, but at that time,² although critique of digital culture and technology had been widespread for decades and Shoshanna Zuboff’s notion of surveillance capitalism was becoming increasingly well known,³ any association of contemporary digital culture with the horrors of nineteenth and twentieth century modernity seemed excessive. Surely the cyberutopian dream hadn’t become that corrupted?

The invasion of Ukraine by Vladimir Putin in February of 2022, the increasingly aggressive geopolitical posturing of Xi Jinping’s Chinese Communist Party (CCP), and the rightward movement of Silicon Valley billionaires convinced me that a deeper analysis was required. *Digital Modernity: Why We Need to Think Historically About the Digital Age* reflects that growing concern. Many of the chapters were shaped by contemporary events as my sense of living through digital modernity hardened and my consciousness of the historical parallels deepened. As *The Financial Times* columnist Edward Luce suggests, it sometimes feels as if “we are entering a period where instability is growing and the centre will struggle to hold”.⁴ It became difficult to keep up with burgeoning evidence for my thesis, and the philosophical and political implications ran deeper with each news story. This was particularly the case with the growth of right-wing politics and the cultural panic associated with industrialized cognition (IC). The core thesis of the book, that modernity provides lessons that can help us avoid the pitfalls and maximize the potential of digital technology, grew more urgent over time.

Many of the issues that readers will undoubtedly identify with *Digital Modernity* stem from that messy context. There are parallel tensions in my admiration for much that has been achieved in Silicon Valley over the last 50 years: on the one hand the growth of open source code and initiatives fostering diversity in the technology industry, and on the other the movement towards the political right among prominent American technologists. As Stephen Witt suggested in an opinion piece in the *New York Times* in 2025, “the situation resembles the railroad wars of 19th-century tycoons”.⁵ This could be dismissed as a historical curiosity if it was not contributing to the conflation of liberal democracy with American exceptionalism. I remain confident in the future of digital modernity, nevertheless. *Digital Modernity* was written during a period of intense ideological and geopolitical realignment and reflects massive changes in power

that are still playing out, but the version of social democracy I grew up with in Aotearoa New Zealand and experienced in the United Kingdom and Australia can withstand its pressures. That is even the case if redistributions of wealth are needed because of automation, or the geopolitical balance of the world changes. An updated theory of modernity can help us understand and navigate those currents, especially if it is grounded in a historically informed analysis of local (rather than only American) political traditions.

This exposes my political bias, but that is inevitable when practising contemporary history.⁶ “[T]he main aim of all historical understanding is the hypothetical reconstruction of a historical *problem-situation*”, but, without the benefit of temporal distance, it is difficult to apply the appropriate historical weight to different pieces of evidence.⁷ Personal experience will enter the analysis, especially when an attempt is made to identify historically significant time periods. In my case, that also extends towards areas of philosophical and technical complexity, leaving sociological questions unanswered. My only defence against such methodological peculiarities is to defer to the power of historicization, as an iterative and collective process. As Reinhart Koselleck has noted, “[t]here is always something awkward about the organization of epochs ... numerous inconsistencies must simply be accepted because the individually proposed divisions cannot be brought into agreement with all the historical findings”.⁸

The abandonment of modernity studies in the twenty-first century worsened the situation, leaving vast areas of terrain to traverse and few maps. *Digital Modernity: Why We Need to Think Historically About the Digital Age* is a contribution to our collective problem-situation more than a straightforward assertion of historical verisimilitude because of that. If my defence of the book is perceived as representationalist, I would hope historians accept the methodological necessity of such a stance.⁹ My goal was to establish a bridgehead for the study of digital modernity, and provide continuity with the critical theory of modernity, in such a way that other authors can pick up traces and apply them to their work. This requires faith in the process of historicization as a social good, a process that builds understanding through the iterative development of narrative frameworks and critical perspectives, grounded in an increasing range of evidence and refined by criticism and discussion. This is the basis of the human sciences (*Geisteswissenschaften*) in the original nineteenth century sense and the foundation stone of social democracy: the application of scientific method to human experience rather than the identification of immutable truths.

