BOOKS & ARTS

Building on failure

Working out why something doesn't work is a good starting point for improving the design.

Success Through Failure: The Paradox of Design
by Henry Petroski
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All the products of human activity we see around us, including the layout of the magazine or website you are reading now, were invented and designed. Design is so prevalent that to some degree most of us are designers. This does not mean we are good at it, or that we have ever given much thought to what it means to produce a successful design.

Not that success goes together with design in Henry Petroski's world. The title of his latest book makes this clear: success is linked to failure. Like theory and truth in Karl Popper's world, a design can never be proved to be a success; success is provisional, it is just the absence of failure. One can hardly improve on the author's words: "Things that succeed teach us little beyond the fact that they have been successful; things that fail provide incontrovertible evidence that the limits of design have been exceeded. Emulating success risks failure; studying failure increases our chances of success. The simple principle that is seldom explicitly stated is that the most successful designs are based on the best and most complete assumptions about failure."

Even though it is dangerous to put the words so close together, there is a clear flavour of evolution — in terms of success riding on the back of failure — to the theme of this design-centred book.

This is but a slice of the design picture, and it is intrinsically unfair to judge a book by what it does not cover. But in order to place the book on a broader canvas, let me mention two things.

The first is that building on the back of failure may sound easy but it is not. Failure is often hard to pinpoint, which is why forensic engineering has emerged as a distinctive discipline. In our rapidly evolving technological world, there can be an almost infinite array of possible design states, and not all can be tested. Plane crashes provide some of the most visible examples, in terms of life lost, cost and the politically charged assignment of cause. The cause of the explosion of TWA flight 800 over Long Island on 17 July 1996 was initially

Safe as houses: the best way to ensure the safety of skyscrapers is to learn from previous failures.

believed to be a terrorist bomb or a missile. But a meticulous reconstruction of recovered pieces, aided by sophisticated laboratory and mathematical analyses, indicated that the likely cause of the explosion was a design defect of the centre fuel tank.

The second is the sheer creativity in design, which makes one wonder if evolution-driven design can be taken too far. True, everything comes from somewhere. Retrospective analyses show that even artistic masterpieces do not suddenly appear from thin air — the final painting is deceptive when presented without context. But some designs are much more than tweaks to previous art, and seemingly appear from nowhere; think of the iPod, the computer mouse, the Blackberry and even the Internet.

But there is no question that failures drive design. "Fail early, fail often" is a mantra in product development. The examples in this book take us through the evolution of bridges, the world's tallest buildings, PowerPoint, the space-shuttle disasters, the collapse of the World Trade Center, flag design and constitutional engineering. Most of the examples are from the worlds of civil and mechanical engineering. The chapters on bridge evolution provide some beautiful and clear illustrations, and there is an intriguing case of a thirty-year cycle of failure yielding a prediction.

The book poses questions that should have occurred to us all but probably didn't. How does one test ever more complicated systems against all possible conditions? How do we test civil engineering projects, such as dams, tunnels, buildings and bridges, "whose scale is so large, whose cost is so great, and whose design is so specific to the site that the structure is unique"?

'Design think' is now at the centre of discussions about technological leadership. It connects with innovation, a topic arising in nearly a dozen high-profile reports in the past two years. It is also emerging as a central theme providing a competitive edge in the strategy of corporations. There is no recipe to good design think; it is non-algorithmic and, as with many creative activities, it pays to practise.

Recent books have brought economics to the masses, and there now seems to be a trend to do the same with design. This is a good thing and this book, like several earlier ones by Petroski, is part of this very welcome trend. *Success Through Failure* is insightful and accessible. I hope it is widely read. ■

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