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TECHNOLOGY AND TRAGEDY
(Students look to teachers for leadership and reassurance...)

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The tragic events that took place on Tuesday, September 11, will remain in all of our minds for the rest of our lives. That a small band of fanatical terrorists can wreak such havoc and take thousands of lives in a few hours is a sobering reminder of the power of modern technology to do evil as well as good. In the hands of people determined, even at the loss of their own lives, to harm a country, city, or individual structure, technologies that we take for granted, such as air travel, can be turned into weapons of mass destruction.

In our courses we usually do not deal with this aspect of science and technology. Perhaps that is as it should be, given that most of us have no special expertise in philosophy, social science, or public policy. On the other hand, it is important for students to be aware that their teachers are concerned about such issues, as human beings and as scientists, and that our scientific and technical expertise can be useful in analyzing and addressing the many issues involved. As scientists we try to be objective in our work, but that is not equivalent to being indifferent toward or uninvolved in the world outside of science.

The power of science to do evil as well as good has been recognized at least since the beginnings of chemistry in the late 18th and early 19th centuries. Scientific discoveries and technological developments based on them bring many benefits but also invariably raise concerns regarding unintended negative consequences. We don't always recognize initially what all of those consequences will be, and fortunately many negative predictions turn out never to be fulfilled. Air transportation has been criticized because of low energy efficiency and contributions to environmental degradation, for example, but not because a hijacked aircraft can become the equivalent of a large incendiary missile. Most of us do not exercise the diabolic imagination needed to come up with such ideas, nor can we conceive of people who would actually put them into practice. Perhaps we all should dedicate some of our thought to imagining unexpected uses of the science and technology with which we are familiar and to creating ways to stymie those who would misuse it.

Debate over whether scientific progress is a net good was long ago supplanted by a sense that discovery and change are inevitable. Overall that has been a big plus for people throughout the world, but the net gain would have been far larger had there been no negative factor. Often the negatives creep up in guises different from those initially predicted. For example, more than half a century ago serious concerns were expressed about invasions of privacy by governments in books such as *1984* (Orwell, 1949) and *Brave New World* (Huxley, 1932). Such concerns are still widely held in America today, but most of us have voluntarily and almost without noticing given up much of our privacy to businesses that sell by mail, telephone, and the Internet. A major consequence of the events of September 11 is

likely to be new calls for restrictions on privacy and freedom, and it remains to be seen whether we will knowingly agree to them in order to partake of the benefits technology has provided with a greater sense of security.

The importance of acknowledging to students our concerns and interests beyond science was brought home to me the day after the tragedy. I felt that it was impossible to teach a class without mentioning the events of the day before, and so I indicated some of my feelings about what had happened, suggested some actions students might take to help those directly involved in the two disasters, and stated that accommodation would be made for any students who were unable to complete assignments or otherwise were adversely affected. None of what I said seemed to me either profound or original, so I was surprised later in the day when I received a communication from a student who expressed appreciation for the simple fact that I had said anything at all. My correspondent said that it was reassuring for students to have a professor demonstrate clearly in the classroom concern about a tragic situation.

I think this applies to any teacher in any classroom. Students (and many others) look to teachers for leadership and reassurance, just as they look to political and spiritual leaders. Providing leadership and reassurance is not necessarily what we were specifically trained to do, but we *were* educated to think effectively. Lack of expertise or eloquence ought not prevent us from attempting to think and act to the best of our abilities. Our message will come through loud and clear, even if it is not stated explicitly or in beautiful phrases. Students observe our behavior as people as well as what we write on the chalkboard as teachers. They usually recognize authentic concern and feelings, which is a major part of what is needed in such a situation.

In the aftermath of a great tragedy it is hard to know what to say or do, but it would be a great mistake to say and do nothing.

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