Our understanding of digital modernity could be greatly enhanced by additional research around the world, research which is likely to remain relevant regardless of our technological future. The discourse of artificial intelligence (AI) supports radically futuristic visions, for example, but we are already witnessing the first signs of normalization of the technology. We should prepare

to live in the age of digital modernity for several decades and – perhaps – centuries more. Warnings of high unemployment have become commonplace, and the robots that might extend this towards manual labour are enabled by digital technology.¹⁰ Similarly with cyberwarfare and autonomous weapons, self-driving cars and televisions. It is unlikely that we will exit to a quantum future for some time and, even then, we can expect digital and quantum technologies to work alongside each other. The question (for our present purpose) is whether the idea of digital modernity can help us shape that future for the common good. Important additional work is needed to deconstruct the rhetoric and ideologies of digital culture and society in the way Gabriele Balbi has done, to better understand the balance between ideology and historical reality in digital modernity.¹¹

This will help to avoid framing digital modernity through the lens of the digital modern, as yet another topic for a TED Talk or a corporate marketing campaign that terraforms our history into product sales.¹² As central as they are to contemporary experience, digital technologies are only one aspect of a much wider “technosphere” that includes the built environment and technologies, including buildings, dams, electrical grids, and nuclear energy.¹³ We need to develop modes of analysis capable of understanding the emerging “polycrisis” that results from the interaction between that environment and human society.¹⁴ Socio-technical complexity overshadows even planetary-scale system complexity in such research. The reality of escalating cyberwarfare and modes of autonomous warfare suggests the analysis provided in the previous chapters only scratches the surface of what will be required to ensure the future of human society. Aside from the potential for major changes to our personal lives, the financial resources required to produce Large Language Models (LLMs) fundamentally change the relationship between government and corporate power. The technological landscape will be further complicated by agential cognition (the deployment of swarms of nonconscious cognitive agents working in unison) across companies and governments, requiring us to question “the prevalent *assumption* that in principle the trajectory of artificial intelligence is convergent to identity with our own”.¹⁵ New forms of democracy may well be needed to manage the social and cultural disruption that emerges from these changes.

And yet the history of modernity suggests that the world has the intellectual resources to correct course if we tailor our thinking in the right way. We can achieve this by returning to the philosophical discourse of modernity and increasing our engagement with critical technical practice.¹⁶ This kind of research is not without its issues, but it provides the context needed to put digital technology in its place. The epistemological and ontological complexity of such work far outweighs any technical and methodological concerns. And if that is the case for projects undertaken in universities, galleries, libraries, archives, and museums, what are the implications for colleagues working for

technology companies or governments? What context do they need to make sense of their daily work? How do any of us parse the rhetoric of the digital modern on our way to the voting booth, for that matter? Despair and cynicism are never far from the surface in such discussions, but we cannot give in to the discourse of pathogenesis.¹⁷ Critical technical practice ensures that at least some of the means of production remain in communities determined to use them for the common good.

Practical engagement with technology is an essential prerequisite for analysis of digital society and culture, but it needs to be guided by adequate critical theory. We need detailed analyses of specific contexts and products, but we also need conceptual frameworks capable of connecting us to historical and intellectual precursors. This assumption is implicit in the historical critique of digital modernity presented in the preceding chapters. The more we understand the relationship between modernity and human experience, the more it becomes apparent that we have co-evolved with computational technologies over centuries, and the better chance we have of steering those technologies in productive directions.¹⁸ The notion that digital technologies and the people who design and maintain them are externalities to be controlled and manipulated, rather than instances of the complex entanglements between human society and technological culture, lies at the root of contemporary problems.¹⁹ Modernity provides us with an interpretative framework to explore this problem in an equitable manner, and with the intellectual labour of previous generations to guide us.

