To Forgive Design: Understanding Failure by Henry Petroski (review)

Edward Tenner

Technology and Culture, Volume 55, Number 1, January 2014, pp. 249-251
(Review)

Published by Johns Hopkins University Press
DOI: 10.1353/tech.2014.0033

For additional information about this article
https://muse.jhu.edu/article/538921
As he explains in an autobiographical chapter of To Forgive Design, Henry Petroski entered the history of technology indirectly, as a specialist in a field between physics and engineering called continuum mechanics, which he was originally hired to teach at Duke University. At Argonne National Laboratory he had become a group leader in the still-new field of fracture analysis. A historic failure like the ones he was studying gave him what proved to be a fortunate break: declining funding after the Three Mile Island nuclear incident in 1979 encouraged his move back to academia.

The present book revisits the themes of Petroski’s first, To Engineer Is Human (1985), with a great range of fresh examples. Failure has a special place in technology, according to the author. The only way to test a design thoroughly is to use it. All design is a compromise; every structure and device may have latent weaknesses that the best theoretical tools can’t reveal, especially since the conditions of use change. We usually discover these flaws only through failures. Mostly these are small problems leading to incremental improvements, but tragedies motivate some of the greatest innovations. Engineers may be responsible for disasters, but they are not necessarily blameworthy; one chapter is called “Things Happen.” Engineers’ duty is to investigate failure and develop means to prevent the same one in the future, yet these modifications may result in new failures.

History and memory are essential for engineers: for example, the research of British academics Paul G. Sibly and Alistair C. Walker in the 1970s revealed a thirty-year cycle of bridge failures, in which disasters encouraged development of newer and apparently safer designs, which a new generation of engineers advanced on an increasing scale, until a latent weakness (often coupled with unforeseen conditions) resulted in a new catastrophe, starting the cycle over again. Petroski believes that the cable-
stayed bridges popular since the 1970s may be vulnerable; retrofitted safety features like cable ties and shock-absorbing dampers may be encouraging a false sense of confidence such as that which possessed engineers in the late 1930s regarding suspension bridges. The collapse of the Tacoma Narrows Bridge in 1940—fortunately with no human casualties—revealed that civil engineers had been neglecting aerodynamic forces.

Memory, Petroski argues, often must go back far beyond thirty years. The substitution of two offset rods for a single continuous steel rod supporting the elevated walkways of the Kansas City Hyatt Regency Hotel resulted in the deaths of 114 guests in 1981; it might have been prevented, Petroski suggests, had the engineers been aware of a story told by Galileo of how adding an additional support to a marble column in storage led to the column’s fracture as the supports at each end sank into the soil.

Technological, social, and political changes and user behaviors also can disrupt the best engineering calculations. Bucksport, Maine’s Waldo-Hancock suspension bridge of 1931, originally acclaimed for its economy and beauty, aged prematurely not only because of saltwater corrosion of its cables but because of an unexpected postwar growth in heavy truck traffic. The grandest of 1930s bridges, the Golden Gate, has remained structurally admirable, but because of its beauty and site has become fatally attractive to potential suicides. Even the Golden Gate began to sway potentially hazardously under a heavy pedestrian load at its fiftieth anniversary. Petroski warns of the manifold perils of today’s exuberant footbridge innovations.

Petroski also points to the complex network of organizations that manage the largest engineered objects, for example the Deepwater Horizon drilling rig in the Gulf of Mexico that caught fire and sank, releasing tens of thousands of barrels of petroleum a day. The problem was partly in the rig’s original design but mostly in the failure of organizations to learn from smaller incidents to avoid shortcuts and false economies under pressure. A similar story could be told of the space shuttle disasters.

To Forgive Design offers no methodology, beyond professional memory and conscientious practice, for eliminating future failures. As Petroski writes regarding Deepwater Horizon, the only way to prevent another offshore drilling accident “or any kind of failure . . . is to cease exploration and innovation” (p. 298). Mistakes, even tragedies, are the price of human ambition and betterment. A kind of original sin inheres in human works; Petroski writes of engineers gaining “absolution” (p. 46) for their profession by making causes and remedies known.

Two recent calamities—the sinking of the Costa Concordia and the Fukushima nuclear disaster—raise a question that Petroski only begins to analyze here. More and more technological hazards arise not only from flaws in engineers’ plans but from the decisions of politicians, managers, and operators, most of them without engineering degrees. Safety mechanisms and interlocks can be defeated or bypassed because of greed, pres-
sure, or simple panic (as in some airline crashes). Some new branches of engineering, for example “pedestrian dynamics” analyzing crowd behavior and building evacuation, are responding to these needs, as “fracture mechanics” has dealt with others since the 1970s. Should the human dimension have a greater part in engineering education? If so, To Forgive Design should be required reading for all aspiring engineers.

EDWARD TENNER

Edward Tenner is a visiting scholar in the Department of History of Rutgers University, the Center for Arts and Cultural Policy Studies at Princeton University, and the Smithsonian’s Lemelson Center. He is author of Why Things Bite Back (1997) and Our Own Devices (2004).

Standards: Recipes for Reality.


Standards: Recipes for Reality by Lawrence Busch, the first in the MIT Press Infrastructure series edited by Geoffrey Bowker and Paul Edwards, examines the interconnected, complex, and path-dependent histories of social and technological standards that frame and facilitate the world around us. While topics such as licensing, accreditation, credentialing, and policy are often seen as mundane and dry, Busch treats his readers to a trove of carefully researched and engaging stories and insightful observations to expose the powerful role of standards in contemporary life. But as rich as it is with examples and vignettes of how the lived experience is framed by standards and standards-making processes, this book is much more than that. Even as he explains the details of standards, Busch deftly implicates Enlightenment-era philosophy and the implementation of neoliberal economic thought as deeply embedded systems of social value and accreting socio-technical systems that control and direct markets, institutions, and governance at increasing levels of scale.

The opening chapter reveals the power of standards by examining common historical examples. Motivated by familiar theories of power and embodiment, such as those of Michel Foucault and Bruno Latour, Busch points out the significant agency (and its often hidden sources) imbued into systems of constraint and enablement that standards represent through the control of both humans and objects. Drawing a distinction between different benchmarks that standards set—Olympic thresholds, filters, divisions, ranks—he provides a useful set of criteria for examining the classifications and categories by which evaluative regimes are constructed. Moving through a broad range of historical examples that include religious standards of moral conduct, the normalization of scientific communication, achieving commensurable measurements of time, constructing a disciplined military through standardized construction of the soldier, and the