Remarks at Plenary Session, Society for the Social Study of Science

Given at Cambridge, Massachusetts on November 1, 2001.

Published “A Technological World We Can Live In,” Technology and Culture, Vol. 43, No. 1 (January 2002): 222-226.

In 1966 I graduated from college on the east coast and immediately headed to the west coast in quest of history, in two senses. First, I planned to get my Ph.D. in the history of science and technology at Berkeley. Second, and frankly more important, I wanted to go to Berkeley because that was where the historical action seemed to be in 1966. As it turned out, I got more historical action there than was good for me, with the result that I returned east the following spring.

In the meantime, I got to study with Hunter Dupree, and under Hunter I wrote a master's thesis on the response to gas warfare in England during the interwar period. Poison gas was first used in battle in 1915, when chlorine canisters were opened on the front at Ypres, killing 5000 soldiers and sowing panic. Although defensive measures kept poison gas from being a decisive weapon in the Great War, the experience haunted the postwar years. It was the first vivid demonstration of the fact that in building a world of complicated and powerful technological systems, we are also constructing a world of powerful and ubiquitous weaponry. In the language of interwar England, gas warfare showed the possibility of the “lightning conversion” of civilian industries and products into “uncivilized” weapons.

In the 1920s and 1930s there was a great deal of effort to find a “sound technical scheme” to prevent such conversion. The despairing conclusion, however, was that there was no way to prevent a deadly combination of poison poison and fire from delivering a “knock-out blow” to large cities like London: “the bomber would always get through.” The only useful response, then, was civil defense, but in a democracy it was all too easy to focus on providing a sense of security rather than the actuality. The British government over invested in gas masks and gasproof shelters for the entire population when it should have provided them only for the city-dwellers most at risk, and should have given equal attention to shelters against non-chemical ordnance.

The research was fascinating, but I had trouble writing a conclusion. In World War II the “knock-out” blows to cities were due to conventional, especially incendiary, and atomic weapons, so it seemed that fears of gas warfare had been something of a historical dead end. I submitted a revised version of the thesis to *Technology and Culture*, which rejected it, no doubt in part because the point was not clear.

I had not thought of this work for years. Then, some weeks ago, driving home from work, I heard a radio commentator discuss the instantaneous conversion of airplanes and letters into weapons of mass destruction on September 11, 2001. I almost swerved off the road: I saw the light. The topic of my master's thesis had not been the advent of gas warfare, but the advent of a world where civilian technologies are readily convertible into military ones. I had wanted to tell a story with an upbeat ending: poison gas was not used in World War II, so the anxieties of the interwar period were unwarranted. In fact the story was not at all over, and was much scarier: in the world of 2001, the possibility of converting civilian technologies into weapons is now far more widespread (now biological and nuclear weapons are also prime candidates) and far more deadly in potential.

Thirty-five years later, I got the point. Disasters have a way of driving home the point. But I must also tell you that as soon as I realized I finally had a conclusion for my thesis, I felt guilty. Here I was thinking about my research and writing, indulging in the intellectual pleasure of solving an old puzzle. It seemed so trivial and selfish.

I would guess that my ambivalence is not untypical. On the one hand, if we ever had any doubts about the importance of our pursuits as students of the human enterprise of technology, those doubts should be laid to rest by recent events. On the other hand, those same events raise new self-doubts about our social role in a time of crisis. I would like to comment on what I think we have learned, or relearned, about technology, and then add a few words on our social role in these times.

Disasters are revelations. With unforgiving clarity, they reveal what is going on “normally.” We never understand a technological system better than when it collapses. The process of destruction unmasks design flaws, and so technological disasters lead to technological postmortems. We peer into the ruins to figure out what needs to be fixed: the O-ring, the cooling system, the struts, the cockpit door. But the collapse of the material elements of the system also reveals what is left when they are gone. The collapse of the World Trade Center towers and the seizing up of the postal system from anthrax-carrying letters are especially instructive in revealing what is left of the technological world when the material part goes.

What is left, first, is history. For decades before September 11, and especially in the 1990s, it seemed that technology had displaced history as the comprehensive process of change over time. I don't think it was just here at MIT-though maybe it was especially true here-that we heard over and over again about the inevitability of “technological change” and the need for “change management” by

"change agents." "Change" was a new software system, a new product, a new technique. People who didn't want to upgrade their software system were "resistant to change." In sum, technology, not history, was going to fashion the future.

Now what we hear over and over is that after Sept. 11 "everything has changed." What has changed most of all is our understanding of change. We know history when we see it. We know we are experiencing change that is significant, that is historical, historical because it involves human relationships and meanings and expectations. On October 1, a number of us involved with the MIT program in the history and social study of science and technology organized a teach-in on Technology, Terrorism, and War. One participant, a professor of aeronautical engineering, remarked, "In twenty minutes on the morning of September 11 our view of the civil aviation system completely changed." The technology of civil aviation did not change at all in those twenty minutes, but everything else did, and the engineering professor understood as much as anyone historian of technology that the "everything else" matters much more than the details of design.

