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WHAT WILL BE: HOW THE NEW WORLD OF INFORMATION WILL CHANGE OUR LIVES

By Michael L. Dertouzos.[1]
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The times they are a-changin'.[2]

Mass communication — its rise and its changes — has dramatically affected life over the course of the twentieth century. We have seen vast changes in the ways we act, interact, work, think, and play. As our world has become smaller and more interconnected, our society has been transformed: our global consciousness rises as international events become our instant headlines, and new intra- and international frictions flare as class and cultural tensions are exacerbated and physical distance becomes increasingly irrelevant. As people become more focused on their individual interests, they have less inclination and time to engage in activities that reinforce community standards, understandings, and reference points. Thus, information access has given us greater freedom to pursue our own desires, but it has also led to the atomization of families, communities, and nations. These trends have played themselves out in political and social movements. Through it all, our legal system has adapted and adjusted to the paradigm shifts in our ways of living and making a living. It has heeded the whims of popular passion and the currents of contemporary conceptions of justice. What comes next for our legal system will be a reflection of what comes next for our society writ large. For those who will make these laws, shape these laws, and abide by these laws, understanding the forthcoming social, economic, and technological changes is essential to understanding what both life and our legal system will look like in the years to come.

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1. Director, Massachusetts Institute of Technology ("MIT") Laboratory for Computer Science.

2. BOB DYLAN, *The Times They Are A-Changin'*, *on* THE TIMES THEY ARE A-CHANGIN' (Columbia Records/CBS Records, Inc. 1964).

I. THE VISIONARY

If anyone is well equipped to explain how information technology is changing and will change our world, it is Michael Dertouzos. For the past twenty-three years, Dertouzos has headed the Massachusetts Institute of Technology ("MIT") Laboratory for Computer Science. During this time, he has overseen some of the most remarkable advances that the computing and information technology fields have ever witnessed. According to Bill Gates's forward, among the progeny of Dertouzos's lab are spreadsheets and RSA encryption technology,[3] along with several dozen start-up companies (p. xiii). The lab also coordinates the World Wide Web Consortium whose 150 member organizations set collective standards that are crucial for the integrity and continued evolution of the Web (p. xiii). Additionally, Dertouzos has scored prior success as a visionary: in 1981, he first described the concept of an "Information Marketplace" as "a twenty-first-century village marketplace where people and computers buy, sell, and freely exchange information and information services" (p. 10). *What Will Be* attempts to continue these predictions "by extrapolating forefront research discoveries to future technical developments, mixing them with ageless human behaviors that never change, and adding some imagination" (p. 11). In *What Will Be*, Dertouzos uses intuition and insight, gained from decades on the cutting edge of information technology, to analyze the long-term practical applications and effects of the technologies that we are beginning to see emerge around us.

II. THE VISION

Into the future, information technology will not only affect "how we work and play, but [also] how we receive health care, how our children learn, how the elderly remain connected to society, how governments conduct their affairs, how ethnic groups preserve their heritage, whose voices are heard, even how nations are formed" (p. 5). What makes this book useful for lawyers, lawmakers, and laypeople alike is that Dertouzos answers this uncertainty by separating science-future from science-fiction in a way that is at once accessible and useful. *What Will Be* is neither "dumbed down" nor overwrought with jargon. In fact, the most technical part of the book, describing how computers transmit information, is pulled out as an appendix which itself is quite manage-

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3. The technology was named after its inventors, Ronald Rivest, Adi Shamir, and Leonard Adleman of the MIT Laboratory for Computer Science (p. 101).

able even for the non-science major (pp. 317-28). Thus, the book is as accessible to those who can program a VCR as to those who can't get the machine to stop blinking "12:00." Throughout, Dertouzos shows why particular inventions are likely to impact society broadly and how far in the future their attainment lies. In this sense, *What Will Be* is more of a vacation guide describing likely destinations than a roadmap detailing every path needed to get there.

Dertouzos makes use of history not only to demonstrate how technological systems have developed, but also to discern basic lessons as to how humans react to information technology. For instance, Dertouzos uses recollections of the birth of time-shared computers in the mid-1960s at MIT to describe the basic building blocks of modern computer connectivity (pp. 26-31). He goes on to explore how his colleagues and their families reacted to the new machines: "[P]eople value greatly the ability to form a community bound by the sharing of information and are willing to readily integrate new information-driven activities into their daily lives" (p. 30, emphasis omitted).

