Introduction: An Endless Spiral of Connectivity?

In 1997, the US Federal Communications Commission issued my staff working paper, *Digital Tornado: The Internet and Telecommunications Policy*. It was distributed in hard copy and, in a novel twist, digitally through the FCC's website, which I had largely coded on my laptop after work. As the paper relates, only 15 percent of Americans at that time used the Internet, and only 40 percent had personal computers. I didn't think to mention that zero had Internet-capable smartphones, because such devices were still science fiction. Even smaller percentages of other nations were online. China, today the world's largest Internet access market, connected its very first public Internet subscriber the summer before *Digital Tornado* was released.

Two decades later, the paper's optimistic vision of an "endless spiral of connectivity" producing an Internet whose scope "mushroom[s] beyond comprehension"[1] has been realized. The Internet swept tornado-like across the world, scrambling established markets and drawing strength from other technological developments such as cloud computing and artificial intelligence. Yet in the process, it produced many unanticipated effects. We now stand at an opportune moment to assess the implications of the Internet's rise.

A TWENTY-YEAR RETROSPECTIVE OF THE FUTURE

In November 2017, the Wharton School of the University of Pennsylvania hosted a major conference, *After the Digital Tornado: Networks, Algorithms, Humanity*. It assembled an exceptional group of scholars from law, business, information studies, media studies, and related fields to consider the landscape twenty years after the publication of *Digital Tornado*. At the conference, and this edited volume, they evaluated the implications for business and society as the physical and digital worlds merge. Video recordings of all the conference sessions are available at http://digitaltornado.net.

[1] Kevin Werbach, *Digital Tornado: The Internet and Telecommunications Policy*, FCC Offices of Plans and Policy Working Paper No. 29 (March 1997), at https://transition.fcc.gov/Bureaus/OPP/working_papers/oppwp29.pdf.

Although the *Digital Tornado* paper was not an official FCC statement, it attracted "more than usual interest,"[2] as one of the first examinations by a government agency of the transformative potential of the Internet. The *Washington Post* ran an editorial celebrating that "a government that created the original Internet through public investment nonetheless has sensibly seen that the product of that investment does best on its own."[3] *Wired* lauded *Digital Tornado* as a "seminal" document "designed to help frame future debates on Internet policy in a pro-competitive context."[4] A *New York Times* column called it "eye-popping" and "the best news Net advocates . . . have gotten out of Washington"[5] because it suggested that the White House would take a "laissez-faire, market-driven approach to Internet regulation."[6]

Indeed, the Clinton Administration's *Framework for Global Electronic Commerce*,[7] released a few months later, decisively argued that regulators could best realize the benefits of the Internet by getting out of the way. "The private sector should lead" and "Governments should avoid undue restrictions on electronic commerce"[8] were its first two core principles. As fate would have it, I also helped draft those words, as the editor of the document for the interagency working group that produced the report.

The argument was not that regulation was always bad, or that, as some insisted at the time, the Internet was a distinct world that should be exempted from compliance with territorial regulations. Rather, the central claim of *Digital Tornado* was that the FCC could best achieve its regulatory goals, such as promoting competition and unleashing innovation in communications markets, by avoiding unnecessary imposition of legacy rules that poorly fit nascent services. Furthermore, government should take into account the novel technical affordances of Internet-based systems.

In 1997, the United States was home to the vast majority of global Internet users, as well as virtually all the significant commercial Internet service providers and online application platforms. It was the decade between the fall of the Soviet Union and 9/11, a period of US global hegemony unmatched in some ways before or since. America's Internet policy was destined, at least initially, to be the

[2] Light Touch on the Net, *Washington Post*, April 7, 1997.
[3] Ibid.
[4] Rebecca Vesely, Scans: Spinning the FCC, *Wired*, August 6, 1997, at www.wired.com/1997/08/scans-spinning-the-fcc/.
[5] Jason Chevrokas and Tom Watson, Administration Set to Assert Role in Cyberspace, *New York Times*, April 25, 1997, at http://movies2.nytimes.com/library/cyber/nation/042597nation.html.
[6] Ibid. The FCC is an independent agency, not subject to the direct authority of the White House. However, as a major technology-focused regulator whose Chair is nominated by the President, its approach is typically consistent with the Administration.
[7] The Framework for Global Electronic Commerce, at https://clintonwhitehouse4.archives.gov/WH/New/Commerce/.
[8] The White House, Framework for Global Electronic Commerce (July 1997), at https://clintonwhitehouse4.archives.gov/WH/New/Commerce/read.html.

dominant framework globally. The Internet economy as we know it grew up in response to the regulatory approach that *Digital Tornado* represented.

