

# *This Astonishing Technological Phenomenon*

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*Address to the Third Harvard University Conference on the Internet and Society  
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AS WE BEGIN this conference on the future of the Internet and society, we can be reasonably sure that whatever we predict is almost guaranteed to be wrong, probably by quite a wide margin. Even if, by chance, some of our ideas are right, few of us, if any, will have the wit to know it. Winston Churchill once said about Stanley Baldwin that he “occasionally stumbles on the truth, but he always picks himself up and hurries on as if nothing happened.” In thinking about the Internet, we shall do well if we can see our way to making sensible choices – and understanding at least some of their implications – to guide us over the course of the next two to four years.

Let me begin by saying that my own view is that the Internet, with all of its related technologies, has introduced the most profound and far-reaching technological revolution since the nineteenth and very early twentieth centuries, when there was a dramatic transformation in fundamental modes of communica-

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tion, in access to immense quantities of new information in new as well as old formats, and in more rapid means of travel in a more open, internationalized world. Throughout the nineteenth century, there were major shifts in the means of production, and in the structure of business enterprise and the patterns of commerce – and, with respect to universities, dramatic changes in teaching, learning, research, and the very structure of fields of knowledge.

The major inventions, discoveries, and innovations that led to this set of transformations more than a century ago are on the whole very well known. They included wired-cable, then telephonic, and then radio communications; new sources of energy that powered railroads, steamships, automobiles, airplanes, and the machinery used in the production of manufactured goods; the design of modern factory systems, which led to new conceptions and patterns of work, of management, and of productivity; and – in the world of universities, information, and learning – the invention of inexpensive large-scale book publishing, using wood-pulp paper and inexpensive binding, which soon led to the creation of massive research libraries with infinitely more information freely available to students, faculty, and others than ever before. At about the same time, modern scientific experimental laboratories began to be created for research and teaching in colleges.

These last two innovations, the creation of major research libraries and modern scientific laboratories, transformed the nature of study and learning. In fact, they changed the whole experience of, and the approach to, education. For the first time, students could be asked to do library and laboratory research on their own, to write more complicated and extensive papers. There was a much greater emphasis on teaching students to learn how to be apprentice scholars, to work more actively as explorers, rather than passively as the “receivers” of established knowledge. All of these changes created massive shifts in how universities functioned.

Nearly all the transformations that I have just described were

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accompanied by hymns of praise extolling the marvels to be wrought by the new technologies, as well as by predictions of the mass disaster we would all suffer at the hands of the new machinery. As it turned out, the human race absorbed and adjusted to everything that took place, although it might be difficult to create a thoughtful balance sheet – a calculus of credits and debits – to evaluate the net effect on society of all that happened in that era.

We know that many of the adjustments were certainly not easy. Untold numbers of people, in various forms of cottage industries and handicrafts, were put out of work. Even apparently simple things, such as learning how to travel by railroad, took more time than we might think. Many passengers tended, for example, to look out of their windows at close range, watching objects flash by rapidly, because they had previously looked out of their much slower horse-drawn carriages in exactly this near-range way. The result for large numbers of people on trains was a kind of perpetual vertigo – dizziness accompanied by uncheerful nausea. Finally, passengers began to develop and use what has since been called “panoramic” vision, a concentration on the middle and far distance, where objects and the horizon remain relatively stable and caused only modest – if any – metabolic mutations.

It is worth remembering some of the ways in which the new information and other technologies affected people’s lives, and their sense of coherence – or incoherence – a century ago, because it provides at least some perspective on the present moment. As we think about the next quarter century or half century in relation to our own set of new technologies, we can be certain that there will be some adverse changes, but we may take some heart from the fact that other eras have confronted similar problems, and yet we have, it seems, apparently survived.

In higher education, I would venture to bet that as a result of the new technologies, there will, in the next few decades, be many

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more institutions – and more different kinds of institutions – devoted to education and training. Some will be more virtual than not. Some will reach entire populations of students, at different age levels, that are mainly beyond the reach of our present education system.

In addition, the ability to deliver vital medical information, for example, about new treatments for disease, or better knowledge about serious problems in public health, or in business and law, and many other fields – that ability carries the potential to affect in positive ways the well-being of people and societies everywhere, and to do so more rapidly and less expensively than is now conceivable.

I am inclined to believe that, at least for most undergraduates and first-degree graduate or professional school students, a residential education that is founded on the ability of human beings to educate one another, through constant association – in a multitude of activities, in class and out of class – will continue to be the most powerful, stimulating, and profound available. The new information technologies can reinforce and extend – powerfully – what can be achieved in such campus-based education and research. For instance, over one thousand of our undergraduate courses already have sophisticated Web sites, with many kinds of information on them that is often unavailable in other forms. E-mail questions pass back and forth at all hours. On-line class discussion groups take place before and after face-to-face classes – and so on.

The uses of the new technologies are already affecting – profoundly – how we teach on campus, how we do research, and how we learn.

At the same time, it is hard to imagine a truly excellent education in all the liberal arts and sciences that would be fundamentally carried out “on-line.” How much real science, experimental science, could one expect to do “virtually”? Can one really do – at least in a research university – major historical work without an

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extraordinary library that has rare printed materials, as well as millions of manuscript pages (and other items) that are vital to the scholar and advanced student but are not likely to be digitized at any point in the foreseeable future?

And how do we help to inculcate important communal as well as individual values – including the benefits of a diverse student body and faculty – if we do not have students and faculty present on campus, in an actual living and working residential community where people must learn to come to terms with one another's differences as well as their similarities? How do we sustain and build an educational community where one can, in microcosm, try to achieve a greater measure of tolerance and understanding among many different kinds of people – something that the world at large will have to achieve if we are finally to manage our human affairs in ways that are peaceable, respectful, and decent?

There is, in short, simply too much of education that involves human growth and development, human interaction, and the stimulus of human debate, discussion, questioning, probing, and collaboration; there is too much that depends on the development of human relations that are real and that cannot be compensated for electronically. Given that fact, I believe that campus-based residential education is here to stay, because of its unrivaled excellence and also because it can do certain vital things that on-line or distance learning simply cannot do.

I am certain that the new technologies will have profound, long-term effects in higher education: they will lead to a greater differentiation of institutional types; they will be especially powerful in mid-career distance learning and in reaching whole populations who have essentially no access to education right now; and they will reinforce and extend the capacity and quality of the very best in undergraduate residential education, rather than replacing the on-campus experience.

For all the other ways in which these technologies will alter

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our lives, I leave to our other conference speakers. I thank you all for coming – and thank you for contributing so much to our collective effort to understand this quite astonishing technological phenomenon that now lives among us and with us.

