

## Profit and Prophecy

**As with avalanches in the sandpile game, the largest and most devastating earthquakes may take place when and where they do for no special reason at all.**

*—quoted from M. Buchanan, Ubiquity, Crown Publishers, New York, 2001, p. 39*

**Left panel: Technology used to beam horrific live images of south Asian tsunami into our living rooms. (sky filled with satellites, Earth covered with communication towers)  
Right panel: Technology used to detect south Asian tsunami. (blank)**

*—quoted from an editorial cartoon by Davies for the Journal News, Westchester County, N.Y., published in The Washington Post, 10–16 January 2005*



Dennis enjoys the scenery of the magnificent gorge in Taughannock Falls State Park near Ithaca, New York.

For me, technology is a defense against the unpleasant aspects of nature. As the sun sets on a winter day, I'm grateful for a house that protects me from the freezing night. Technology also supports public safety against hazards to health and well-being. As an engineer, I take pride and solace in these benefits of technology.

While technology can prevent disasters, many threats to our well-being come from technology itself. Automobile and aircraft accidents, toxic waste spills, faulty construction, and military actions kill thousands. Whether the cause is negligence, malevolence, or simply bad luck is not the issue. What is clear is that we need technology to protect us *from* technology. To a large extent—although I take no pride in saying it—actual and potential technology-related disasters create job security for the engineering profession.

While we often accept technology-related disasters as the price we pay for the benefits of technology, we are forced to think differently about disasters that seem to have nothing to do with technology. These natural disasters arise from neither the limitations of technology nor the malevolence of individuals but can only be attributed to bad luck.

Rather than speculate on the theological aspects of natural disasters, I'll focus on the causes—or lack of causes—due to technology. The tsunami, hurricanes, and earthquake that occurred in 2004 and 2005 were natural events with tragic consequences. No conceivable technology could have controlled these events. We were both blameless and helpless.

Or maybe not. Our overwhelming success in exploiting petroleum has injected huge amounts of stored carbon into the atmosphere. Although the consequences may be statistical and arguable, upsetting a system as complex as the climate is cause to shudder. Control engineering will receive its 15 minutes of fame (or infamy) when some astute science writer traces the exponential growth of hydrocarbon usage to the steam engine governor.

If we ignore the possibility that technology has had any real effect on weather and climate, then humans are blameless for these events. But responsibility for lacking foresight is a different matter. Modeling, simulation, and data collection are what we do for a living. As systems theorists, we are the developers of tools for prediction. Although we have little authority over the use of these predictions, our role is to assist those whose job it is to warn and protect.

Unlike hurricanes, it is difficult to conceive of a causality between technology and earthquakes. Causality aside, many scientists believe that earthquake prediction is impossible. Whether or not this is the case, let's not forget that when we stand on open ground, we are in little danger from an earthquake. It is the structures we live in—the very ones that protect us from the elements—that

threaten us, and those structures are the product of technology. Since earthquake-proof structures are expensive, the problem is not only technological but also economic and political.

I do not know whether earthquake prediction is truly impossible. There are many problems that we as a community of systems theorists and practicing engineers cannot yet solve. Each year, however, brings advances—some incremental and some surprising—as our community continues to contribute unique ideas and methods to the scientific table. As developers of prediction technology, our task is to help mitigate the destruction wrought by natural disasters. There is much to be done.

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