

PART III

Designing to Avoid Future Disasters

Why We Have So Much Bad Design

In a recent paper, economists Itzhak Ben-David, John R. Graham, and Harvey R. Campbell report on research that they conducted into chief financial officers in major American corporations, finding that most do not do a very good job at forecasting their financial future.¹ Maybe we should not expect this of them: who can predict with any accuracy something as complex as global finance, affected by so many unpredictable events? But the disturbing aspect of Ben-David, Graham, and Campbell's research lies in the seeming overconfidence that the CFOs expressed about their ability to make such predictions. CFOs think they are much better at this than they really are, suggesting that people in positions of power often think that the success of the entities they lead stems from their own genius, a hubris that can lead to their undoing. As economist Richard Thaler observed, "One route to the corner office is to combine overconfidence with luck, which can be hard to distinguish from skill."²

This pertains directly to the problem of bad design and suggests at least one reason why we have so much of it. An overconfident client or leader can make design itself seem irrelevant. One of the core skills of designers lies in the rigorous, iterative, and often punishingly critical process of envisioning possible futures. That often involves something very specific—a future building, product, or service, for example—but behind the instrumental goal of designing something that doesn't yet exist there lies a method of studying and critically

evaluating a number of scenarios until the option that meets the greatest number of needs with the fewest possible problems eventually emerges. The public often doesn't see design—or creative activity generally—in this way. The popular image of creative genius, coming up with a brilliant idea like a bolt of lightning, completely misrepresents the long hours, repeated study, and constant revisions that almost always precede a good design, one that meets the stated needs within the given constraints.

Overconfident leaders and managers—like overconfident designers—may have bought into that popular culture image of the genius. Understandably, they can come to believe in their invincibility because of their prior success, and can become impatient with those who caution against making decisions too hastily or moving forward with too little study of the possible negative results or unintended consequences of an action. Good designers know all too well what can happen when impatience or intemperance leads to shortcuts in either the timeline of a design or in its execution. And, given the number of spectacularly expensive and damaging catastrophes we have experienced in recent years, the general public now knows as well. As business analyst Stuart Albert has observed, the timing of decisions can make all the difference between success and failure of an enterprise, and just as too much caution can lead to missed opportunities, so too little caution, without sufficient analysis of potential failure, can lead to even more calamitous losses.³

To avoid such disasters from happening, and to ensure that we don't inadvertently design our way into them again, we need a broader sense of what we mean by the word "design." The word has its origin in the Latin word "designo," which means to make a mark, to sketch, delineate, or trace out, as well as to signify, contrive, arrange, and regulate. In other words, design involves a range of human activities involving planning, organizing, and envisioning something that doesn't yet exist. The generality of the origin of the word "design" matters, for it can help us sketch a different future from what we have had in the past, one that will enable us to do a better job at sustaining ourselves.

We typically think of design in a much narrower way, mainly in terms of the products we buy—cars, computers, cameras—and the

environments in which we spend most of our time—our homes and offices, stores and schools. Underlying almost everything we employ in our daily lives, from the attire we wear to the furniture we use to the fixtures we operate, design obviously plays a key role in economic activity; without design, many companies would have little to sell, and most people would have little to buy.

We rarely apply the word “design,” however, to non-physical things, to systems, organizations, operations, conceptions, and methods. Indeed, when it comes to the system that overrides almost everything else humans do—the economy—many people remain openly hostile to the idea of design. The very term—a designed economy—may remind many of socialism, communism, or worse of something government bureaucrats do in totalitarian countries. That gets at the sometimes malevolent aspect of the word “design,” in the sense of having “designs on someone,” perpetrating something unwillingly on others.

Most of us think of the free-market economy as unplanned or undesignated, as individuals and organizations making economic decisions based on supply and demand, with prices that continually reset the balance between the two. At a conceptual level, that view of economics may hold true, but it overlooks, at a finer grain, the myriad ways in which design permeates our economy—and every economy. When Adam Smith wrote about the “invisible hand” of the marketplace, he did not conceive of that hand as acting randomly or without intention. If anything, the marketplace remains full of people with “designs” on how to maximize returns on and minimize risks of investments. The issue has to do not with design per se, but with the way in which design occurs, top down or bottom up, based on the decisions of a few or of many.

That issue of top-down versus bottom-up design remains a key point of debate in the design community, and it underscores one of the primary reasons why we have designed our way into so many disasters. Because of the hostility in the past to the very idea of design, especially in our economy, we have ended up falling prey to global economic recessions and personal financial catastrophes that we could—and should—have avoided. Instead, the common misreading of the invisible hand of the marketplace makes too many

of us too fatalistic about our ability to design an economic system—and the myriad systems that result from it—in ways that do not leave so many people, communities, and species so vulnerable to the designs that a relatively few people, investment bankers as much as government bureaucrats, have had on us.

The real problem lies not with design itself, but with the inept way in which design has occurred in parts of our economy that many people don't think of as designed. If ineptitude sounds like a strong word, consider this: what would we call it if a company offered products that not only harmed many of its customers, but the very people who designed and marketed those products, who had such a poor understanding of what they created that it brought their entire company down? Assuming such self-destructive behavior did not represent intentional malice, the only other explanation has to involve some combination of incredible ignorance and gross incompetence. And yet, because we don't think of financial products in the same that we think of cars, computers, or cell phones, we don't see what happened to investment banks like Bear Sterns and Lehman Brothers as a profound design failure that needs the same kind of regulation and oversight that we insist on in the auto or electronics industries in order to protect consumers—and the companies themselves. The Dodd-Frank Wall Street Reform Act is a longoverdue effort in that direction.⁴

Product designers spend years preparing to do this work, gaining a lot of skill and experience in the process. And despite the popular misconception that design involves mainly talent and intuition that either you have or you do not, the activity that generates almost everything we use in our daily lives demands a great deal of discipline. So why do we entrust the design of other kinds of products to those who often have never taken so much as one course in design? That may have something to do with the paradoxical nature of design, which is its pervasiveness and its simultaneous invisibility. Like the very air we breathe, the designed world we occupy seems always with us, and because of that most people remain largely unaware of the work that goes into creating everything we use and occupy in our daily lives. The invisibility of design has also affected designers in some respects. The design

disciplines have long accepted the idea that they create physical things, while overlooking the fact that the systems, services, and structures that we depend on in the process of living our lives have been designed as well.

Think about what we do when we go shopping. We go to a store or go online and get a cart, we find the goods we want in locations organized in some logical and legible way, and we then proceed to a cash register in order to pay. Throughout that process, we interact not just with the products we seek, which someone designed, packaged, and marketed, but also with the systems devised to make our ability to shop even possible: the system of putting products in particular places so that we can find them most easily, the system of cashiers— virtual or real—that enables us to make the transaction quickly and conveniently, and the system of banks and other lending institutions that allow us to pay with cash, check, or credit or debit card. Add to that the system of ordering, transporting, storing, and stocking goods in the store; the system of hiring, paying, and supervising the people who work in the store; the system of heating, cooling, and lighting that makes the store—at least the physical version—inhabitable; and the system of building and zoning ordinances that enables shoppers to find and access the store and that ensures their safety inside, and you quickly see the store not just as a designed enclosure for designed goods, but also as part of designed systems that operate at a range of scales, each adjusted to its purpose.