It is worth remembering that many of the young men described in the previous chapters did not have an innate talent for political manoeuvring. Many of them were presumably more comfortable with circuit boards and programming languages than boardroom and government politics. They simply found themselves at a confluence of historical forces and were propelled into positions of power because of their technical talent and enthusiasm for computers. Bill Gates admitted as much in an interview with *The Times* in 2025, when he continually returned to how lucky he was in his education, his family, and his relationships.²⁰ As much as we might like to assume powerful forces were at work, there was no grand conspiracy between the military-industrial complex and the teenage attendees of the Homebrew Computer Club, no subterranean historical forces at work pushing technologists into positions where they could express their regressive will to power. Despite obvious advantages, there was no absolute guarantee that either the United States or Silicon Valley would lead the world in chip manufacturing and the development of the Internet. The nature of global politics and economics after World War Two meant the United States had significant competitive advantages, but they were always subject to decisions made by other state actors, not to mention everyday voters and consumers.

This perspective has political but also tactical implications. The recent phase of digital modernity could be characterized as a case of “revenge of the nerds”²¹ through corporate and government sponsorship, transforming young men with a penchant for *Popular Electronics* into millionaire software developers and billionaire technology barons. The changes to culture and economy were an obvious extension of “the new electric Age of Information and programmed production”²² defined by Marshall McLuhan in 1964,²³ but they were contingent on a wide range of sociocultural, economic, and political factors. To people actively engaged with them, the more powerful computers became, the more apparent it was that they allowed the production and manipulation of new media from data structures and algorithms that amounted to “two halves of the ontology of the world according to a computer”, but this did not require technical genius – it only required active participation and experimentation.²⁴ It is too easily forgotten that the transition from McLuhan’s “total and inclusive”²⁵ electrical age to globally distributed computing occurred while many humanities and social science researchers were rejecting any engagement with digital technology. This resulted in over reliance on ideological rather than socio-technical critique, which has proven to be ineffective and even counterproductive.

The Rationalist and Effective Altruist (EA)²⁶ and Acknowledging Christ in Technology and Society Collective (Acts 17)²⁷ movements are perhaps the most worrying manifestation of this. They need to be better connected to the tradition of reactionary modernity described in earlier chapters and opposed to traditions of social democracy this book is designed to defend. Classically antimodern in their union of technological romanticism and Christianity, respectively, these groups wield considerable influence through their networks. As with many examples of technological modernity, they mix libertarianism with an interest in eugenics and race science, hidden beneath futuristic sounding political philosophies grounded in radical forms of market capitalism.²⁸ Many of their ideas have just enough purchase to interest passers-by, but are so disconnected from robust modes of humanities and social science thought to endanger civil society. Blinkered by the digital modern, they have no space for the traditions of social democracy that emerged from the ashes of the nineteenth century in large parts of the world, from the United Kingdom to Scandinavia, Australia, and Aotearoa New Zealand. In conflating science and technology with politics and religion, they enable a post-liberal world devoid of historical understanding and undermine an understanding of the good life handed down over generations. This is the challenge digital modernity presents: not the dominance of IC and the emergence of killer robots but disconnection from the collective wisdom of our immediate past.

The reactionary turn in Silicon Valley offers only a “Dark Enlightenment”, demonstrating the urgency of this mode of analysis.²⁹ The on-ramp to this mode of thinking is dangerously saccharine. Venture capitalist Marc

Andreesen's "Techno-Optimist" manifesto (2023) provides a poster example, joining corporate marketing with cyberutopian vacuity:

Our civilization was built on technology.
 Our civilization is built on technology.
 Technology is the glory of human ambition and achievement, the
 spearhead of progress, and the realization of our potential.
 For hundreds of years, we properly glorified this – until recently.
 I am here to bring the good news.
 We can advance to a far superior way of living, and of being.
 We have the tools, the systems, the ideas.
 We have the will.
 It is time, once again, to raise the technology flag.
 It is time to be Techno-Optimists.³⁰

