Calzati Stefano and de Kerckhove Derrick (2025) Quantum Ecology: Why and How New Information Technologies Will Reshape Societies. Cambridge: MIT Press. 288 pages. ISBN: 9780262546218.

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Quantum Ecology by Stefano Calzati and Derrick de Kerckhove presents a comprehensive analysis of how quantum technologies are poised to transform the very fabric of human society, politics, and environmental engagement. The book argues that humanity is entering a new sociotechnical paradigm, which the authors term 'quantum ecology.' This paradigm builds on and moves beyond earlier language-based and digital ecologies, fundamentally altering how humans understand and interact with reality. Unlike its predecessors, the quantum ecology introduces principles from quantum mechanics – such as superposition, entanglement, uncertainty, and discreteness – into sociotechnical systems, challenging foundational assumptions of classical and digital thinking.

The authors begin by exploring the historical evolution of societal paradigms. The language ecology, rooted in oral, alphabetic, and logographic systems, provided humanity with tools for representation, collective organization, and meaning-making. These systems, while essential for structuring human experience, are tied to a fixed, representational understanding of reality. The digital ecology, emerging in the late 20th century, introduced algorithmic processes that emphasize computation, performance, and scalability. By transforming reality into measurable and processable data, digital systems facilitated global connectivity and optimization but often did so at the expense of nuance, context, and meaning. The authors contend that the limitations of these ecologies – namely, their inability to fully account for complexity, emergence, and relational interdependencies – make way for the quantum ecology, which embodies an entirely new ontological and epistemological framework.

Central to the argument is the idea that quantum mechanics disrupts classical notions of a fixed, objective reality. Instead, reality is relational and emergent, shaped by the interplay between observer and observed. The authors extend this principle to sociotechnical systems, suggesting that the quantum ecology is not merely a technological shift but a reimagining of human experience, politics, and environmental interaction. In this ecology, concepts like entanglement and superposition challenge binary and deterministic thinking, encouraging more holistic and interconnected approaches. The political implications of this shift are examined in depth. The authors propose 'quantum realpolitik,' a framework for understanding how quantum technologies redefine power relations. Traditional political systems are built on linear causality, predictability, and territorial sovereignty. However, quantum principles – particularly entanglement and nonlocality – undermine these assumptions, suggesting that power and influence are increasingly distributed and interdependent. Geopolitical competition over quantum technologies, particularly between global powers such as the United States and China, highlights the strategic importance of this paradigm. Quantum technologies like quantum cryptography and quantum sensing are

becoming critical tools in shaping global power dynamics. The authors emphasize that these technologies could reinforce existing inequalities if monopolized by dominant actors or could enable more decentralized and equitable systems if approached inclusively. Governance in the quantum ecology must address the ethical and accountability challenges posed by the inherent uncertainty and complexity of quantum systems.

The ecological dimension of the quantum paradigm is equally transformative. The authors propose a 'quantum ecology' framework that applies the principles of quantum mechanics to environmental systems. Traditional ecological models, influenced by classical mechanics, often view ecosystems as discrete, deterministic entities. In contrast, the quantum ecology emphasizes interconnectedness, emergence, and adaptability. For example, the phenomenon of quantum entanglement offers both a powerful metaphor and a practical model for understanding the interdependencies within ecosystems. Quantum sensing technologies could revolutionize environmental monitoring by providing precise, real-time data on ecological changes, while quantum computing could enable advanced modeling of complex phenomena such as climate change and biodiversity loss.

The book also critiques current sustainability practices, arguing that they often rely on mechanistic and reductionist approaches that fail to address the dynamic and adaptive nature of ecological systems. A quantum-based approach to sustainability would prioritize resilience and adaptability, recognizing that ecological systems are constantly evolving. However, the authors caution that quantum technologies could exacerbate existing inequalities if deployed without careful ethical oversight. They advocate for a holistic approach that integrates the principles of quantum mechanics into environmental policy and governance, ensuring that these technologies promote equity, inclusivity, and sustainability.

Throughout the book, the authors stress the need for interdisciplinary and transdisciplinary collaboration to navigate the transition to the quantum ecology. Drawing on insights from philosophy (Heidegger, 1977; Agamben, 2009), computer science (Hofstadter, 1979), sociology and media studies (De Kerckhove, 1996), and quantum physics (Aaronson, 2013), they construct a comprehensive framework for understanding the sociotechnical implications of quantum technologies. They argue that the quantum ecology synthesizes the representational strengths of the language ecology and the computational efficiencies of the digital ecology, while introducing new possibilities for understanding and engaging with reality. This synthesis challenges anthropocentric and instrumentalist views of technology, emphasizing the co-evolution of human, technological, and environmental dimensions. This might seem like nothing new within the contemporary STS landscape, but the book instead shows that quantum technologies open up a different perspective—one that encourages a rethinking of established paradigms.

While the book presents a compelling vision of the quantum ecology, it is not without its weaknesses. One potential criticism is its reliance on speculative connections between quantum mechanics and sociotechnical systems. Although the authors acknowledge the philosophical underpinnings of their arguments, the leap from quantum physical principles to societal and ecological paradigms risks being overly metaphorical and lacking in empirical grounding. Critics might argue that this weakens the book's claims about the transformative potential of quantum technologies in fields like governance and ecology. A second criticism concerns the lack of specific concrete policy recommendations or actionable strategies for navigating the transition to the quantum ecology. While the authors emphasize the importance of ethical oversight and interdisciplinary collaboration, they stop short of providing detailed frameworks for implementation, leaving readers with a vision that may feel abstract or idealistic. It is also true that the starting point of this work is and remains (critical) media theory and semiotics more broadly, so that governance is sketched more because it is a near horizon of the work rather than the central interest. This aspect can also be considered an advantage; in this way, the book creatively extends the long tradition of studies on language and media and the relationship between media and society begun by McLuhan.

Despite these potential shortcomings, *Quantum Ecology* offers a provocative and thought-provoking exploration of a paradigm shift that could redefine human society and non-human lives. By integrating the principles of quantum mechanics into discussions of politics, ecology, and technology, the book challenges readers to rethink fundamental assumptions about reality and to embrace a more interconnected and emergent worldview. This book serves as a significant resource especially for the contemporary STS community. Rather than merely reiterating established analytical frames—such as those developed around nanotechnology and biotechnology—it invites a deeper, more self-reflective engagement with what "quantum technologies" mean, how they are taking shape, and what kinds of social, political, and epistemic commitments they mobilize. Whether or not all of its claims prove empirically robust, it succeeds in opening new avenues for interdisciplinary dialogue and inquiry. One of the key strengths of this work is its ability to approach emerging technologies from a fresh perspective, avoiding both the simplistic alignment with the rhetoric of responsible innovation (a particularly European framing) as well as an empty, generic ethics of technology.

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