In some ways, design may experience in the twenty-first century what science did in the twentieth century—what science writer Richard Panek has called its “invisible century.”⁵ Panek writes about how some scientists at the end of the nineteenth century thought that science had largely understood everything about the physical world, and that science, as they understood it, had come to an end. Little did they know that, with the coming of the twentieth century, science would discover the “invisible” world, with Freud’s exploration of the subconscious, Einstein’s theories of relativity, and Max Plank’s descriptions of quarks among many discoveries, including the human genome effort in the latter part of the century. The “invisible” world has become as central to scientific inquiry as the visible one.

Design stands at the brink of a similar “invisible century.” While designers will continue to create the products and environments that we use and inhabit in our daily lives, the design community has begun to discover that the demand for how we think is as great in the invisible world of systems, policies, procedures, and processes. Designing a less vulnerable financial system, a less error-prone healthcare system, a less convoluted policy arena, and a less polarized political process are among the most important areas that designers can help with. Designers have the training to look for system failures, to investigate possible solutions, to explore analogies from other fields, to prototype and test new procedures, and to find the simplest way of achieving the best results—all of which would benefit the invisible designed world that has increasingly failed us.

Not that what we design never fails. Despite a design process that has evolved to catch possible failures before they are enacted, unintended errors still, on occasion, do occur. In fact, designers have developed failure as a central part of their process. The discipline of design involves the iterative activity of developing ideas, prototyping, testing and critiquing them, refining them, and starting over again until the best ideas emerge, fully developed, to meet the greatest number of needs in the most elegant and cost-effective manner. But the disasters we increasingly face come from areas of our economy and society not often thought of as designed, not created with designers as part of their development, and so not well designed, with the possibility of failure in mind. The answer does not entail putting some bureaucrat in some central government office to turn the levers of industry; that image of the demonic, dictatorial designer has become so out-dated and irrelevant that we should not even waste our time thinking about it. Instead, the way to avert disasters in the future entails seeing them mostly as the result of design failures and starting to engage designers not just in the creation of sellable products or rentable space, but also in the very conception and critique of the systems, services, and structures we all depend on and suffer from should they fail.

This aligns completely with a free-market economy. As business school dean, Roger Martin, has written:

Businesspeople don't just need to understand designers better—they need to become designers... For any company that chooses to innovate, the foremost challenge is this: Are you willing to step back and ask, "What's the problem we're trying to solve?" Well, that's what designers do: They take on a mystery, some abstract challenge, and they try to create a solution... In the end, design is about shaping a context, rather than taking it as it is. When it comes to design, success arises not by emulating others, but by using organizational assets and integrative thinking to identify, build on, and leverage asymmetries, evolving unique models, products and experiences—in short, creativebusiness solutions.⁶

Nor does Martin stand alone in advocating for a new role for designers in our economy. As the writer Daniel Pink has asked in his popular book, *A Whole New Mind* :

What if we could identify companies that have integrated design into their very business model? Would they make good investments?... The answer is a resounding yes... Five publicly-held companies that differentiate based on design: Apple, Target, Starbucks, Motorola, and Procter & Gamble... have easily outperformed the S&P 500 and the NASDAQ over the last five years... Maybe it's time for an index of companies that grasp this new competitive logic of business. Call it theDADI, for Design as Differentiator Index.⁷

Were we to have such an index we might find what researchers in the UK discovered—that, on average, design-alert businesses have increased their market share by 6.3 percent over companies that are not design savvy, with those in the retail sector increasing their share by 6.9 percent. Less than half of design-alert businesses compete mainly on price compared to two-thirds of those who don't use design, and shares in design-led businesses have outperformed the top 100 companies on the London stock exchange by more than 200 percent over the past decade.⁸

We live in a designed world, with an economy increasingly design based and design dependent, and yet we have yet to integrate design thinking into especially the invisible systems, non-tangible services, and ephemeral products that have taken an ever-larger share of economic activity. Until we make that transition to the “whole new mind” Pink talks about, we will have to endure the consequences of failed banking systems, toxic financial products, unmarketable real-estate assets, over-extended infrastructure, and unsustainable industries—all disasters waiting to happen. What is that design mind like, and how can we begin to employ it to stem the tide of catastrophes that has resulted from so many years of bad design?

The Design Mind

We all have the capability of designing. Like any number of other basic capabilities—music, speech, writing, mathematical calculation, and so on—design remains fundamental to human beings. When we put on a particular combination of clothing in the morning, look ahead to the day and plan accordingly, arrange a variety of things into a greater whole, solve problems that we have not encountered before, act on a hunch without clear evidence to back up our intuition, see connections among things that seem otherwise unrelated, and play out scenarios about events in the future—all of those activities involve our thinking and acting in a designed way. Design involves purpose and function, but it also engages a part of our mind that can see something that doesn't yet exist, and so it remains one of the key skills we have in shaping the world around us according to some intention or goal.

Because we live in a world that tends to recognize extremes and to downplay the things we have in common, most of us don't think of ourselves as designers. We generally reserve that for people trained as such or for people who have a gift in that area, for someone who has design talent outside the norm. As a result, we often don't think of what we all do on a daily basis as involving design. Likewise, we often don't see how much design pervades our lives. We absolutely depend on it in order to function and we cannot escape it, however much we might try. Just look around. Virtually everything you see has been designed: the room that surrounds you and the chair you

occupy, the building you work or live in and the clothing you wear, the book or electronic device in front of you and the roads, vehicles, landscape, and infrastructure outside the nearby window. Design is “making things better for people,” as the designer Richard Seymour put it, knowing that, as designer Bill Moggridge quipped, “a lot of trial and error goes into making things look effortless.”¹



Figure 26.1 We have deskilled most of the human population by overly professionalizing activities that people used to know how to do. Professionals can build resilience back into communities by becoming better communicators, facilitators, and advisors rather than experts with some sort of mysterious and unassailable knowledge.

Because of the pervasiveness of our designed surrounding, we rarely think about it. Like fish in water, we swim in a sea of design and so take it for granted that we don’t know how much it affects us or how much we each engage in it. The invisibility of design occurs especially—and ironically—when done well. Peter Senge, of MIT’s Sloan School of Management, has observed that “The functions of design... are rarely visible; they take place behind the scenes. The consequences that appear today are the result of work done long in the past, and work today will show its benefits far in the future.”² We usually become aware of design when done badly, when something designed inconveniences us, makes us uncomfortable, or fails in such a way that it harms us or results in a great deal of damage.

We have sought to protect ourselves from bad design by professionalizing its creation. Having done so with other fields that affect our health, safety, and welfare, we hold designers responsible for their failures. While good as far as that goes, the problem lies in

the fact that, as have seen, many non-designers, people who don't even know they do design, end up doing a lot of bad design, causing great harm, and producing the most massive failures—often unintentionally. We need professionally trained designers, but we also need a degree of understanding about design in the general population, at least enough so that people know what they don't know and where they can go to get help. In that sense, design, which involves the health of our physical environment, needs to become like human health, something that almost everyone knows enough about to recognize what they don't know and where to go to get the professional attention they need.

That also demands that professional designers rethink their roles. As we move into a much more complex and overcrowded world, the needs far outstrip the ability of professionally trained people to respond adequately. Accordingly, professionals need to become not just technical experts, but also facilitators of others who, to varying degrees, can guide and counsel people who have need of such advice but not the means for or access to it. I teach in a design college, where we educate our students to become designers—landscape architects and urban designers, architects and interior designers, apparel and graphic designers. They learn not only a number of technical skills and detailed knowledge, but also a way of thinking and a process of creating the designed products and environments we all use everyday. They work hard and their education takes years. We can only prepare a relatively few people, however, and as we have professionalized the field, design has mainly become available to a relatively small and very wealthy percentage of the world's population who can afford the fees.