This from a technology billionaire with access to the best of the world's knowledge. The effect is jarring, an embarrassing reminder of the intellectual immaturity of the Silicon Valley echo chamber and the extreme rhetoric that characterizes contemporary American politics. It is worth comparing Andreesen's effort to a song from IBM's 1937 corporate songbook, organized around the adoration of their founder Thomas J. Watson and designed to sell main-frame computers:

We're the I. B. M. Go-Getters,
 All the live-long-day.
 We are all One Hundred Pointers
 And will strive to be always.
 We have learned from Mr. Watson,
 Loyally we'll serve him all the time;
 And we'll always help each other
 Sell our whole big line.³¹

The schoolboy earnestness and lack of self-awareness recall the corporate groupthink identified by William H. Whyte in *The Organization Man* (1956). Its absurdity could perhaps be combatted with wry humour, but it has disturbing associations in the context of modernity.³² The lack of historical awareness stands in glaring opposition to world-altering levels of technological insight, leaving open the possibility that a collapse of American liberalism could undermine other forms of democracy too. Outside the United States, the claims exhibit a terrifying banality that borders on the insane: in 2025, the billionaire technologist Peter Thiel reportedly used similar logic to claim that regulation of AI would hasten the appearance of the Antichrist.³³ As painful as it might be to admit, interpreting such statements is impossible without reference to perspectives

last deployed against twentieth-century totalitarian regimes. The gap between reactionary modernity and technological utopianism has narrowed in similar ways before.³⁴

Notes

- 1 Zygmunt Bauman, *Modernity and Ambivalence* (Ithaca, NY: Cornell University Press, 1991), 39.
- 2 Thomas Piketty, *Capital in the Twenty-First Century* (Cambridge, MA: Harvard University Press, 2014).
- 3 Shoshana Zuboff, *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power* (New York: PublicAffairs, 2019).
- 4 Edward Luce, *The Retreat of Western Liberalism* (London: Abacus, 2018), 172.
- 5 Stephen Witt, "The A.I. Prompt That Could End the World," *The New York Times*, October 10, 2025, <https://www.nytimes.com/2025/10/10/opinion/ai-destruction-technology-future.html>, accessed February 20, 2026.
- 6 Reinhart Koselleck, *Sediments of Time: On Possible Histories* (Stanford: Stanford University Press, 2018), 100–16.
- 7 Karl Popper, "On the Theory of the Objective Mind" [1968], in *Objective Knowledge: An Evolutionary Approach* [1972] (Oxford: Oxford University Press, 1994), 170. Popper's emphasis.
- 8 Reinhart Koselleck, *The Practice of Conceptual History: Timing History, Spacing Concepts* (Stanford: Stanford University Press, 2002), 154. See also Helge Jordheim, "Against Periodization: Koselleck's Theory of Multiple Temporalities," *History and Theory* 51 (2012): 151–71.
- 9 Frank Ankersmit, *Meaning, Truth, and Reference in Historical Representation* (Ithaca: Cornell University Press, 2012).
- 10 Martin Ford, *The Rise of the Robots: Technology and the Threat of Mass Unemployment* (London: One World, 2015).
- 11 Gabriele Balbi, *The Digital Revolution: A Short History of an Ideology* (Oxford: Oxford University Press, 2023).
- 12 Something that has already been tried, via IBM's 'Modern Times' campaign featuring an actor playing Charlie Chaplin, during the 1980s.
- 13 Jan Zalasiewicz et al., "Scale and Diversity of the Physical Technosphere: A Geological Perspective," *The Anthropocene Review* 4, no. 1 (April 1, 2017): 9–22.
- 14 Michael Lawrence et al., "Global Polycrisis: The Causal Mechanisms of Crisis Entanglement," *Global Sustainability* 7 (January 2024): e6, 1–16.
- 15 Willard McCarty, "Steps towards a Therapeutic Artificial Intelligence," *Interdisciplinary Science Reviews* 49, no. 1 (2024): 107. McCarty's emphasis.
- 16 Philip E. Agre, "Toward a Critical Technical Practice: Lessons Learned in Trying to Reform AI," in *Social Science, Technical Systems, and Cooperative Work: Beyond the Great Divide*, ed. Geoffrey C. Bowker, Susan Leigh Star, Les Gasser, and William Turner (Mahwah, NJ: Lawrence Erlbaum Associates, 1997), 131–57.
- 17 Reinhart Koselleck, *Critique and Crisis: Enlightenment and the Pathogenesis of Modern Society* [1988] (Cambridge, MA: MIT Press, 2015).
- 18 Don Ihde, *Technology and the Lifeworld: From Garden to Earth* (Bloomington: Indiana University Press, 1990).
- 19 Peter-Paul Verbeek, *Moralizing Technology: Understanding and Designing the Morality of Things* (Chicago: University of Chicago Press, 2011).
- 20 Alice Thomson, "Bill Gates: Trump, Musk and How My Neurodiversity Made Me," *The Times*, January 28, 2025, <https://www.thetimes.com/life-style/celebrity/article/bill-gates-interview-new-book-memoir-wh766b9bs>, accessed August 15, 2025.