The other thing that is left, when the material technology collapses, is humanity. We always knew that technological systems are composed of both material and social elements, but now, as the saying goes, we get it. People died and are dying because all the interlocking systems-aviation, military, safety, health, information-are crawling with humanity-passengers on airlines, emergency workers in the streets, knowledge workers at their desks, medics in ambulances, security checkers in airports, postal carriers, mail sorters-men and women of all colors and nationalities and languages, of all levels of education, only a few of them who might be called engineers-yet all of them had their lives bound up with the creation, maintenance, and use of technological systems.

When the material systems crashed, human beings rose to the occasion: the firefighters charging to the rescue, husbands and wives calling a parting message of love, passengers resolving to die rather than surrender. They are heroic, yes, but the revelation here is the heroism of everyday life, always entangled with, and often obscured by, the technological connections: the everyday life of people doing their jobs, and the everyday life of people loving family and friends.

In short, what disaster has revealed is the core truth of technology and science studies: that technoscience is embedded in human history and human society. Those of us who are historians focus on the "historical" part, those of us who are anthropologists or sociologists focus on the "social" part, but this is just a matter of emphasis, a trivial

distinction compared to the common focus on the human.

But what are we supposed to do with this truth in a crisis? The intellect can take us only so far. Keats famously reminded us of "the truth of imagination," and in this situation we must seek this truth too. Terrorism works on imagination; so must counter-terrorism.

In doing research on gas warfare, I learned that the fourth of T.S. Eliot's *Four Quartets*, the one titled "Little Gidding," was written in 1942-43, at the time when Eliot was taking his turn as a nighttime fire-watcher during the incendiary bombings of London. In a letter to a friend Eliot wrote that "During the Blitz the accumulated debris was suspended in the London air for hours after a bombing. Then it would slowly descend and cover one's sleeves and coat with a fine white ash." In "Little Gidding," as in New York this fall, ash is the image of despair:

Dust in the air suspended
Marks the place where a story ended.
Dust inbreathed was a house-
The wall, the wainscot, and the mouse.
The death of hope and despair,
This is the death of air.

Later on in the poem Eliot uses the imagery of the Pentacostal dove-or is it a diving bomber?--to proclaim our choice: the fire of love or the fire of death:

The dove descending breaks the air
With flames of incandescent terror
Of which the tongues declare
The one discharge from sin and error.
The only hope, or else despair
Lies in the choice of pyre or pyre-
To be redeemed from fire by fire.

The imagination of disaster-or, more specifically, what George Steiner called "nostalgia for disaster"-- has been a recurring theme in Western culture since the nineteenth century. The attack on the World Trade Center is an unforgettable and in its own way a brilliant image of hatred and destruction. It also provides an equally unforgettable image of what a human world could look like. In the imagination of disaster, catastrophe may have the paradoxical effect of restoring a more human-centered way of life. It can strengthen individuals, sweep away conventional social distinctions, and reaffirm social bonds eroded by the relentless workings of "change," in the

degraded technological sense. The “disaster utopia” reveals the grandeur latent in individuals and societies. It provides an imaginative model of the kind of world we should strive to compose for everyday life.

In situations of stress, it helps to have another type of imaginative model-a professional model of conduct that provides guidance through confusion. Remember what they keep saying about the firemen: they were just doing their jobs. We have a professional role: we are scholars and educators. To be sure, as Wiebe Bijker has warned, we should not succumb to the temptation of STSocracy, a new version of technocracy. I would also warn, however, against succumbing to a Hamlet-like self-doubt about one's knowledge and one's role, which leads to inactivity.

As scholars and educators, our first duty is to try as hard as we can--through learning, writing, and thinking--to understand the world. Each of us should follow his or her best judgment as to what knowledge is important and useful. Each of us must pursue what we consider the basic, deep questions are, whether or not they appear to have any relevance to the present crisis. If they are true they will sooner or later be relevant.

In addition to being scholars, many of us are members of communities explicitly organized around an ethos of learning, and all of us are members of communities that provide opportunities for learning. In an influential report on MIT education written in 1949, this wonderful sentence appears: “Education is preparation for life.” Let us reconsider who we are teaching, and who we might teach, and consider how to prepare them for life in a hybrid and reflexive world.

I am glad that we organized a series of teach-ins at MIT-but a teach-in implies that some important things are not being taught in the normal course of events.

We may not entirely trust ourselves as experts, but we can trust the process of learning.

In “Little Gidding,” T.S. Eliot writes of love beyond desire that provides “liberation/From the future as well as the past.” We should not be attached to abstractions like “past” or “future,” Eliot says. The attachment that matters is “to our own field of action,” which, even if we find “that action of little importance,” we also find it is “never indifferent.” We are students of technology, left with history and with human beings, as together with our students and each other we seek preparation for life in a strange and not at all brave new world.

Note: I want to thank David Mindell for conversations that

contributed to this essay.