This direction was far from foreordained. Just a year earlier, Congress passed, and President Clinton signed, legislation imposing broadcast-style indecency regulations on the Internet. The Administration was also pushing a plan to mandate government backdoors on strong encryption technology, as media companies pressed for strict online copyright enforcement and telephone carriers urged per-minute fees to prevent dialup Internet usage from overwhelming the phone network. In the end, those arguing that emerging online services should be protected from chilling regulation won the day. The potential benefits for innovation, new competitive entry, and a more open information ecosystem were too great to ignore.

As the Internet grew as a commercial and social force, first in the United States but soon throughout the world, this policy approach, which a later FCC working paper labeled as "unregulation,"[9] was viewed as an unambiguous success. The Internet, and the global web of communities and communications it fostered, was not snuffed out by incumbents. It was not turned into the centrally managed telephone network, or the centrally controlled content pipe of cable television, or a paid service offering of technology titans such as Microsoft. Small startups like Amazon.com and eBay became global commerce powerhouses, while others not yet founded, such as Google, Facebook, Alibaba, and Tencent, became some of the largest and most powerful corporations in the world. Apple, in 1997 a struggling niche vendor of personal computers, rode the smartphone boom to become the first trillion-dollar American company by market capitalization. This sort of revolution was what our small band of Internet policymakers dreamed of in 1997, but we could hardly imagine how dramatic it would be.

Today we find ourselves in a world where little remains untouched by the wave of digital connectivity that *Digital Tornado* anticipated. Yet fundamental questions remain unresolved, and even more serious new questions have emerged.

Networks powered by algorithms are eating everything. Many of the contemporary technology trends with the greatest significance for the economy and for public policy – the Internet of Things, Big Data, Platform Economy, Blockchain, and Algorithmic Society – should be seen as manifestations of this larger phenomenon. Growing tensions around governance, innovation, surveillance, competition, consumer/worker protection, privacy, and discrimination are best understood within a broader frame. The algorithmic networked world poses deep questions about power, freedom, fairness, and human agency.

Ubiquitous networking means the transformation of every form of economic activity, and a large chunk of noneconomic activity, along the same lines as the Internet. Algorithmic control means that increasingly dynamic software will manage

[9] Jason Oxman, The FCC and the Unregulation of the Internet, FCC Office of Plans and Policy Working Paper No. 33 (July 1999), at https://transition.fcc.gov/Bureaus/OPP/working_papers/oppwp31.pdf.

not just transactions and communication, but also human systems. Our cultures and institutions are ill-adapted to this new environment. Equally important, systems engineered for a distinct and limited digital world can be ill-suited for the complexities of the "real" world. Already, a number of controversies have arisen, many of which are difficult to address under established legal rules.

Some of the essential questions include: How should organizations appropriately make use of the vast array of data they can now collect, process, and analyze? How can bedrock notions of fairness, justice, trust, and liberty be applied when computers make critical decisions, often based on obscure factors? What new business models will emerge, and how will competitive dynamics evolve? Will there be resistance to a future in which the line between networked people and networked devices becomes increasingly blurred? And can we build new legal structures, and new institutions, to better fit the world we find ourselves in?

The insightful contributions in this volume attack such questions from a range of disciplinary and other perspectives. There is no unitary answer, but taken together, these chapters paint a sophisticated picture of the contemporary digital world, its discontents, and its potential futures.

