S|S|S

Comments on Lynn Eden's *Whole World on Fire: Organizations, Knowledge, & Nuclear Weapons Devastation*

Thomas P. Hughes

In a book well deserving of the Merton Award, Lynn Eden (2004) lays out her overarching thesis imaginatively, clearly, and with impressive scholarship. She asks: why has the US government seriously underestimated for more than a half-century the damage that nuclear weapons would cause? Why did it develop detailed knowledge about blast damage, but fail to develop it about the even more devastating effects of mass fire damage? This asymmetrical government approach persisted despite the history of shocking fire damage during World War II in Hiroshima, Nagasaki, Tokyo, Hamburg, and Dresden. Professor Eden searched for an answer in countless relevant reports and interviews carefully documented in her prodigious footnotes.

Eden concludes that shortly after World War II those in the USA analyzing and predicting nuclear weapons damage concluded that fire damage involved too many variables to allow prediction. The relevant agencies remained committed to this conclusion for reasons Eden takes pains to explain.

Yet I find also persuasive a reason that she does not emphasize. In a subordinated section of her book, she asks if most of the military and the Pentagon civilians responsible for predicting nuclear bomb damage ignored fire because they found the effects too horrible to contemplate. Or to put it differently, did the US government's announced policy of precision bombing of military and industrial targets and its emphasis upon blast damage make nuclear war more acceptable to those who would wage war and to the public? Eden does acknowledge, 'After World War II, U.S. war planners did not want to think of nuclear weapons as incendiary weapons and therefore did not attend to the problem of developing a methodology to predict fire damage from them' (p. 46).

On the other hand, I can imagine that many of the military and civilians analyzing the effect of nuclear weapons may have been mainly concerned about moral repugnance on the part of the citizenry. If informed about fire damage, it might have effectively opposed the build up of nuclear weapons during the Cold War out of fear of reprisals.

Social Studies of Science **36/4(August 2006) 641–644**

ISSN 0306-3127 DOI: 10.1177/0306312706064814
www.sagepublications.com

Air Force General Curtis LeMay, who headed the strategic bombing campaign against Japan, was not troubled by moral repugnance. According to Eden, he said 'all you had to do was visit one of those targets after we'd roasted it, and see the ruins of a multitude of tiny houses, with a drill press sticking up through the wreckage.' More recently a commentator on Air Force affairs said 'The notion that vaporizing Japanese cities is unusually immoral is, rationally speaking, pretty silly . . . What is the moral difference between frying a jillion people serially with lots of every day explosives and frying them in parallel with an atomic bomb?' (p. 47). This quote is also from Eden.

Let me expand further upon the moral repugnance theme. In her opening pages Eden describes a scenario suggesting the potential effects of dropping a 300-kiloton nuclear bomb on the Pentagon. It is a horror story beyond comprehension. Eden also includes an account of the 27–28 July 1943 incendiary air raid on Hamburg. Within 6 hours, the fire burned out more than 5 square miles (13 km^2) and created a 'dead city'. Between 60,000 and 100,000 people died, many in excruciating pain with burns. Hamburg experienced hurricane winds and temperatures between 400 and 500°F (200 and 260°C). A vividly described account of the horrors will be found in W.G. Sebald's *On the Natural History of Destruction* (2003).

Herman Kahn, who took pride in his rational and direct confrontation with what he believed to be the realities of nuclear war strategy, conflict, and survival, may not have been able to stomach thoughts about a firestorm and may not have entered mass fire damage into his analyses and predictions. I have found no reference to mass fire damage discussed in Sharon Ghamari-Tabrizi's biography entitled *The Worlds of Herman Kahn* (2005). Nor is Hamburg to be found in her index. Kahn is not in the index of Eden's book either.

I now turn to Eden's use of concepts that she associates with the fields of science and technology studies and organizational theory. She employs these concepts throughout her book to provide a theoretical framework to support her narrative. She distinguishes between science and technology studies and organizational theory. Science and technology studies usually depend upon 'theorized case studies (much like the discipline of anthropology), in which specific situations are understood as instances of some larger issue.' In contrast, organizational theory 'tends toward the abstract, striving to achieve broad theoretical statements . . . while it subordinates case studies' (p. 59). From science and technology studies, Eden chooses the concepts of social construction and frames. With a nod to organizational theory, she refers to 'organizational frames'. To these she adds path dependency.

Eden imaginatively stresses the relationships among organizational frames, path dependency, and social construction as she searches for reasons why fire damage was virtually ignored. She defines frames, specifically organizational frames, as a constraining context, the particular perspective in which an organization decides 'what counts as problems, how problems are represented, the strategies to be used to solve those problems,

and the constraints and requirements placed on possible solutions' (p. 50). US government organizations predicting nuclear explosion damage, for example, saw the world through a 'blast frame' rather than a fire frame.

Path dependency holds that past choices and actions, such as an organizational frame, shape present and future organizational behavior 'both by shaping the understanding that actors bring to new situations and by shaping the social environment in which decisions are made and carried out' (p. 51). A classic example of path dependency is Thomas Edison's establishing almost by chance the 110-V system that we still use today.