To exacerbate the problem of a limited number of professional designers, the design community has chosen to operate according to a medical model of practice, in which professionals work with individual clients to address their particular needs. While that remains an important activity, key to the creation of much what we use in our lives, it leaves out the vast majority of the world's population that has a great need for design creativity—most valuable when doing the most with the least—and who have little or no access to designers. Design is perhaps the greatest social art,

affecting the most people of all the arts every day. That widespread effect suggests that designers might consider, as an alternative form of practice, the rise of the public health profession out of the medical field in the nineteenth century, and give birth to a public-health version of themselves. Design as a form of public health would enable us to meet the needs of literally billions of people through affordable, prototypical, and locally appropriate solutions to people's most important physical problems. This new field would also help people relearn how to design their world themselves, something that humans all knew how to do before we turned to professionals to do it for us.



Figure 26.2 Just as medicine gave birth to public health to attend to the health needs of those who could not directly pay for services, the design fields need a public health version of themselves, making the results of this value-creating activity available to all.

While there remain important roles for professional designers, there also exists in everyone, to varying degrees, an ability to design. Unlike human activities that primarily utilize the left brain—math and language, for instance—or primarily use the right brain—art and music—design involves moving back and forth between the two hemispheres of our brains. Demanding both the analytical left

brain and creative right brain, design engages in an iterative, cyclical process, involving the kind of practical creativity that not only produces the things we need in order to live, but also the innovations essential to success in a highly competitive global economy. Most of us think of designers as imaginative non-conformists, but what differentiates designers from, say, fine artists, lies in the strong leftbrain logic that complements the right-brain creativity. Designers, in the end, make practical things: products, environments, systems, and structures that work, ideally beautifully, efficiently, and cost effectively. Learning how to design does not just equip us to create useful things, design also provides us with the sense of pleasure and accomplishment that comes from the process of doing so.

Many universities, of course, have design programs, but these creative fields often do not have the stature of the sciences. This reflects a larger problem in modern intellectual life: we have become exceptional in our ability to understand and explain the world as it exists, as science does with extraordinary amounts of data to make its case. We have not done nearly as good a job, however, in knowing what we should do differently in the future, based on that knowledge. Many reasons for that probably exist. We don't have data about the future and so cannot back up our recommendations in the same way that we can through scientific analysis. Also, such recommendations can seem subjective, which objectively minded people often want to avoid, or seem politically charged, which publicly supported and donor-supported institutions may also want to avoid. The somewhat marginal role design plays in most universities reflects this dilemma: the discipline most capable of helping us imagine alternative futures remains somewhat marginalized in institutions charged with helping create a better world. As Adelle Wapnick, founding director of advertising agency Cross Colours, observes, "Design is... an all-pervasive discipline that underpins almost everything we do, inhabit, eat, consume or adorn. More importantly, it's probably the most underestimated discipline in business."³

Part of the neglect of design in universities comes from its neglect in primary and secondary education. Although key to economic success, design almost never gets taught in preK–12 schools, and

even when it does, it often gets lumped in with primarily right-brain subjects like fine art and music, fields that, unwisely, get cut during budget shortfalls. That neglect of the creative fields, as the writer Daniel Pink has argued, puts us at a great disadvantage in a world that increasingly needs the kind of right-and-left-brain thinking, the practical imagination that designers do. Indeed, our not seeing design thinking as a basic skill of all students may amount to one of the most competitively disadvantageous aspects of American education today.

As a result of this unfamiliarity with or suppression of design, we often equate it, wrongly, with aesthetics. The writer Bill Breen recognizes that “Design’s power runs far deeper than aesthetics... If you are mapping out a sales strategy, or streamlining a manufacturing operation, or crafting a new system for innovating you are engaged in the practice of design.”⁴ Or we think, also wrongly, of design as simply about craft, about making things. “If business and design are to come together fruitfully on a large scale,” says Patrick Whitney, director of the Institute of Design at IIT, “... change must come from separating design thinking from ‘the crafting of things’. The power of design thinking must be freed up to deal with all sorts of issues on a global scale.”⁵

What design really does is help us think in innovative, out-of-the-box ways, seeing the world as not just the result of logical, rational decision-making, but also as an emotional and deeply cultural response to reality that has a lot to do with the look and feel of things. Bruce Nussbaum of *Business Week* has shown how “Designers are teaching CEOs and managers how to innovate... They pitch themselves to businesses as a resource to help with a broad array of issues that affect strategy and organization—creating new brands, defining customer experiences, understanding user needs, changing business practices.”⁶ For that reason, it has become critical that we see design not as something that just goes on in the design department in a company, any more than we would see writing as only going on in the communications department or math only in the accounting department. “Design is the philosophical core of the company,” writes John Zapolski of the Management Innovation Group. “Everyone in the company becomes involved in

designing, whether that means creating financial plans or selecting casing materials for an industrial product. Design isn't something that the design department does. It's a way of operating the company. It's an ongoing set of choices about how the company is going to exist, to compete, to grow."⁷

Smart businesses and communities understand this, turning to what former Herman Miller president Ed Simon calls "organizational architects." "We need a new generation of organizational architects," says Simon. "But to get there we must first correct basic misunderstandings about the nature of business design. It's not just rearranging the organization structure. We have to get away from the P&L statement and design for the long term—based on understanding interdependencies. Most changes in organization structure are piecemeal reactions to problems. Real designers are continually trying to understand wholes."⁸ And we don't just need people thinking like designers. We also need people skilled at managing the creative process of design, something only now being discussed in business schools. As Angela Dumas and Henry Mintzberg write, "This role of manager as designer is hardly mentioned in the literature, and barely acknowledged in business practice... Managers practice 'silent design'... the many decisions taken by nondesigners who enter directly into the design process, no matter how unaware they or others may be of their impact."⁹

For all there are practical reasons for elevating design thinking, there also exist profound intellectual and cultural reasons for doing so. Design can change how we see ourselves in relation to each other and to the world around us, for design seeks to avoid win-lose situations and provide win-win solutions. As such, it involves less competition than collaboration, while helping us see the world not in terms of the survival of the fittest so much as an interdependent web of interactions to which we all contribute and upon which we all depend. As psychologist Rudi Webster puts it, "All stakeholders need to abandon their adversarial thinking and approach and engage in design thinking to find a win/win solution... It is simply about changing beliefs and perspectives and designing an optimal

solution. Remember, it is beliefs that determine the limits of your achievements.”[10](#)

The Process of Design

How can design help us create a better future for ourselves? Answering that question has taken on a certain urgency; it is something that we need to do if we are to thrive in the future. As psychologist Richard Farson, director of the Western Behavioral Sciences Institute, wrote at the opening of the twenty-first century:

We will either design our way through the deadly challenges of this century, or we won't make it. For our institutions—in truth, for our civilization—to survive and prosper, we must solve extremely complex problems and cope with many bewildering dilemmas. We cannot assume that, following our present path, we will simply evolve toward a better world. But we can design that better world. That is why designers need to become leaders, and why leaders need to become designers.¹

