

Henry Petroski: Most Advanced Yet Acceptable

Written by Steven Heller

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*Henry Petroski is a Professor of Civil Engineering and History at Duke University and author of *Invention by Design: How Engineers Get from Thought to Thing* (Harvard University Press, 1996), *Engineers of Dreams: Great Bridge Builders and the Spanning of America* (Alfred A. Knopf, 1995), *Design Paradigms: Case Histories of Error and Judgment in Engineering* (Cambridge University Press, 1994), *The Pencil: A History of Design and Circumstance* (A. Knopf, 1990), *To Engineer Is Human: The Role of Failure in Successful Design* (St. Martin's Press, 1985), and *Small Things Considered: Why There Is No Perfect Design* (Vintage, 2005). His book of essays *Pushing the Limits: New Adventures in Engineering* (Knopf, 2005) was recently published.*

"When I set out to write about engineering, I wanted my books to be accessible to all readers, engineer and non-engineer alike," he says. "Using everyday objects as examples of design seemed to be a potentially very fruitful way of approaching the challenge." In this interview Professor Petroski discusses why any single thing has the potential to illustrate the nature of design, but that everyday things provide the most widely accessible examples for explaining the hows and whys of design.

Heller: Often the most brilliantly functional objects are the most sublimely designed (like a safety pin or paper clip) but can something be well designed and also be aesthetically poor, even ugly? Do form and function really go hand in hand?

Petroski: The design ideal should be totally integrated function and form, and to call something a well-designed object should imply that it excels in both. The paper clip is an interesting example. It is often cited—especially by artists, product designers, and architects—as a model of design. When it is pictured, it is usually all by itself, (i.e., not attached to papers) so as to best show off its complete form. Attaching the clip to a stack of papers hides at least half of it. Yet, it is the function of the paper clip to clip papers together. When performing its function, the paper clip no longer maintains its perfect form especially when the stack of papers it holds is of a good size. In this case, the paper clip's jaws are wedged open by the papers, its body is twisted out of shape, and its ends dig into the papers. It can be an ugly sight. The function is being performed but at the expense of form. The ideal design should maintain a positive aesthetic presence at all times.

Heller: Then are you saying that in a state of isolation a paper clip is good design but in practice it is not? And is this why designers have created alternative clips that are colorful and rectilinear rather than curvilinear?

Petroski: I am saying that, when looked at strictly as an aesthetic object, the classic Gem paper clip is almost universally admired. When it is performing its function, however, it leaves much to be desired from an aesthetic point of view. This could be one reason why alternative forms for the paper clip have been developed. But mostly, those new forms have been developed because existing paper clips fail in some way to perform their function fully satisfactorily.

Heller: In your book *Small Things Considered*, you begin with an analysis of the little tripod used in pizza boxes to prevent the lid from sticking to the cheese. It certainly is a useful device (and is fairly recent too). Is the measure of good design how it solves the intended problem, or whether it provides unintended solutions as well?

Petroski: The little tripod is called a “pizza saver” by those who manufacture and market it. As with a paper clip, the name describes the object’s function rather than its form. The pizza saver is a good design because it solves a problem, that of pizza-box lids sticking to a pizza’s cheese topping, and it does so in an elegantly economical way. The form of the typical pizza saver leaves a lot to be desired, and much of the admiration for the design is derived from appreciating how its form serves its function so simply and efficiently. Whether or not the pizza saver has unintended uses does not affect these observations. The fact that it can be adapted for other purposes, such as being used upside-down to hold an egg that is being decorated, may call attention to and increase our admiration for the design, but that is not necessary for us to appreciate it simply as a pizza saver. All designs can have unintended uses, because everyone who uses anything is a potential designer and re-designer.

Heller: Is the pizza saver the perfect end product for this function? Is there another more beautiful and functional alternative? Just because something was invented in a particular way, and adopted by the public, does this infer that it is the Platonic ideal? Or is this simply the “best” our talents and intelligence can produce at the time?

Petroski: I certainly would not say that the pizza savers that I know are perfect end products. To me, their form is almost purely functional, with little attention being given to aesthetic details. There is certainly plenty of room for improvement of the form presumably without having to sacrifice any function.

Heller: I’ve heard a term, “tyranny of the functional,” from designers who argue that functionality (serving a specific purpose) is the most important measure of design. Aesthetics is the after thought that often governs the whole. Do you believe that aesthetics is merely surface?

Petroski: No, I do not believe that. Among the largest and most visible designs that an engineer can undertake is a long-span bridge. Such an enormous structure begins as a form. To be sure, that form must serve the function of carrying traffic, but that function does not force the form. Some bridges are more aesthetically pleasing than others because some engineers have a better aesthetic eye than others. There is general agreement that the Golden Gate

Bridge is a beautiful structure, but as first conceived by its engineer, Joseph Strauss, the bridge was an ugly hybrid structure that might be said to have been all function. It was another engineer, Leon Moisseiff, who was engaged as a consultant, who insisted that the bridge should have a more integrated form. Some surface embellishments were contributed at the end by the architect Irving Morrow, but the basic structural form of the bridge—as conceived and proportioned by Moisseiff—is what makes the Golden Gate such a striking presence.