OUTLINE OF CONTENTS

The initial chapter of this volume reprints key excerpts from the *Digital Tornado* working paper published in 1997. Some portions read as historical artifacts from a time when TCI and Netscape were important players in the digital economy, while Google, Facebook, and Amazon were either tiny or nonexistent. As an FCC document, the paper emphasizes agency-specific question such as whether real-time Internet communications services should be regulated as telephone companies. Yet in some ways, its claims are surprisingly broad and surprisingly fresh:

> The chaotic nature of the Internet may be troubling for governments, which tend to value stability and certainty. However, the uncertainty of the Internet is a strength, not a weakness. With decentralization comes flexibility, and with flexibility comes dynamism. Order may emerge from the complex interactions of many uncoordinated entities, without the need for cumbersome and rigid centralized hierarchies. Because it is not tied to traditional models or regulatory environments, the Internet holds the potential to dramatically change the communications landscape. The Internet creates new forms of competition, valuable services for end users, and benefits to the economy.[10]

The intervening decades have vindicated this strikingly optimistic vision in some ways, while revealing its errors in others. Today, Internet-based platforms count their users in the billions, and are major players in the global economy. Most of the population of the world carries around a smartphone, which is deeply integrated into

[10] *Digital Tornado*, at ii.

both their business activities and their social lives. Extraordinary amounts of wealth have been created, along with many other benefits. Yet overall, our view of the Internet now is darker, or at least more gray. It has created new concentrations of power that by some measures exceed those before, and it has opened the door to massive violations of privacy, manipulation, discrimination, information warfare, exploitation, and other abuses. Movements toward digital ethics, taking back control of online activities, and new regulations of digital platforms are the prominent features of our current Internet policy debates. The pendulum will doubtless swing again, making it all the more valuable to stop and assess where we are, and where we've come from.

The remainder of the volume is organized along around three pillars, which were also the framework for the conference at Wharton: networks, algorithms, and humanity.

PART I: NETWORKS

The network is the basic organizing structure of our increasingly digital society. *Digital Tornado* urged that "The FCC's goal should not be to foster the development of . . . networks individually, but to maximize the public benefits that flow from the Network that encompasses all of those networks.[11]

Networks are the channels for the collection, aggregation, manipulation, and application of vast quantities of data from every facet of the world. As platforms for economic activity, networks are already shaping global business. As frameworks for the exercise of power, they can be tools for either empowerment or control. The contributions in this section consider how private and governmental actors seek to exploit the networked environment, and what mechanisms could promote the most desirable outcomes for individuals, organizations, and communities.

Chris Marsden frames *Digital Tornado* within a debate between two positions on Internet regulation, where the winner turns out to be a third option. He offers a transatlantic perspective on the past two decades of Internet policy as a corrective to the frequent tendency of American experts to assume they are the only game in town. The United Kingdom and Europe have been far from idle in considering the implications of the "information society," and their policy approaches often vary from the dominant American strain. In particular, they have emphasized the hybrid of governmental and private market oversight known as coregulation. Marsden sees this approach to making regulation more adaptive addressing key dilemmas that fast-moving, slippery technologies pose for the traditional regulator's toolkit. The common thread across the Atlantic that he identifies is that the technocratic consensus for Internet "unregulation" unraveled as it met the cold reality of real-world harms.

[11] *Digital Tornado*, at 9.

Julie Cohen offers skepticism that governments can control the operators of cyberspace through force of law. She explains how networks, constituted through standards, have turned into a new transnational and extragovernmental form of regulation. In hindsight, a critical blind spot of the 1990s' vision for the digital economy was the assumption that Internet-based networking would generally lead to the diffusion of power. Astute observers recognized that technical means of regulation might be more restrictive and less democratic than conventional legal forms, but the dominant viewpoint was optimistic. *Digital Tornado* declared that: "The Internet is dynamic precisely because it is not dominated by monopolies or governments."[12] As Cohen demonstrates, the rise of networks has, in many cases, either created new dominant power centers or entrenched old ones. Her key insight is that networks and standards represent a new hybrid legal-institutional form of governance. The rise of networked governance has, in turn, empowered digital platforms to exercise enormous power outside the limitations of regulation or other traditional constraints.

