INTRODUCTION

Most of us are caught up in the quickening whirl of technological change. As consumers we can readily recognize the benefits created by the quicker technological tempo—ever smarter phones, more effective medicines, and faster connections to those around us. We thrive as companies leapfrog one another to create the next new thing. We rarely pause, however, to consider what such technological progression means for our lives as citizens.

Yet the central political problem of our time is how to adapt our venerable democracy to the acceleration of the information age. Modern technology creates a supply of new tools for improved governance, but it also creates an urgent demand for putting these tools to use. We need better policies to obtain the benefits of innovation as quickly as possible and to manage the social problems that speedier innovation will inevitably create—from pollution to weapons of mass destruction.

Exponential growth in computation is driving today's social change. The key advantage for politics is that increases in computational power dramatically improve information technology. Thus, unlike most technological innovations of the past, many innovations today directly supply new mechanisms for evaluating the consequences of social policies. Our task is to place politics progressively within the domain of information technology—to use its new or enhanced tools, such as empiricism, information markets, dispersed media, and artificial intelligence, to reinvent governance.

For instance, the Internet greatly facilitates betting pools called information or prediction markets that permit people to bet on the occurrence of future events. Such markets already gauge election results more accurately than polls do. If legalized and modestly subsidized, they could also foretell many policy results better than politicians or experts alone. We could then better predict the consequences of changes in educational policy on educational outcomes or a stimulus program on economic growth. In short, prediction markets would provide a visible hand to help guide policy choices.

The Internet today also encourages dispersed media like blogs to intensify confrontations about contending policy claims. Previously a less diverse mainstream media tended to settle for received wisdom. Our more competitive media culture permits the rapid recombination of innovative

policy proposals and expert analysis no less than our more competitive scientific culture provides an incubator for new computer applications. A novel plan for reducing unemployment is immediately analyzed, critiqued, and compared to other programs.

Because of this greater computational capacity, society can also use more effective methods of social science to evaluate empirically the results of policies. Like prediction markets and dispersed media, the turn to empiricism benefits from competitive structures. Different jurisdictions, from states to school districts, try to gain advantages over one another by adopting better policies. With our more sophisticated empirical tools, we can then assess the effect of their distinctive policies, gauging the degree to which gun control helps prevent crime or whether longer school hours improve student learning.

Thus, the technological transformation of society contains within itself the dynamo of its own management, but only if we create laws and regulations to permit the information revolution to wash through our democratic structures. For instance, Congress must legalize online prediction markets and systematically encourage policy experimentation within the framework of its legislation. The Supreme Court must assure that the changing media can deliver information to citizens, particularly at election time. We cannot tolerate social learning that moves at glacial speed when technological change gallops apace; we cannot put up with a government that inaccurately assesses policy results with outdated methods when new smarter mechanisms are within its reach. The technological revolution is giving us progressively better hardware to gather the information in the world to improve policy outcomes. But government structures and rules provide the essential social software to make that hardware work effectively on behalf of society.

With the advent of new technology, the ideal structure for social governance today starkly contrasts with previous visions of modern government, like that celebrated in the New Deal, which relied on centralized planning. There the focus was also on improved governance through the use of social information, but the analysis was to be handed down from the top—from experts and bureaucrats. Today technology permits knowledge to bubble up from more dispersed sources that are filtered through more competitive mechanisms, sustaining a more decentralized and accurate system of social discovery. We can acquire general expertise without being beholden to particular experts. The nation can retain and improve the best of the model of governance we have—a politics that seeks to be informed by expertise and social-scientific knowledge—while shedding the error-prone arrogance and insularity of a technocracy.

The promise of modern information technology for improving social governance should not be confused with an enthusiasm for using technol-

ogy simply to increase democratic participation. Often labeled "digital democracy," this perspective animates President Barack Obama's promise to respond to Web-based petitions that collect five thousand signatures.[1] But more equal participation is not sufficient to assess more accurately the consequences of social policy, because citizens do not possess equal knowledge.

Modern information technology instead allows us to root improved governance in a realistic assessment of human nature. It permits competitive mechanisms and the scientific method to harness man's self-interest and unequally distributed knowledge for the public good. More utopian visions of social reform, which rely solely either on the opinions of an elite or the unrefined sentiment of the people to remake society, are worse than political blunders. They are anachronisms in the information age, with its more accurate methods for sifting information and translating it into the knowledge needed to evaluate policy.

The use of market mechanisms and the scientific method also could lower the political temperature. Such tools encourage a greater recognition of the uncertain effects of all human action and thereby bring a greater dispassion to the business of social reform. This style of politics makes it more likely that society will act on the best evidence available to make steady improvements and avoid the worst catastrophes.