To design a better world, we need to understand the process that makes design as rigorous a discipline as any of the sciences, social sciences, or humanities. The popular media typically depicts designers, like those in other creative fields, as having bursts of insight that come suddenly and fully formed. While such sudden connections do occur in the design process, that process also involves a great deal of effort. The 10 percent inspiration/90 percent perspiration rule applies here; design occurs in a loopy way, in which

the designer makes a move, critiques its flaws, and often takes a slight step back to reassess the idea in order to move forward in a more effective way. That two-steps-ahead-and-one-step-back process may seem frustrating to those of us who, educated in more left-brain ways, tend to see the world in more linear ways and success in terms of how quickly we get to a solution. But because design deals with what doesn't yet exist, it remains a process of probing into the future, creating it as we go. As computer scientist Herbert Simon wrote about design, it concerns itself "not with the necessary but with the contingent—not with how things are but with how they might be."²

Design shares with science and math the drive to understand the world, but it differs from them in a fundamental way. Most other disciplines try to comprehend the world as it is, dealing with the past and present; design remains one of the few fields that primarily tries to envision the world as it could be. To do this, designers often use analogies and metaphors to imagine what hasn't happened yet by likening it to what we know from the past and present. As Jeanne Liedtka of the University of Virginia's Darden School of Business puts it:

The most fundamental difference between [design and science] is that design thinking deals primarily with what does not yet exist; while scientists deal with explaining what is. That scientists discover the laws that govern today's reality, while designers invent a different future is a common theme. Thus, while both methods of thinking are hypothesis-driven, the design hypothesis differs from the scientific hypothesis.³

Designers, of course, engage in analysis, just as scientists and mathematicians do. Every time a designer draws general conclusions about a project from the specific needs in a client's program, or applies an overall theory of design to a particular project, induction and deduction occur. But design thinking has a "both-and" character and it involves reason and imagination in an almost continuous and near simultaneous flow. This, in turn, runs counter to the way most people have thought about thought itself, heavily influenced by Aristotle's "the law of the excluded middle," which holds that something cannot be one thing and something else at the

same time.⁴ Designers do not just take things apart and keep them distinct; we also put them back together and reconnect them in new ways, while accepting a high degree of ambiguity and simultaneity in the process. Designers also project ideas forward in time and space, toward unimagined possibilities. Designers, of course, also look to the past, to history for lessons and ideas, and to the present, to the sciences and social sciences for information and data. The distinguishing characteristic of design thinking, however, involves imagining the future, while accepting the fact that we can never know for certain what doesn't yet exist, in an iterative process that expands outward in order to focus in and takes steps backward in order to move forward to the best solution.

Certainty was served as the holy grail of modern thought, with science becoming the standard against which we measured other disciplines, and so the inherent fluidity and uncertainty of design made it seem undisciplined as a result. But with post-modern thought has come a much greater openness to ambiguity, complexity, and both—and solutions, which design excels at. While it remains to be seen how much designers can change the discipline's still somewhat marginal place in most universities, organizations, and corporations, it seems beyond a doubt that design thinking will need to become more central to intellectual life because of its ability to keep many seemingly contradictory ideas in play at the same time as a way of finding the most creative solutions.



Figure 27.1 As the psychologist Richard Farson has observed in his book *The Power of Design: A Force for Transforming Everything*, the complexity of the challenges we face requires a new field, which he calls “metadesign,” that addresses the serious design flaws in the social, economic, and political systems that we depend on.

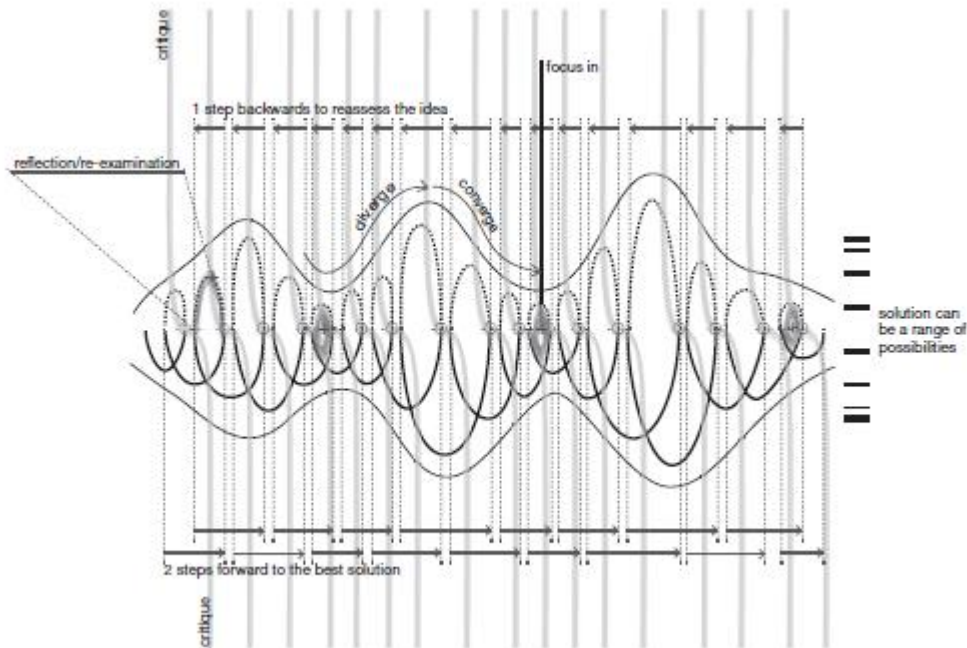


Figure 27.2 In a world increasingly viewed as a web rather than as a series of hierarchical silos, design thinking becomes especially valuable because of its ability to see the connections among disparate things, to navigate ambiguity in order to achieve results, and to envision alternative futures different from what we have known.

Another aspect of design that distinguishes it from many other forms of thought involves its interweaving of thinking and making. Western thought has had a long-held suspicion of those who work with their hands, perhaps a reflection of the fact that the first academy that Plato founded in ancient Greece arose out of an aristocratic culture in which slaves did much of the hand labor. That first institution of higher education in the West instilled in academics a deep bias against the making of forms, as opposed to the thinking about Form.⁵ Here, too, design thinking flies in the face of that mind-body split. Design involves an iterative process of thinking in the act of making and of making as an act of thinking, and it encompasses both the making of things and the things themselves, the environments of daily life as well as the ideas that underlie them.

That process of thinking and making also involves another skill: problem seeking. Other fields, like literature and philosophy, have a

history of envisioning utopias, idealized futures that overcome the perceived problems of the present. Most of those utopias, however, remain thought experiments, and in the rare instance where people have actually tried to put utopian ideas into practice, it has often turned into a nightmarish dystopia because of the lack of critical assessment of the possible problems and their potential downsides. Designers also envision idealized futures, but along with that visioning comes a set of critical skills in how to assess the shortcomings and potential liabilities of every scenario we create. The often perceptive and sometimes picky criticism that occurs in design juries and journals can seem brutal to non-designers, but it is essential in ensuring the appropriateness and responsiveness of the solutions that designers devise.

Design, in sum, involves a particular kind of lateral, expansive, speculative, iterative, and skeptical thinking that can handle high levels of ambiguity and uncertainty. But how, exactly, do designers think when they work? How do they come up with new ideas or imagine environments that don't yet exist? Most designers use analogies, looking for something new based on its similarities with what we already know. The analogies may be more visual than verbal, and more figural than literal in nature, and the connections may arise from within design or from other fields. But designers get good at finding productive analogies and practical parallels.