There is currently a project ongoing to improve the appearance of another San Francisco Bay bridge. The San Francisco–Oakland Bay Bridge was damaged in the 1989 earthquake, since then there has been a project to make it more functional and, in the process, make its East Bay span more attractive. But in this case, aesthetics is coming at enormous cost, and Bay Area residents are being asked to decide—through their political representatives—whether they are willing to pay the price. If there is a tyranny, it is a tyranny of economics.

Heller: History shows that product designers often need the help of advertising and package designers to give the perfect widget its allure. Is it possible to design something so novel that its graphic design must be more pedestrian lest the consumer gets frightened (remember the Edsel)?

Petroski: Ideally, a well-designed product should sell itself, but we do not live in an ideal world. (I do not believe there is a perfect widget. Everything can be improved upon.) Novelty can be a deterrent to success, since the consumer does not necessarily know what to do with the truly novel. There is a maxim attributed to the product designer Raymond Loewy that states that designs should be the “most advanced yet acceptable,” which is often abbreviated to the acronym, MAYA. Redesigning something to the point where it is not recognizable as what it is intended to be or do can be the death of a design. Even advertising and package design may not be able to help sell a widget that gives no hint that it is a widget.

This is not to say that novel designs must be pedestrian. There are many fine examples of redesigned objects that are considerable aesthetic improvements over their artifactual ancestors. Early computer mice were quite boxy and unattractive and probably correspondingly uncomfortable to use by today’s standards. The Model T may be considered a wonderful design because it was mass produced, inexpensive, and black, but the latest automobiles seem much more attractive to just about everyone buying a car today. But for the mass market, a car must still resemble a car of its times.

Heller: Again in your book *Small Things Considered* you compare the stainless steel Ekco to the OXO Good Grip vegetable peeler. The former is the old standard, the latter is the hip new-comer. I’ve used both and each functions well. But I’ve bought the OXO because it looks good (and yes, it feels good). Which is better?

Petroski: Some readers have written to me that they think the bare-bones Ekco is the better peeler. Mostly they argue on functional grounds, but there is also a good deal of nostalgia that seems to affect their judgment. Like the paper clip, the stainless-steel Ekco can be appreciated for its minimalist design. Every part and curve seems to serve a function in an almost effortless way. It is a very efficient design, and it derives its aesthetic presence from

that fact. (Those who prefer the OXO might arguably say the same about it.) The OXO, on the other hand, is strikingly modern in its look and texture. Its large, soft handle may be a boon to arthritics, but to those who are not so impaired obviously designed gadgets like the Oxo peeler are an aesthetic extravagance.

Heller: I've always been struck that new and improved is the mantra of advertising. Ever since the late 20s with the advent of "industrial design" and "forced obsolescence" (or what Earnest Elmo Calkins called "styling the goods") futuristic veneers have been applied to all products. But is it really necessary for new products to look "modern"? Why can't they look, well, old?

Petroski: Anything designed is subject to the fashion of the times. Sometimes that fashion is to be "futuristic," but sometimes it is to be retro. In fact, both fashions can coexist. There seems always to be enough fashion to go around and to satisfy different aesthetic senses and sensibilities.

Heller: Paul Rand, the American graphic designer, used to say about modernist design that it was built on geometry, and 'what could be more perfect than geometry?' Would you say there are perfect designs (golden mean designs) that cannot or should not be tampered with? Or is everything fair game for new and re-design?

Petroski: I was recently sent a book on Paul Rand's design, and I found much in it to admire. However, I think that everything is fair game for criticism and attempted improvement. Geometry may be perfect, but geometers are not. I do not believe there are any perfect designs. Because design typically involves constraints that are inherently contradictory, choices and compromises must be made. The mark of good design is the artful juggling of such compromises and choices in such a way that the finished design evokes admiration not only for its form and function, but also for its human accomplishment of doing the best under the circumstances. I would not say that nothing should be tampered with, for I think it is the nature of design to tamper. Designers are forever seeking to improve and go beyond what is. It is a human trait that is felt most strongly in creative people, which designers certainly are.

Heller: I also believe that Rand was talking about "timelessness," do you believe that there is such a thing as timeless design? Or is design always of its time?

Petroski: Design can be both, I believe. There are certainly designs that are timeless, and if that were not the case I don't imagine we would have museums. We call the timeless things "masterpieces" and "classics," and museums ranging from the Louvre to the Museum of Modern Art are full of them. Museums, especially contemporary art museums, also display the latest notable things. To me, there is no contradiction in admiring (and being inspired) by timeless designs to develop things that are also of the present time.