Contemporary technology not only supplies tools for better decision making but also creates a demand for their deployment to both speed the benefits of innovation and handle its dangers. Technological innovations today hold the potential to provide a great boon to humanity. Advances in biotechnology and other fields promise longer life through medical innovation, and those in computation generate greater wealth through enhanced productivity. But the pace of these beneficial inventions depends in part on government decisions about taxes, government investments in basic science, and laws on intellectual property. Government can create a virtuous circle by using technology to sustain social processes that in turn create a faster cycle of valuable technologies. In contrast, bad government policy on innovation is today more costly than ever, because it can squander unparalleled opportunities for technological advance.

Even more important, better government is needed to address the downsides of faster and likely accelerating technological change. Energy-intensive machines began the process of injecting greenhouse gases into the atmosphere at the time of industrialization. Yet almost no one recognized this development until relatively recently, in large part because we did not have the necessary predictive tools. Thus our prior failure to foretell global warming signals the need for earlier and more accurate assessment of the possibly dangerous by-products of more advanced and more rapidly developing technology.

Domestically, fast-moving technology can be socially disruptive. Improving machine intelligence can at times complement the value of an employee, enhancing his or her productivity. But it can also at times provide a complete substitute for human labor. As computer search capabilities become more effective, the human premium on simply knowing things falls, as most recently demonstrated by the victory of the computer Watson over the best players in the history of *Jeopardy!*—the preeminent television quiz show. Such computer programs will perform a greater range of clerical tasks, displacing routine white-collar jobs.

The result is likely to be more unemployment in the short term and perhaps greater inequality—a recipe for social instability. Economists are right to remind us that workers who are displaced by machine intelligence need not be condemned to long-term idleness. Given the infinite variety of human desires, there is always more work to be done. But society will need to facilitate social structures that help employees face a lifetime of job changes.

Abroad, technological change will create even more disruption as the wave of acceleration engulfs societies that have not yet come to terms with the social demands of industrialization, let alone more recent technological change. Mass disorientation can become the source of both national aggression and non-state terrorism—aggression and terrorism made all the more devastating by access to weapons that are not only increasingly powerful but also deployable by ever smaller groups. Even if almost all nations in the world democratize, the one remaining rogue nation may exploit technology to cause mass destruction. Even if most terrorist organizations subside, the few that are left may gain even more power in asymmetric warfare through access to new destructive devices.

Because of such dangers, the dynamic of modern technology could as easily lead to a nightfall of civilization as to the dawn of a far better world.[2] The quality of our politics may make the difference between nightfall and dawn as we decide how to grapple with our fast-moving technological advances. Those decisions include when to regulate technologies that may prove dangerous and how to unleash from obsolescent regulation technologies that may prove beneficial. It also includes more general policy improvements to increase economic growth and social stability so that we can provide the resources and rally the popular support to address the disruptions that successive waves of technological change will cause.

The evolutionary history of mankind highlights the challenge of adjusting social governance to faster and faster change. Slowly animals evolved to learn from their environment. Through writing, Homo sapiens then became the first species to preserve learning, enabling knowledge

to grow, ultimately at an exponential pace. Collective learning over time then became the source of technological improvement, a process that could move much faster than evolution.

But because human nature evolved in an era before collective learning accelerated, we are all fitted to living in a world that does not change much after our formative years. For example, the capacity to learn new languages dissipates from youth, because historically most people never leave the society into which they are born. As we come of age, we form beliefs, social networks, and allegiances without any natural expectation that they may need to be altered in light of different circumstances. During the period of our evolution, the technology that mankind created could not change, let alone destroy, the future of our children and grandchildren. Thus, there is likely a mismatch between our individual nature and the speed at which the world now changes. But while we are not individually well adapted to radical change, together we must handle the social revolutions generated by our technology. To do so requires better mechanisms for generating the kind of social knowledge that will lead to wise policy.

In the 1990s the growth of knowledge became central to explaining economic prosperity.[3] Recombining ideas in novel ways creates new ideas that allow us to do more with less and thus helps propel long-term economic growth. Just as new knowledge is a key to sustaining economic growth, it is also a key to sustaining political stability and progress. In this respect, the contemporary polity is not so different from a contemporary firm. Both must create a structure and a culture that facilitates product improvement in a rapidly changing world.

We can also compare social knowledge to the knowledge of natural science. Evidence of nature's pattern of regularities is always falling on the earth.[4] Progress in science has occurred through creating mechanisms like telescopes and microscopes to collect data and through generating a culture that seeks natural rather than supernatural explanations of the patterns generated by the data. Similarly, evidence of the social world's regularities is all around us. But we must use the best mechanisms of information technology available to gather such data and see their patterns. We also need a social culture that encourages democracy to embrace explanations that fit the data rather than explanations that stubbornly adhere to our ideological preconceptions.