- 21 Douglas Rushkoff, *Cyberia: Life in the Trenches of Hyperspace* (New York: Harper Collins, 1994), 1–40.
- 22 Marshall McLuhan, *Understanding Media: The Extensions of Man* [1964] (Cambridge, MA: MIT Press, 1994), 36.
- 23 The Altair 8800 that inspired Steve Jobs and Steve Wozniak to establish Apple Computers was reviewed in a 1975 edition of *Popular Electronics*. Paul E. Ceruzzi, *A History of Modern Computing* (Cambridge, MA: MIT Press, 2003), 226.
- 24 Lev Manovich, *The Language of New Media* (Cambridge, MA: MIT Press, 2001), 198.
- 25 McLuhan, *Understanding Media*, 57.
- 26 Leif Wenar, “The Deaths of Effective Altruism,” *Wired*, <https://www.wired.com/story/deaths-of-effective-altruism/>, accessed September 26, 2025.
- 27 James Hurley, “Regulating AI Hastens the Antichrist, Says Palantir’s Peter Thiel,” *The Times*, September 25, 2025, <https://www.thetimes.com/business-money/technology/article/palantir-founder-peter-thiel-antichrist-lectures-religion-qzmpth35t>, accessed January 23, 2026.
- 28 Cade Metz, “The Rise of Silicon Valley’s Techno-Religion,” *The New York Times*, August 4, 2025, <https://www.nytimes.com/2025/08/04/technology/rationalists-ai-lighthaven.html>, accessed February 20.
- 29 David Mbembe, cited in David W. Bates, *An Artificial History of Natural Intelligence: Thinking with Machines from Descartes to the Digital Age* (Chicago: University of Chicago Press, 2024), 9.
- 30 Marc Andreessen, “The Techno-Optimist Manifesto,” Andreessen Horowitz, October 16, 2023, <https://a16z.com/the-techno-optimist-manifesto/>, accessed January 23, 2026.
- 31 IBM, “IBM One Hundred Percent Club Song Number One,” in *Songs of The IBM* (International Business Machines, 1937), 36.
- 32 William H. Whyte, *The Organization Man* (New York: Simon and Schuster, 1956).
- 33 Hurley, “Regulating AI Hastens the Antichrist”.
- 34 T. Rohkramer, “Antimodernism, Reactionary Modernism and National Socialism: Technocratic Tendencies in Germany, 1890–1945,” *Contemporary European History* 8, no. 1 (1999): 29–50.

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