So, what are we to do? While the focus of this collection is not on particular policy responses to specific problems, Tim Wu offers some hope. He does so by, ironically, going back in time to the decades before there was an Internet. His focus is on the IBM antitrust case. Extending from the end of the 1960s to the beginning of the 1980s, when it was finally dropped by the Department of Justice, the IBM case is usually viewed as a cautionary tale of wasteful government overreach into fast-moving technology industries. Wu argues that, far from being a failure, the Justice Department's efforts to rein in IBM led to the creation of independent markets for software and personal computers. IBM's fall from dominance, necessary to open the door for Microsoft, Apple, and the entire Internet industry, was not a foregone consequence of Schumpeterian forces, but the outcome of sustained government action. The vision of unrelenting technological progress embodied in *Digital Tornado's* "endless spiral of connectivity" is not, Wu emphasizes, inherently self-actualizing. While regulators should, as *Digital Tornado* emphasized, consider potential innovation harms of intervention, they should not shy away from bold action to promote innovation in protomarkets that otherwise might never develop.

PART II: ALGORITHMS

The network revolution is moving to a new stage thanks to the development of machine learning, artificial intelligence, and analytics that can automate human decision making. Firms and industries are being reconfigured to capture the benefits of digital platforms and algorithmic systems. And as more and more decisions are automated through systems that substitute correlations for causation and understanding, foundational notions of legal and ethical responsibility come into

[12] *Digital Tornado*, at 83.

question. Algorithms are not neutral; they reflect the preferences and biases of those who design them. The contributions in this section highlight the potential as well as the challenges of an algorithmic world, and suggest responses to the dangers they highlight. In particular, they go beyond the recognition that algorithmic markets and services create policy concerns around data protection, fairness, manipulation, and market competition to offer guidance for firms and governments in developing responses.

Kartik Hosanagar (with Alex Miller) provides a simple framework to understand algorithmic systems in terms of data, algorithmic logic, and human interactions. Abstracting in this way avoids getting caught up in the complexity and variety of data science techniques. It also counterbalances the natural tendency to focus solely on algorithms themselves. Hosanagar and Miller apply their framework to one of the most concerning unanticipated consequences of the Internet: the rise of "filter bubbles," which narrow the scope of users' information environments. While services such as Facebook contribute to filter bubbles by algorithmically recommending content that reinforces existing viewpoints, what users share to begin with and what they click on once surfaced by the algorithm also matter. Through a simulation experiment, Hosanagar and Miller show that filter bubbles emerge or collapse from the interactions of all three factors.

The interaction effects between data and algorithms also have significant business implications, which Viktor Mayer-Schönberger considers in his chapter. As many observers recognize, market concentration is a significant and growing problem in precisely the digital markets where the Internet was supposed to herald an era of healthy competition. Mayer-Schönberger points out that algorithmic systems are subject to a significant new force shifting market competition, which he labels the "feedback effect." More data not only produces better results through traditional scale and scope economies, but also by generating better machine learning models. This means that traditional antitrust remedies, such as those explored by Tim Wu in Chapter 3, are poorly suited to redress competitive imbalances. Instead, Mayer-Schönberger argues, regulators should impose a progressive data-sharing mandate. With this novel mechanism, dominant digital platforms would be required to make data available to competitors, blunting their inherent advantage in algorithm-dominated markets.

Deirdre Mulligan (with Daniel Kluttz and Nitin Kohli) offers another pathway forward. The standard response to concerns about "black box" algorithms is to make those algorithms transparent or explainable. Such approaches, however, involve significant limitations, especially in professional contexts such as medicine, law, or financial advice. Mulligan, Kluttz, and Kohli argue instead for designing systems to be contestable, meaning that those subject to algorithmic decisions can engage with and challenge them. They apply this concept to machine learning in the context of professional expert domains. Both laws and norms can encourage contestability of these automated decisions, but systems designers still must take explicit

steps to promote effective questioning and challenges. The overall message of the chapter, as with the others in this section, is that we cannot take algorithms and their impacts for granted. Just as network platforms sometimes require regulatory oversight, algorithmic systems need conscious evaluation and shaping to blunt their unintended consequences.

PART III: HUMANITY

The final contributors consider the big question: What is the future for humans in an environment increasingly dominated by data-driven algorithms and networked machines? The opportunities in this world to create both new wealth and tighter interpersonal connections are extraordinary. Yet for many, the digital tornado is a destructive force, undermining economic security, creative freedom, or individual agency. What mechanisms of oversight or resistance could counteract these effects? Throughout history, both societies and organizations have innovated in structures of governance to promote social welfare in changing environments. The contributions in this section consider whether, at a time when trust is fraying across the board, there is hope for solutions that expand the pie and promote human flourishing.