The analogy to science also helps us recognize that social knowledge is always provisional. Throughout our history, scientific theories have been replaced by theories that have yielded better predictions. Yet at least since the eighteenth century, relying on contemporary science has greatly improved human life. Similarly, while new technological mechanisms can yield better assessments and predictions of social policy, such social knowledge can always be revised and improved.

The analogy also reminds us that social knowledge, like scientific knowledge, requires funds to generate it. Because technology is reducing the cost of acquiring social information, government should rationally reshape its structures and revise its laws to acquire more of it. There is widespread agreement that we should spend the resources needed to achieve such public goods as reducing pollution and avoiding damage from weapons of mass destruction. Government thus should be willing to spend resources to buy the information that helps tell us how best to furnish such goods. Social knowledge is the master public good without which other public goods cannot be well provided.

Technology progresses because humans exploit some element of the world from water and fire to magnetic fields and the quantum movement of atoms.[5] Government structure then also progresses as the new technology is deployed to create better sources of information for its social decision making, including decisions about problems created by the novel technology. Ultimately, the distinctive forms of government throughout history have been the outgrowth of the human genius for material invention, a social echo of the Promethean capture of some natural element for our collective improvement. What is new today is the pace of change and hence the pace of necessary adaptation.

A renewed agenda for a politics of learning is part of the long tradition in Western political philosophy of trying to reduce the social salience of issues like questions about religious doctrine, which have no clear answer, and focus on issues on which there can be progress, such as the creation of wealth and the extension of life. For much of the last few centuries, progress on such tractable issues has derived from the natural sciences. Today our structure of governance must create rules to elicit information from the social sciences on disputed issues of policy as well. Technological acceleration simultaneously creates a greater capacity for the polity to update policy on the basis of information and a greater need for updating to navigate the rapids of faster social transformations. The capacity of a society for learning must match its capacity for change.

The Plan of This Book

This book comprises three parts. The first offers an analysis of the relation of social knowledge to both democracy and technological change. Chapter 1 makes the case that because of computational advances, the world is changing fast, perhaps faster than at any other time in human history. It shows how this rate of change raises acute problems for governance. It thus provides the premise for both the possibility and urgency of improving political deliberation.

Chapter 2 outlines a theory of a central function of social governance and an important function of democracy—assessing consequences of social policy—that underlies the need to create social knowledge. An inquiry into political reform today must combine what is very new—the latest developments in our advancing technology—with what is very old—the difficulties societies face in making necessary collective decisions. The rise of new information technologies has only recently begun to be explored by political theorists. Improving collective decision making by increasing social knowledge concerns matters that have vexed political theorists and statesmen since ancient Athens. But combining these two subjects offers the only prospect for political reform in our restless age of relentless change.

The second part of the book addresses four information technologies—empiricism, prediction markets, dispersed media, and artificial intelligence—each in its own chapter. New information technology can provide fuller and more objective information about policy consequences by making better use of competitive and decentralized mechanisms such as betting markets and federalism. These technologies create synergies that deliver an information stream that is more powerful than the sum of its sources. Empiricism helps us understand the consequences of past policies. Artificial intelligence can help structure the data and even suggest hypotheses that empiricism can test. Prediction markets then combine this empirical expertise with information dispersed throughout society, translating that compound into numbers that can command attention.

But these technologies can be effective only if government creates new rules for information production. The political branches must take steps to unleash prediction markets and systematically make legislation a platform for policy experiments. The judiciary must formulate a jurisprudence of social discovery, permitting states and localities to experiment in social policy, thus creating different policy regimes that can be evaluated. Government must permit dispersed media to trumpet this information about policy, particularly at election time, when citizens pay most attention.

Much of modern government is administrative government. Chapter 7 focuses on how the administrative state can integrate these new technologies to base decisions on dispersed information rather than on bureaucratic fiat.

The third and final part confronts the issue of bias. If people were so biased that they disregarded information at odds with their prior beliefs, new information technologies and new information production rules would not help in updating democratic policies. Chapter 8 surveys the many kinds of political bias. It then shows that democracy already has mechanisms to permit updating even in the face of bias. Nevertheless,

bias remains a substantial, even if not insuperable, obstacle to democratic updating. Chapter 9 discusses how democracy can adopt reforms, including those based on new information technology, to combat bias more effectively.

The concluding chapter shows that our current need to enhance social knowledge is but the latest stage in the long history of exploiting technological progress to improve governance. From ancient Athens, to Britain on the cusp of the industrial age, to the founding of our own republic, successful societies have navigated the turbulences of technological change by creating better mechanisms to gather information about the social world and to translate it into wise decisions. This history underscores the fact that improving information about consequences in politics is an incremental process. It is not an argument against renovating our political information structures that reform will be imperfect or that political bias will continue to exist. The recognition that previous societies have succeeded in enriching social deliberation should give us confidence that we too can seize the opportunities newly available to begin to transform our political life.