Turning to Eden's use of social construction, she allows that the physical world, or nature – not social construction – as ascertained by experiments and observation in the years immediately after World War II led to the conclusion in the minds of science-oriented professionals that too many variables, such as weather conditions, precluded objective predictions of fire damage. Incidentally, their conclusion is a special example of social construction, even though Eden does not introduce this argument. Because of their education and professional values, science-oriented professionals are biased in favor of what they consider objective, quantitative approaches in problem-solving. In choosing the blast frame, they did not take into consideration case histories, such as the Hamburg episode, which would have demonstrated fire damage.

Social construction took over after the early 'scientific' conclusion became over time an organizational frame, the blast frame, triggering path dependency. Social construction then shaped future attitudes, behavior, and knowledge routines. So Eden has neatly and persuasively related frames and social construction.

While Eden imaginatively finds relationships among the three concepts, she does not claim that they originated with her. She borrowed both social construction and the frames concepts from science and technology studies. A 1987 book edited by Wiebe Bijker, Trevor Pinch, and me entitled *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Bijker et al., 1987) spread the social construction approach in the technology studies field. Bijker (1987) used the frame concept in a paper included in this volume and enlarged the discussion in *Of Bicycles, Bakelites, and Bulbs* (1995). Even earlier, however, Erving Goffman published *Frame Analysis* (1974) and Peter Berger and Thomas Luckmann published *The Social Construction of Reality* (1967).[1] Eden attributes the path dependency concept to Paul David, an economist who draws upon history, including history of technology, as he introduces new concepts.

The Social Construction of Technological Systems book came out of papers given at a conference held at the University of Twente in the Netherlands in 1984. The conference brought together sociologists of technology and historians of technology, or to place the meeting in Eden's science and technology studies framework, theory-driven sociologists interacted creatively with case study historians. I remember several of us attending the conference interpreted it as essentially such a creative interaction. I find

Eden's book similarly creative because of her appreciation of both history and theory.

There is, however, a theoretical concept not used by Eden, which would have enriched her narrative. She repeatedly refers to past organizational choices shaping present and future organizational behavior. This to her is an example of the interaction of social construction, frames, and path dependence. Eden also stresses how difficult it is to change organizational behavior in the present and the future. Those supporting the blast frame in analyzing nuclear bomb damage could not adjust to a fire frame even when physicists Ted Postol and Harold Brode persuasively presented it. For me this reaction is an example of organizational momentum, a broad concept that subsumes frames, path dependency, and social construction.

I define organizational momentum by analogy with the physics concept. It is the inertia of a mass in motion. Force must be applied to change its velocity or direction. Organizational mass includes the capital invested in the physical plant of the organization, the organizational frames, or problem-solving skills and knowledge of its employees, and the socially constructed organizational structures or bureaucratic routines designed for its administration. The 'direction' of the organization, I associate metaphorically with path dependences. The velocity arises from growth and evolutionary change over time. As an organization becomes larger and more complex, it gathers momentum. For me the government organizations that resolutely did blast damage analyses and neglected mass fire damage had high momentum.

Finally I urge all in this audience to read Lynn Eden's book. She asks a question of historic and, unfortunately, of future importance.

Note

1. Professor Carolyn Marvin called my attention to Goffman, Berger, and Luckmann.

References

Berger, Peter & Thomas Luckmann (1967) *The Social Construction of Reality* (New York: Doubleday).

Bijker, Wiebe (1987) 'The Social Construction of Bakelite: Toward a Theory of Invention', in W.E. Bijker, T.P. Hughes & T.J. Pinch (eds), *The Social Construction of Technological Systems* (Cambridge, MA: MIT Press): 159–87.

Bijker, Wiebe (1995) *Of Bicycles, Bakelites, and Bulbs* (Cambridge, MA: MIT Press).

Bijker, Wiebe, Thomas P. Hughes & Trevor J. Pinch (eds) (1987) *The Social Construction of Technological Systems* (Cambridge, MA: MIT Press).

Eden, Lynn (2004) *Whole World on Fire: Organizations, Knowledge, & Nuclear Weapons Devastation* (Ithaca, NY: Cornell University Press).

Ghamari-Tabrizi, Sharon (2005) *The Worlds of Herman Kahn: The Intuitive Science of Thermonuclear War* (Cambridge, MA: Harvard University Press).

Goffman, Erving (1974) *Frame Analysis* (New York: Harper and Row).

Sebald, W.G. (2003) *On the Natural History of Destruction* (trans. Anthea Bell) (New York: Random House, Inc.).

Thomas P. Hughes is Professor Emeritus, University of Pennsylvania, and Distinguished Visiting Professor, MIT. He is author of many books and articles on the history of technology. His most recent book is *Human-Built World: How to Think about Technology and Culture* (University of Chicago Press, 2004).

Address: 8330 Millman Street, Philadelphia, PA 19118-3925, USA; tel: +1 215 248 0327; email: thughes@sas.upenn.edu