Brett Frischmann (with Evan Selinger) argues that networked digital systems are engaged in no less than the reengineering of humanity. While the narrative of artificial intelligence for many decades has been about computers becoming more like people, the reverse is also occurring: People are effectively being turned into machines. Frischmann and Selinger make an impassioned case that promoting human flourishing means allowing for different conceptions of the good life. That means pushing back on the reductionist systems that private companies engineer for their own interests, and respecting the right to turn off. They use Robert Nozick's classic thought experiment of a machine that can simulate any experiences, and a modern-day variant, to test ethical intuitions. What ultimately differentiates humans and machines is that we can and do make choices that diverge from simple optimization functions. The benefits of networking, automation, and new services that digital connectivity provides should not come at the price of our deepest values.

Striking a similar chord, Shoshana Zuboff explains how the combination of pervasive networking, algorithmic decision making, and advertising-based platform business models gave rise to a new and dangerous economic form: surveillance capitalism. Industrialization in the nineteenth century had to crush the natural concept of beauty in order to produce the orderly structures of capitalist market exchange. Similarly, the new capitalism based around relentless aggregation and algorithmic exploitation of data necessarily undermines protection of privacy, which resists the transformation of personal information into raw material for corporate exploitation. Zuboff explains how the battles now underway over the power and role of digital platforms are not just conflicts over regulation and antitrust (although they are that), but fundamental conflicts about the very structures of power in our society.

The Internet's transformation from source of creative innovation to agent of domination may have been avoidable, but the seed of surveillance capitalism were present from the early days.

Finally, my contribution, *The Siren Song*, aims forward. If the original *Digital Tornado* was an analysis in 1997 based on a vision of 2007 or 2017, what would a similar exercise look like today? One of the most plausible scenarios for how newer technologies might disrupt and reconstitute the Internet economy is based on blockchain and related mechanisms. Because of their fundamental decentralization, enforced through cryptography, these technologies hold out the promise of resisting the centralization of control that Zuboff highlights. The problem is that the power of blockchain to create trust without reliance on trusted third parties depends on immutable transactions. And that means prospectively limiting human freedom of action. Like Frischmann and Selinger, I worry about replacing human judgment with relentlessly logical machines, although my focus is more practical than normative. Immutability inevitably creates the possibility of catastrophe, unless paired with imperfect governance mechanisms that keep humans in the loop. There is still no free lunch.

THE CHOICES WE FACE

In the third decade of the twenty-first century, as in the last decade of the twentieth, our approach to technology can emphasize the safety of the familiar or the protean creativity of the new, but each choice brings complications. Those who warned that a lightly regulated Internet would produce harmful consequences were not wrong, nor are those who point out that for all the current problems, Internet-based platforms still generate economic and social benefits for much of the world's population.

History, even recent history, is a collection of narratives we create to give coherence to events. The US government in the 1990s might have taken a different line toward the Internet, being more radically deregulatory or (more likely) imposing more traditional rules on unfamiliar and threatening new systems. We can only speculate on the counterfactual present that would have produced.

The final line of *Digital Tornado* was the following: "In the long run, the endless spiral of connectivity is more powerful than any government edict."[13] The intervening years have demonstrated both the truth of that prediction, and its incompleteness. The Internet did shape the world in incredibly significant ways, in spite of resistance of governments and private actors. Yet both also found ways to rein it in, or even bend the Internet to serve their aims. Some of the edicts the Internet overran were mechanisms to protect privacy, prevent harassment, protect consumers, and other desirable initiatives. Not all forms of self-reinforcing growth are healthy; some

[13] *Digital Tornado*, at 84.

are cancerous. From the vantage point of 2017, the speculative optimism of 1997 seems both prescient and naïve.

The next twenty years are likely to witness similarly surprising development patterns. The raw number of individuals touched by the Internet will not grow by two orders of magnitude again, because we have nearly run out of unconnected people (although pockets without access remain a problem). Yet how people experience connectivity will change. The social consequences will continue to evolve as the networks of machines grow in numbers and sophistication.

My hope is that this volume contributes to our collective understanding of the next turnings of the endless spiral of connectivity.

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