Heller: You have written about failure in design being endemic to engineering. I realize the old adage "learning from mistakes" is true, but often when design fails it is already in the marketplace. Bad design may not kill, but it can endanger. Must there be casualties in the quest for better design?

Petroski: Many failed designs never make it to the marketplace. One of the obligations of the engineer is to design and test products for safety. Those that fail the test are supposed to be redesigned before they become available to consumers. Obviously, this is the ideal. Designers are fallible human beings, and hence their designs are always flawed in some way—aesthetic or functional—and sometimes flawed objects fall through the safety net of testing and land in the marketplace where they meet the real test. No thing cannot be improved upon—not even the latest improved thing. This is why design is an endless endeavor.

Ideally, as flawed as they are, designs are not dangerous. They should be made with features that protect the user from harm. Of course, this requires the designer to understand how a product can be used and misused, which is not necessarily a trivial thing to do. The best design anticipates all the ways in which something can fail, but since design is embedded in a changing world, which it itself contributes to changing, what might not be possible to imagine today may be likely to happen tomorrow.

Heller: Design has the power to change (and control) behavior, how is this balanced so that the result is positive?

Petroski: Design, like any other creation of the human mind, can be used for good or evil. Fortunately, the overwhelming majority of human beings (and hence designers) are good and well-intentioned people. As a result, on balance, the world of design works toward positive change.

Heller: I agree, but what about those inventions designed for evil. I've been to gun shows and some of the weaponry is beautiful in a scary way. Designers do not have to swear to a Hippocratic Oath, but should they swear to something that limits how design will be used?

Petroski: I doubt it would be possible to get all designers to agree on what is good and what evil. Artists support art for art's sake, even though some art may offend. As artists, some designers at least might be expected to support design for design's sake. Thus, we can expect that some will admire a gun for its form but despise it for its function.

Heller: Since this is a graphic design publication, I must ask whether you believe graphic design—typography, imagery, etc.—plays as important a social or cultural role as the engineering feats you study?

Petroski: I certainly do believe that graphic design plays an important social and cultural role. I see graphic design everywhere, and the best of it enhances the environment in which we live. I greatly admire well-designed signs that point me in the right direction, well-designed instructions that make transparent the operation of a product that I buy, and well-designed typography in the books, magazines, and newspapers that I read. These things add pleasure to life among things.

Of course, poorly-designed graphics can be a blight on the designed environment, can keep us from figuring out how to open or assemble a new product, and can make a book or a web site difficult to read.

Heller: Have you experienced graphic design as adding value to any of the products you've studied?

Petroski: I have recently been looking at so-called child-resistant packaging for drugs, and I have found that graphic design is not consistently used to advantage. Clearly, a lot of design, both formal and functional, went into the package in which the pain reliever Aleve is sold. The design of its now-familiar bottle is protected by both design and utility patents, and it is generally an attractive and workable design. However, I think the graphic designs on its label and top are somewhat wanting. They give inconsistent instructions and, in my opinion, detract from the overall design. Another pain reliever, Advil, comes in a bottle with a child-resistant top that has excellent (wordless) graphics showing how to open it. I do think that this provides added value to the overall design of the total Advil package.

Heller: As I was reading “Small Things Considered” I was thinking about the form I was holding—the book itself. I think we take for granted that the book is an amazing object. It has been designed in different ways (with various bells and whistles) but the basic form—cover and pages - has been the same since before Guttenberg. How do you rate the book in the pantheon of “small things” or large?

Petroski: I have written affectionately about the book in *The Book on the Bookshelf*, but the focus of that essay was how we store books rather than the book itself as a designed object. I have recently been thinking a good deal about the design of the book itself, and I am finding it wanting, especially in its ergonomic features. Hardcover books are heavy and have sharp corners. Their natural configuration appears to be the closed position, and so we have to work to keep them open. Though hardbacks generally look better on the bookshelf, I have come to prefer paperbacks for their lighter weight, softer shape, and greater compliance. This is a subject that I expect to write an essay on shortly.

Heller: This is probably an unfair question, but what is the most significant “thing” designed in the late twentieth early twenty-first century, that has influenced, helped, hindered, whatever, the most people, and where design is key?

Petroski: I am reluctant to single out one thing for such distinction. To me, all well-designed things embody within them the spirit of achievement and improvement that makes the world and our experience in it more pleasant and enjoyable. Today's latest design will provide inspiration for tomorrow's design. Long live good design.

About the Author. Steven Heller, co-chair of MFA “Designer As Author” at School of Visual Arts, is the author of *Merz to Emigre and Beyond: Avant Garde Magazine Design of the Twentieth Century* (Phaidon Press), *The Education of a Comics Artist* co-edited with Michael Dooley (Allworth Press), *The Education of a Graphic Designer, Second Edition* and *The Education of an Art Director* (with Veronique Vienne) (Allworth Press).