They do so through the use of techniques common to all creative fields. These include:

- transference—taking something from one context and applying it to another;
- rescaling—transforming something by interpreting it at a very different size;
- inversion—flipping something metaphorically on its head or turning it inside out;
- reassembly—chopping something up and rearranging it for a new purpose or potential.

These and other tools enable designers to envision possibilities and alternative scenarios, seeing beyond what is to what could be. The

designer's skill in doing so has become particularly important in the world in which we find ourselves, where we need to create a greener economy, more resilient infrastructure, and a more adaptable physical environment if we are to accommodate the needs of a growing human population threatened by dwindling resources and a decaying natural environment. Never has the imagining and testing of alternative futures been more pressing than it is now.

Every design amounts to what is essentially a "what if " experiment, based on what we know about the needs of particular people and environments and the conditions of a particular place and time. We have generally not seen design in that way. Instead, most of us view design as a subjective activity, a matter of personal taste in what we buy, use, and occupy. As such, design seems outside of the realm of serious discussion, more something that we do in our spare time, when we shop or decorate our houses, rather than a central part of everything we do. This all contributes to the disconnect we suffer with now, between the poor design decisions made by those who don't think of what they do as design, and the disastrous outcomes that have resulted from those decisions.

In science, almost all experiments happen in controlled laboratory settings, so that if an experiment fails—as they often do—no one gets hurt and we can learn from the failure in order to conduct a more successful experiment next time. In design, though, we have few laboratories. Design experiments, in contrast, often happen at full scale and in real time, with the potential for great harm and tremendous cost should they fail—as they sometimes do. Many of the human-generated disasters we have witnessed in recent years show the catastrophic nature of design experiments gone awry. Never drilled oil wells over a mile underwater? Never allowed minimally regulated sub-prime mortgages? Never pumped so much carbon into the atmosphere before? No problem. We've already conducted those experiments on ourselves and we have learned just how destructive their failure can be.

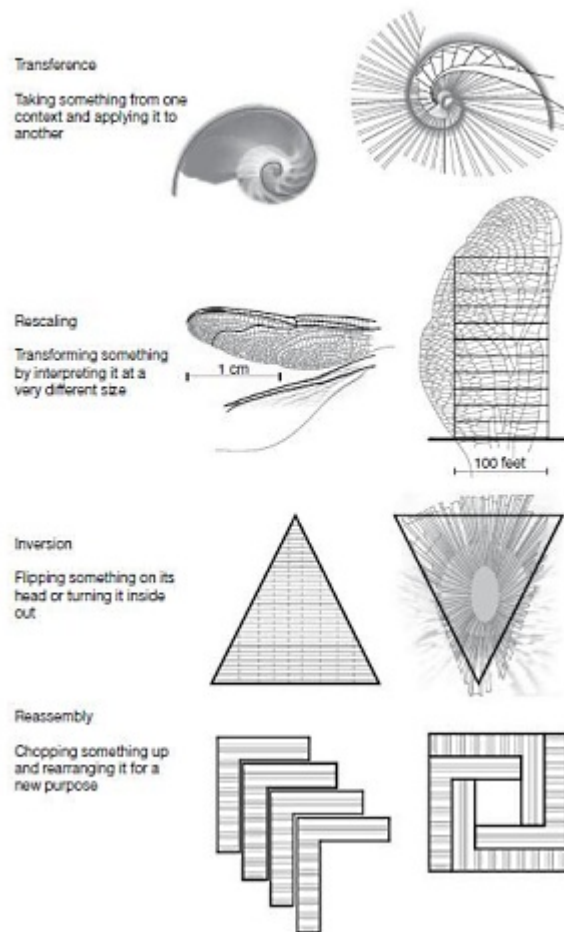


Figure 27.3 When we judge a design at the moment of its completion, without looking at its potential limitations or shortcomings over time, we flirt with disasters such as the ones we have experienced recently

Because we don't recognize these and other disasters as failed design experiments, we also don't talk about the failures as scientists do theirs. Politicians call hearings, the media seeks blame, the public demands compensation, and those responsible for the failures point fingers at others, but too few of us try to understand the deeper, systemic error from which many of these disasters arise. Instead, we make a few more laws, invest in some new technology, increase regulations as much as politically possible, maybe fire a few scapegoats, and hope that the disaster won't happen again. But all too often, the thinking behind the catastrophe remains unchanged,

and we go on conducting deadly experiments on ourselves and on the natural environment.

Were we to operate as the scientific community does when conducting and evaluating experiments, we would require ample documentation, without claims of proprietary information; demand their replication, without allowing things to go live ahead of time; and disseminate the findings through peer-reviewed journals, before we go to market. These procedures, of course, occur in some parts of the marketplace where not doing so can have immediately deadly results: in the design of vehicles, for example, or pharmaceuticals. But we often overlook the equally deadly results of untested experiments in most other parts of the marketplace. Did we think, when we developed automobiles, that not only would the vehicles themselves become the single greatest cause of deaths among young people between ages 15 and 24, but also that they would fragment communities, isolate families, contaminate the air, and contribute to the pollution of our waterways and the fragmentation of other species' habitat?⁶ And the automobile remains just one of many grand experiments we have enacted upon ourselves, the results of which have begun to come in. The question is: do we continue to do this to our planet and to ourselves, or can we change our perspective and design our world in a different way?

The Logic of Design

Designers, as a group, tend to have strong visual and spatial skills, and the ability to think simultaneously in two and three dimensions, at various scales and from different perspectives at the same time, with drawing and diagramming as essential tools to convey their ideas. But while that visual and spatial intelligence occurs in some people more strongly than in others, it also constitutes one of the eight forms of intelligence that psychologist Howard Gardner has identified in his theory of multiple intelligences (linguistic, logical/mathematical, musical, visual/spatial, body/kinesthetic, interpersonal, intrapersonal, naturalist) and so it exists in almost everyone to some degree.¹ Navigating the three-dimensional world would be nearly impossible without it. That, in turn, suggests that virtually everyone can learn at least the basic components of design thinking and how to apply it to their work, however non-visual or non-spatial they might be.

In the spirit of visualizing the invisible, what does design thinking look like? How would we diagram it and what can we learn about it by thinking about it not as some ephemeral or mysterious process, but as a three-dimensional object? Such questions suggest that diagramming design thinking itself remains a design problem. As in every other design act, conceiving what design thinking looks like demands an iterative process that will undoubtedly improve the diagram as the result of critique and subsequent redesign. But all

design starts somewhere, and so the following figure represents an initial idea for consideration.