While Dertouzos's observations are mainly sociological, they also demonstrate an awareness of how cultural issues overflow into legal issues. In *What Will Be*, Dertouzos comes to the painful conclusion that the spread of the Information Revolution will have a divergent economic effect on the world's haves and have-nots. As he writes, "[L]eft to its own devices, the Information Marketplace will increase the gap between rich and poor countries and between rich and poor people" (p. 241, emphasis omitted). Since the rich value information much more than the poor, the rich will leverage new information tools to improve their situation while the poor will lose out (p. 241). How the government should respond to this dilemma will become an increasingly salient social concern as the Information Age unfolds.

Already, the government is grappling with more limited issues, such as the Communications Decency Act of 1996[4] ("CDA") and encryption, which raise both access and privacy concerns. The CDA sought to restrict obscene or indecent material from being transmitted via the Internet to any minor. In the summer of 1997, the Supreme Court overturned the CDA's broad ban on the transmission of "indecent" material in *Reno v. ACLU*.[5] The Court held that "[i]n order to deny minors access to potentially harmful speech, the CDA effectively suppresses a large amount of speech that adults have a constitutional

4. Telecommunications Act of 1996, Pub. L. No. 104-104, tit. 5, 110 Stat. 133-43 (codified in scattered sections of 18 U.S.C.A. and 47 U.S.C.A.).

5. 117 S. Ct. 2329 (1997).

right to receive and to address to one another."[6] The Court indicated its hesitancy to allow broad government regulation of information content, saying, "The CDA, casting a far darker shadow over free speech, threatens to torch a large segment of the Internet community."[7]

The Court's decision in *Reno* juxtaposed the same two conflicting considerations that are fueling the encryption debate. On one side is the interest in assuring privacy for Internet communications and transactions; this privacy is essential to electronic commerce and information sharing.[8] On the other side is the government's interest in retaining some ability to access transactions and information exchanges that might be criminal in nature. As RSA "dual key" technology[9] becomes the standard means for encryption and authentication on the Internet (pp. 101-05), key-escrow schemes, in which the government would retain the key to decode transactions, are being hotly debated (pp. 224-26). The primary idea is for the keys "to be stored at government-sanctioned depositories and used under court authorization comparable to that required today when the FBI taps a phone."[10] Dertouzos indicates that:

> The overarching question is ultimately non-technical. The people and organizations of this world will have to decide whether they want to be the ones controlling the privacy of their communications, or whether they are willing to share this right with their governments in order to protect themselves from criminal and enemy activities (p. 225).

"What will be" is as much a product of social reactions to technology as a function of technological innovation itself. This

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6. *Id.* at 2346.

7. *Id.* at 2350.

8. *See* Russ Mitchell, *Is the FBI Reading Your E-mail?*, U.S. NEWS & WORLD REP., Oct. 13, 1997, at 49. Mitchell analyzes the issue as follows:

> Some degree of secure encryption is essential if electronic commerce is ever to fulfill its potential. In theory, the Internet and other data networks will be the ideal way to transmit medical records, credit card numbers, or other commercial information. In reality, no one will entrust such sensitive data to the Net without guarantees that it will be secure.

Id. at 49.

9. For background information, see Joshua B. Konvisser, Note, *Coins, Notes, and Bits: The Case for Legal Tender on the Internet*, 10 HARV. J.L. & TECH. 321, 338-40 (1997).

10. Mitchell, *supra* note 8, at 49.

acknowledgment is a theme that underlies the entire book. It culminates in Dertouzos's call to reunite the technological and humanistic aspects of society and to utilize these two primary human characteristics to shape the future (pp. 310-16).

III. PRESENTING THE VISION: THE BOOK'S STRUCTURE

What Will Be consists of three sections. The first section, "Shaping the Future," explains the technological advances that are in the works. The practical application of these innovations and how they will "recast" life and society is explored in the second section, "How Your Life Will Change." The final section, "Reuniting Technology and Humanity," examines how the potential impact of technological changes will be guided and bounded by inherent elements of our humanity.