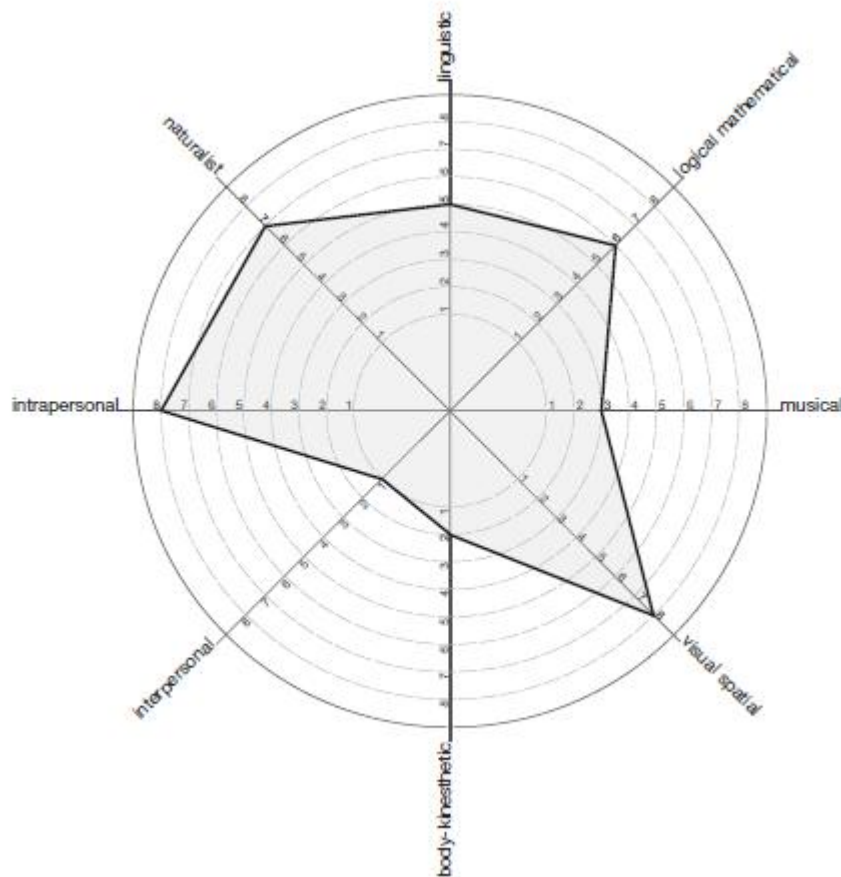


Figure 28.1 Visual and spatial intelligence occurs in some people more strongly than in others, it also constitutes one of the eight that psychologist Howard Gardner has identified in his theory of multiple intelligences and so exists in almost everyone to some degree.

Look at this in relation to inductive and deductive thinking.² We can think of those two forms of logic moving in opposite directions along a triangle. Deduction works from an initial premise and draws from it either valid or invalid conclusions based on the truth of that premise or on the logic of the reasoning involved in coming to those conclusions. We might diagram it as a process that starts at the top of the triangle, from a set of premises assumed to be true, with many possible conclusions flowing in diverse directions from that point. Mathematics typically entails such deductive reasoning. From a set

of axioms or definitions, mathematicians can generate conclusions that logically follow from the premises.

Induction moves in the other direction. It starts from empirical observations of phenomena or experiences and, based on that activity, constructs one or more general theories or laws that have a high probability of explaining the properties or relationships of the things observed. As we know from science, the test of induction comes from the ability to repeat an experiment, observe the same phenomena, and arrive at the same conclusions predicted by the theory. From the multiple occurrences or experiences in our lives and that form the base of our triangle, induction focuses on some in order to draw a conclusion that, like the point of the triangle, has a high degree of stability and explanatory power.

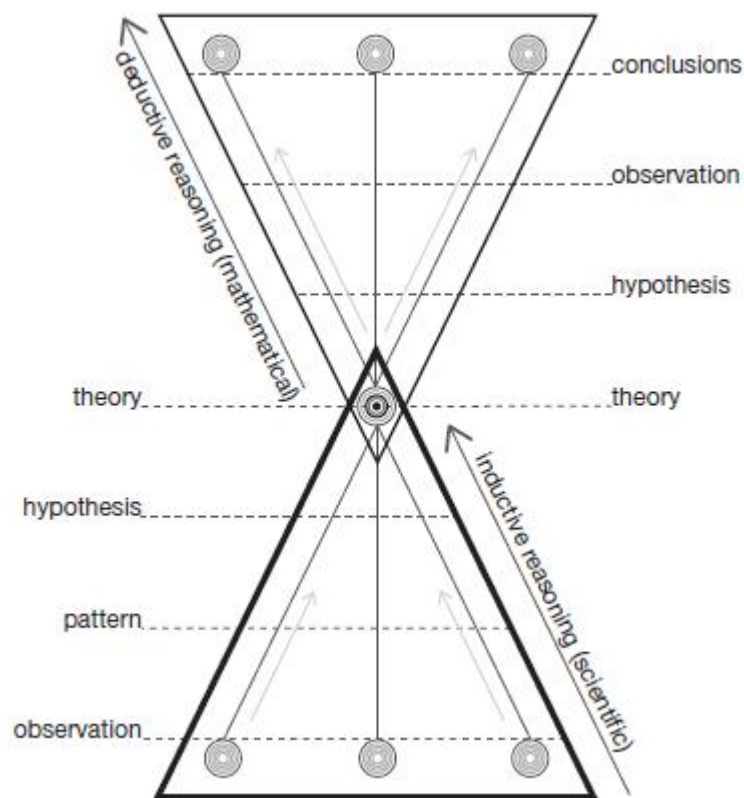


Figure 28.2 The inductive/deductive triangle. Deduction works from an initial premise and draws from it either valid or invalid conclusions based on the truth of that premise. Induction starts from empirical observations of phenomena or experiences and based on that activity, constructs general theories that have a high probability of explanation.

Abduction takes a very different form.³ First, it doesn't move vertically up or down the pyramid of reasoning like induction or deduction. Instead abduction moves laterally, typically making analogies between seemingly unrelated phenomena or disconnected things in order to draw new and often unexpected conclusions that might be useful in a particular situation. Such lateral or analogical thinking involves a form of induction, in that it draws conclusions from observed phenomena. But unlike induction, it doesn't seek general laws or universal principles, instead it connects particular things in order to solve specific problems in a given time and place. This is what design thinking does and why it remains different from mathematics and science, and yet as essential to our ability to live in and understand the world.

Second, abductive reasoning does not have the linear direction that we often associate with induction and deduction. Instead, design thinking has a spiraling or looping form, in which, faced with a problem to solve or a need to serve, we make an initial step based on our understanding of the situation, and then test that first scheme in terms of how well it addresses the problem or need. Even the most skilled designers find that that preliminary hunch needs revision of some sort and so the process involves both looping back to reexamine the problem and gathering more information about it and its context in order to move forward toward a better solution.

That looping back and expanding out can seem disturbing to those who think that, inductively or deductively, solutions should follow logically and linearly from a problem. The abductive process may look undisciplined or uncertain as it takes a step back or broadens out its perspective, but that spiraling motion, in fact, provides a way of ensuring that the ultimate solution satisfies as many of the needs and accounts for as many of the considerations as simply and efficiently as possible. Abductive thinkers know that to go forward they also have to go backward, and that to arrive at the best answer, they also need to consider more possibilities than a linear approach to a problem might suggest.

Indeed, the lateral, loopy, and undulating form that results from this process highlights the reason why we have suffered from so much poor design and such catastrophic failures in areas where

people have not followed this path. Dealing with design problems in a reductive or linear way, as if every problem has a simple and logical solution, eliminates what remains most valuable about the design process: the continual self-criticism and collective critique that forces the designer to go back and reconsider. That critical examination occurs at every point in the diagram where the process loops back and/or expands out, and the more that happens—within reason—the better the results and, more importantly, the less likely they will lead to a catastrophic failure. No process, of course, is perfect; design flaws do occur and product failures do happen. Such setbacks, however, typically stem from a design process cut too short or followed too fast, reducing the number of critiques, the range of input, or the time to completion to the point where flaws got through or possible failures did not get caught.

When allowed the time it needs, however, and when given the support it takes to do it right, the abductive design process has evolved over the course of human history to ensure the best results given the problem at hand and the resources available. Bad design occurs not only when the results fail, or at least fail to live up to our expectation or to meet our needs. Bad design also happens when something costs too much or wastes too much or takes too much to make. While the design process does not lead to a true or verifiable conclusion, as happens with deduction or induction, it does generate a limited number of optimal solutions that address the greatest number of issues in the most elegant and efficient way.

The Pragmatics of Design

The value of abduction lies in its consequences, as Charles Sanders Peirce, the nineteenth-century American philosopher, argued.¹ The lateral connections that abductive thinking—design thinking—makes can be very productive or completely meaningless depending upon its results. The key question is: did a creative insight lead to something useful or not? Peirce called this judging of things according to their consequences “pragmatism.” Critics of pragmatism have argued that we can never know the full consequences of things in the future, and so we have no way to measure their pragmatic value. Designers have likewise shown a degree of skepticism about judging their work based on long-term consequences, given the relative lack of time and attention given to the assessment of design objects, systems, and environments after the fact by designers themselves. That may stem from the long-held prejudice in the larger culture that design and creativity in general remain intuitive and inexplicable. But even the most cursory investigation of abduction shows that that is not the case. Abduction involves a highly disciplined way of discovering new knowledge and developing new ideas.

Educational psychologists Gary Shank and Donald J. Cunningham have developed a more nuanced way of thinking about abduction, showing how abductive thinking and research proceeds in an orderly and methodical way toward the development of useful inferences.² The six modes of inferences that Shank and Cunningham identified

describe, in different words, the design process. But Shank and Cunningham's analysis of abduction also shows how the design process constitutes a type of discovery that can produce results as valuable as anything coming out of a scientific lab or off a mathematician's blackboard. While we can't know what Peirce, who died in 1914, would have thought about this, it does seem very much in line with his pragmatic temper, which embraced all thinking that helps us solve problems and get on with life. Indeed, Shank and Cunningham's work is, itself, abductive—a creative leap that connects seemingly unrelated ideas to create something new and useful.

The six classes of inferences or ways in which we draw conclusions about the world, according to Shank and Cunningham, are:

- 1 Omen or Hunch, when we have an intuition about some possibility.
- 2 Symptom, when we find in that intuition a resemblance to other things.
- 3 Metaphor or Analogy, when we see clear parallels to things we already know.
- 4 Clue, when we relate the specifics of the particular case to more general solutions.
- 5 Diagnosis or Scenario, when we apply it as a prototype to more than the particular case.
- 6 Explanation, when we evolve a theory from the particular case that can apply to all cases.³

When working on a project or problem, an experienced designer will often have a hunch that an idea will work to organize and make sense of the diversity of requirements. That hunch usually arises out of aspects of the problem that are symptomatic of other, similar problems the designer has faced, from which parallels get drawn. The design will then typically evolve in an analogous or metaphorical way, in which ideas about what we already know or have already solved get applied to the new situation, changing in the process and becoming a new gestalt. As the design proceeds, other clues emerge that suggest new applications of the idea, beyond what has

happened before, which eventually leads to more general scenarios and possibly to a broader theory that can be of use to others when confronting the same sort of problem.

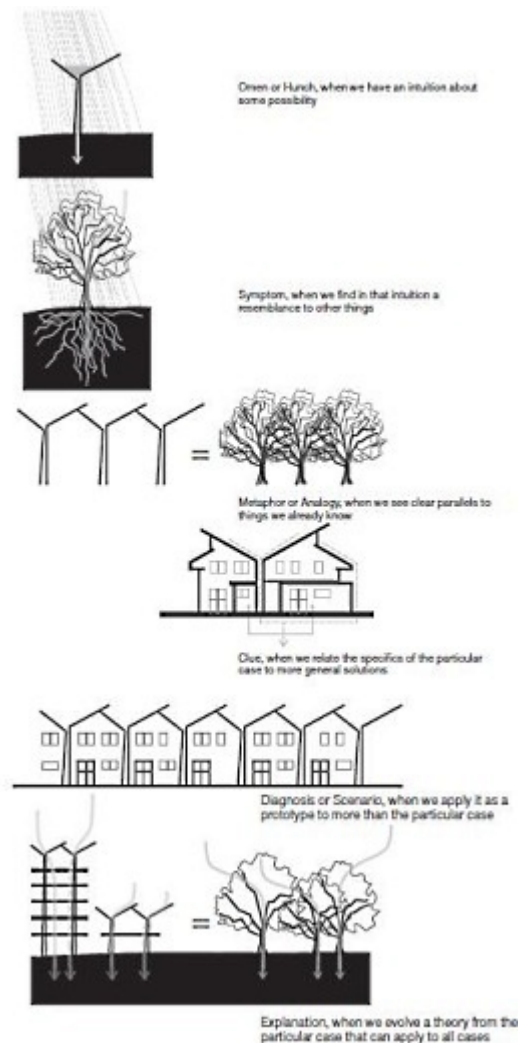


Figure 29.1 Designers use various methods to develop new ideas, often using metaphors and analogies, or looking for similar patterns or functions, which enable them to tell a story about what is new in terms of what we already know.

Shank and Cunningham do more, here, than simply put into new words what designers already do. They help us see that there exist at least six distinct ways in which creative ideas can emerge, and as a result, at least six different ways in which designers proceed to work. As a set of disciplines, the design community has long been accustomed to judging something based on its success in meeting a need, but rarely do we look at the consequences of what we do in

terms of the inferences we make. What difference does it make, in other words, to work from a hunch, as opposed to seeking an omen, looking for symptoms, applying a metaphor, drawing an analogy, responding to clues, making a diagnosis, envisioning a scenario, or offering an explanation? Do certain starting points lend themselves better to some situations rather than others? Do some produce better results than others? Are they all equally valid or simply a matter of personal preference, or does each mode of inference have strengths and weaknesses?

Such questions are not simply of academic interest. Research into the nature of designers' abductive thinking can go a long way toward helping others not only understand the value of design, but also understand the importance that different approaches to design thinking has in terms of end results as well as in terms of the role design thinking plays in the conduct of research. Abduction, as Peirce observed, serves as the prelude to all other research; without it, induction and deduction would not occur, for the latter would not have the hunches that lead to the hypotheses from which to proceed.⁴

This, in turn, suggests that the design community has too narrowly defined what it does in terms of the products of its actions. We have legally determined that only people licensed to design buildings can call themselves architects, for example. But were we to understand the nature of the inferences designers make, we would see that this mode of thinking has applications far beyond the products and environments that we have associated with design for so long. Abductive reasoning gives designers the capacity not only to solve problems in the physical world related to people's material needs, but also to see what Peirce called "firstness": the potentiality of and in things.⁵ Every new design creates something that didn't exist before and juxtaposes entities never brought together before in the same space and time. As such, it creates potential opportunities for us to relate to others in new ways, improving the effect that we have on other people, other species, future generations, and the planet as a whole.

This runs counter to the prejudice of some people who see designers as impractical or unable to stay on schedule or in budget

— all characteristics of a bad designer. Design, when done well, meets a need well, with a practical, durable, and affordable result. And when done poorly, we get the kind of disastrous failures we have seen in our financial industry, our housing industry, our oil industry—to name just a few. Many have tried to pin these failures on corrupt officials, cowardly consultants, contemptuous corporate bosses, or incompetent workers. But no amount of careful fabrication and maintenance can compensate for not understanding the nature of abductive reasoning and not seeing the bad design that can result from that misunderstanding. So while most people are not and never will be professional designers, everyone faced with creating something new, something to meet a new need or address a new problem, will think like a designer. And when we do that well, we can begin to create a more durable, resilient, cost-effective, and failure-resistant world, quite unlike the world that we have constructed, over the last century, at our peril.