In "Shaping the Future," Dertouzos describes the central construct of the book: the Information Marketplace that he sees developing. Recalling youthful days spent at the Athens flea market, Dertouzos writes that "[t]here was no central authority anywhere; all the participants controlled their own pursuits" (p. 9). This is precisely how he sees the forthcoming Information Marketplace: organic, self-regulating, and, while built on exchange, exceeding mere commerce in its reach and impact. Dertouzos's Information Marketplace is still in its embryonic stage, but its evolution will inevitably result from the coming commercial conflicts over control of our information infrastructures. He foresees a major problem in the development of these information infrastructures:

> [The telecommunications], software, and hardware companies . . . naturally view the future as a place predominantly for their products and services. The infrastructure that ties all these participants together is of secondary interest to them. They each want to set up their stores along the highway, and they don't see it as their job to actually lay down the pavement . . . . The challenge before them, and the rest of us, is to get competitors to work in concert to build an infrastructure, rather than let it happen as it might (pp. 17-18).

This analysis raises some fundamental questions about what role law and government should and will play if informal interactions among competitors cannot create baselines and standards for development. While Dertouzos's own Web Consortium is one example of successful self-regulation, there is a strong likelihood that divergent economic self-interests will lead to a breakdown in any voluntary private-governance

organization. As it did with the power grid and the telephone system,[11] the government may need to oversee the development and use of an information infrastructure to ensure that industry standards are established in a timely fashion, to protect against monopoly pricing, and to promote over-riding social goals like universal access. Of course, any government role would lead to a whole labyrinth of oversight regulations and agencies whose efforts would be complicated even further by the fact that information infrastructures and standards need to be transnational.

Dertouzos breaks the information infrastructure into three substructures: pipes, interfaces, and tools (p. 107). While some companies will battle to control the conduits of information (pipes), others will be rounding out the information infrastructure by increasing ease of use (interfaces) and by permitting numerous independent activities (tools). New human-machine interfaces, such as speech recognition (pp. 57, 63-64), will make the use of computers and machines much more efficient. Other new interfaces on the horizon include smart rooms (computers in the walls that sense your movements, reactions, etc.) (pp. 66-68), haptic interfaces (bodysuits or gloves that will allow you to feel tactile impressions as a computer senses your movements) (pp. 55-56, 76-77), and virtual reality (pp. 68-73). New software tools that allow automatization (the offloading of human information work onto computers) and groupwork will make us more productive and make our tasks easier (pp. 83-84, 89-94).

In the book's second section, "How Your Life Will Change," Dertouzos applies the forthcoming information advances to our society. Everyday life will be changed dramatically: the music we like will fill the house when we enter (pp. 113-15), our kitchens will cook for us and tell us when we need to order more food from the supermarket (pp. 117-20), our cars will give us directions (pp. 122-24), and movies and games will be delivered on demand (pp. 139-41, 160-62). Health care will also be transformed as our medical records and X rays will be easily transferable from doctor to doctor for second opinions, for analysis by remote specialists, and for continuing medical education (pp. 11-13, 169-71). In the long term, robotic and augmented-reality surgery may even be possible (pp. 172-74). Education systems will focus on life-long learning, while new techniques such as simulators and automated tutors will provide new instruction tools (pp. 180-86).

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11. *See generally* CHARLES F. PHILLIPS, JR., THE REGULATION OF PUBLIC UTILITIES (3d ed. 1993) (providing a history and analysis of several public utility industries). For a general discussion of the political challenges inherent in traditional utility regulation, see WILLIAM T. GORMLEY, JR., THE POLITICS OF PUBLIC UTILITY REGULATION (1983).

In Dertouzos's vision, commerce and community will also be radically altered. Technology will allow for remote production techniques, which will lessen the significance of a "work-place" and allow people more work-flexibility and more time with family (pp. 196-98). "Reverse advertising" will become the standard in shopping as individuals broadcast their desires and companies electronically respond with their products that best match the person's requests (pp. 127-30). Consumers will then be able to choose whether to accept any of the offers or perhaps order a custom-made item that exactly fits their needs. At the same time, individuals will be able to build their own communities with others who share their interests (pp. 158-60). Virtual communities, complete with video and audio connections, could allow shut-ins to interact with others and could bridge the gap between classes and cultures as physical distance would no longer be a substantial hindrance to interaction.

The third section, "Reuniting Technology and Humanity," explores the social limits on technological change. New technology is not imposed on a *tabula rasa* society. Rather, we are ingrained with "ancient human" instincts, which will determine how we react to the "electronic bulldozers" that will make us more productive and the "electronic proximity" that will ensue from greater Internet-facilitated interactions (pp. 295-302). As Dertouzos writes, "[N]o matter how powerful and pervasive a technological force may be, it will face some immutable human traits that will always act to conserve the constancy and stability of our species" (p. 295). Thus, *What Will Be* is as a much a study of what technological advances we will accept as it is a study of what the advances will be.

"Electronic bulldozers" will leverage our intellects and increase our productivity only to the extent that these new tools can co-exist with our human traits (pp. 295-98). For instance, we will not be able to make use of the most powerful information search engine if it is too complicated for us to use effectively or if we simply lose patience due to less-than-optimal user-interfaces. Thus, increased ease of use is essential for leveraging the power of the Information Marketplace (p. 262). In addition, we will increasingly need tools to help us sort and organize information, because our limited biological capabilities to handle information can easily cause us to overload (pp. 238-39, 266-67).

"Electronic proximity" will allow us to communicate with millions of people instantly. Yet, this technical ability is restrained by the fact that humans "have a limited capacity for the number of human contacts we can handle at any given time and those we can cultivate throughout our lifetime" (p. 295). It remains to be seen how we will cope with a more universal culture and how we will adapt to life as "urban villagers,"

physically separated from many of our most intimate work associates and friends (pp. 280-81). In addition, according to Dertouzos, there are many human forces that cannot pass through the Information Marketplace (p. 300). These "forces of the cave" are the essence of our humanity and, while they may be facilitated by new information technologies, they cannot be replaced by them. These "ancient human" forces, including trust, love, and physical interaction, form "a clear threshold and a boundary to the quality and extent of human bonds that the Information Marketplace can support" (p. 302).

IV. CAVEATS: DO NOT BE BLINDED BY THE VISION

As interesting as Dertouzos's hypotheses are, several caveats are necessary. First, of course, is that *What Will Be* is simply one man's vision of how the coming age will play out. Anyone is bound to be off the mark to some degree, despite being as well-positioned to glimpse the future as Dertouzos. As he admits:

> Trying to foresee the future uses of the Information Marketplace is as futile as Alexander Graham Bell's having dreamed that his invention would lead to answering machines, 900 numbers, phone sex, dial-a-prayer, faxes, and cellular car phones (there was no such thing as a "car"!) . . . . Some of what I predict will undoubtedly prove wrong, but I hope to identify some lasting patterns of tomorrow's Information Marketplace, along with its major promises and problems (p. 21).

Further, while he emphasizes that the social and economic change fostered by the Information Age will force society to confront choices with profound policy implications, Dertouzos only briefly touches on the role of the government in shaping the new era. Many people tend to forget that the laws the government enacts to regulate the means of transmission and the content of information will provide a framework for the evolution of the Information Age. This becomes evident with the realization that a different Supreme Court decision in *Reno*[12] would have significantly altered the way that certain types of information would have to be transmitted on the Internet.

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12. Reno v. ACLU, 117 S. Ct. 2329 (1997).

V. CONCLUSION

At the outset, Dertouzos invites his reader on a journey for which he promises, "I will tell it like it is . . . debunk the hype out there, help you see through the haze of opinions, public relations, press stories, and advertising so you'll be able to judge for yourself what is important and what isn't" (pp. 25-26). By combining tales of technological innovation with an exploration of the commercial and humanistic limitations on the development of practical technology, Dertouzos fulfills his pledge. *What Will Be* gives the reader a clearer sense of the coming technological developments and how society is likely to incorporate them. Understanding where we are going as a society is imperative for those who seek to lead, shape, and regulate society in the new millennium. It is equally important for those who seek to understand how they can best prepare themselves and their families for living and thriving in the nascent Information Age.

If law is simply a codification of our community beliefs and our common understandings, the fundamental question for the Information Age is how a diminution in the commonality of these understandings will impact our social fabric and our legal life. Will the nascent Information Age reinforce our social structures and the ways our understandings are transmitted and mutually affirmed, or will it cause greater social fragmentation? Answers to these questions will have profound implications for our lives and for how our society is structured and run. In the end, no one can know "what will be," but Michael Dertouzos is certainly in the ideal position to make the best educated-guess. He has the perspective and experience to allow him to look beyond the ebb and flow of technology-induced societal change and to prognosticate about new trends that will alter the tide of human history and drive the age to come. He purports to describe only the broad contours of life in the Information Age. The details are left for us and for time to fill in.

David L. Calone