The Holon of Design

We might also begin to understand the larger relevance of design thinking—not only as a tool to create useful things, but also as a way of being in the world. To see that, let's imagine turning the undulating, spiraling design process ninety degrees and looking at it on-end. We would see a series of connected loops nested within each other, with some of the spirals more tightly wound and others less so, as the design process narrowed in and then expanded out along its course. The backward loops that seem such a disorienting aspect of the design process, as we take a step back in order to move forward, have largely disappeared in this end view. Instead, the connection among the various levels or scales at which the design process occurs has become more prominent. What seemed loose and even somewhat disorganized from the side, now appears to move in a much tighter and more integrated way from an end view.

That end view reveals the design process as what Arthur Koestler called a “holon.” Koestler argued that everything exists simultaneously as an independent whole made up of parts and as parts of a larger whole.¹ This seems like a fairly obvious idea when we stop to think about it. Nature contains holons across every scale, from atoms that exist as wholes and also as parts of molecular wholes that exist as parts of cellular wholes that exist as parts of organisms and so on. The same holds true for the built world. A doorknob, while a whole, also exists as part of a door that, while a

whole, also exists as part of a wall that, while a whole, also exists as part of a room, as part of a building, as part of a neighborhood, and so on.

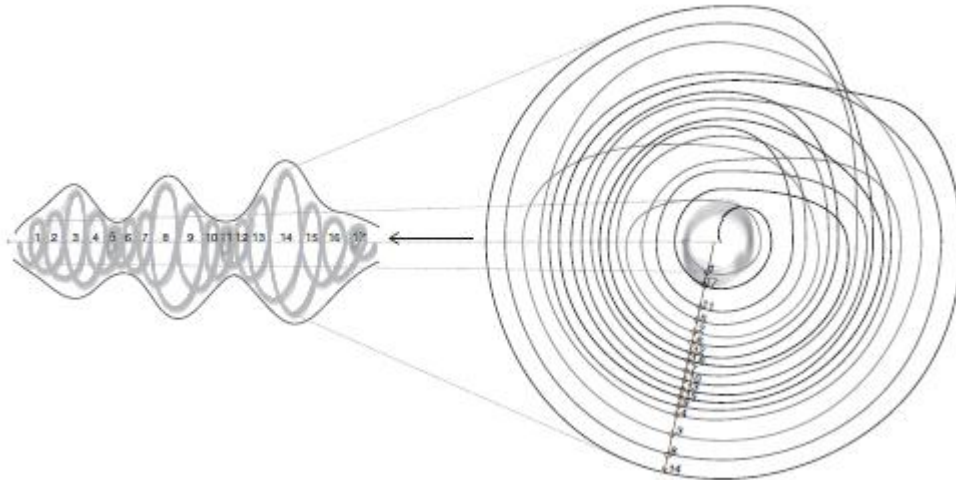


Figure 30.1 The holon of design. The connection among the various levels or scales at which the design process occurs makes it a “holon,” a word coined by Arthur Koestler to describe the reality in which we live, where everything is at once a whole made up of parts and a part of a larger whole.

Many of the conflicts in the world arise, as Koestler noted, from our not recognizing everything’s simultaneous “both–and” existence.² Prejudice and hate, ignorance and fear, exploitation and repression, war and violence—almost every ill we can imagine stems from people not seeing their inseparability, interdependence, and absolute reliance on each other and on all of the other species on the planet, however foreign they may appear. At the same time, a “holonistic” view of the world recognizes the distinction between parts—between individuals in a society, details in a composition, components of a system—and doesn’t lose sight of them by over-emphasizing the whole. Abduction, as a form of reasoning that sees relationships among seemingly unrelated things, and design, as a process that constructs such relationships, both reinforce this holonistic worldview.

An end view of the design process shows how. As the design process spirals outward and inward, forward and backward toward the optimal solutions to problems, it also links everything that it

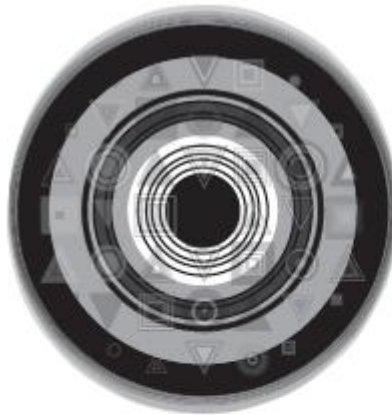
encounters and reveals those connections in a well-resolved final product. Bad design, on the other hand, like poor reasoning, makes artificial divisions, false distinctions, and forced separations among things and therein lays the source of many catastrophic collapses and devastating disasters we have experienced of late. These failures have occurred not just because of shoddy construction, poor maintenance, and unregulated greed, but also come from a fundamental misunderstanding of the profoundly interconnected “holonistic” nature of the world.

A holonistic view of things also shows, in specific ways, how failures occur. One common error, evident in totalitarian systems of all sorts, involves too strong a focus on the whole, without enough attention paid to the wholeness of the parts that comprise it. This leads, in politics, to the repression of individuals on behalf of some group, nation, or ideal, seeing people as means to some larger end. We also see this in the design of things, environments, and systems. The dismissal or lack of attention to parts or details often serves as a prelude to disaster. Think of the inspectors who overlooked the overstressed gusset plate that brought down the I-35W Bridge, the engineers whose over-dependence on the blow-out protector led to the BP oil spill, or the over-confidence of the designers of the aging levee system prior to the flooding of New Orleans after Katrina. Whether involving people or things, political systems or infrastructural ones, too great a focus on the whole to the detriment of the parts will inevitably bring the whole down. Wholes depend on their parts and only by recognizing the wholeness of each part and by valuing each part (or person as Kant said) as an end itself, and not as a means to other ends, will the larger whole survive.³

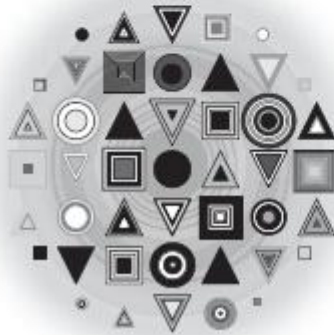
Attending to the parts to the detriment of the whole also presents a problem. Like libertarian politics, with its pitting of individual freedom against the good of the group, paying too much attention to the parts without seeing their dependence on the larger whole can also lead to disaster. Unlike the break in an overlooked part that brings down the whole in a fracture-critical collapse, the fracturing or fragmentation of the whole can make it impossible for the parts to thrive. The heroic individualism that has fueled much of the anti-government rhetoric of recent years remains stubbornly, and sometimes stupidly, blind to all

the ways in which individuals depend on the government—and on larger wholes of all sorts, including communities and the natural environment. Neglecting those wholes by too fiercely focusing on the parts underlies the collapse of the financial industry and the bursting of the housing bubble, in which individual greed trumped the collective good, harming a great number of people as a result.

While apparently opposed to each other, the extreme collectivist and the extreme individualist make the same mistake from a holonistic perspective. Both pay too much attention to one level of the holon and disconnect it from other levels, either smaller-scale parts or larger-scale wholes. And because of that disconnection, stresses in systems that would normally get absorbed across the holon, from one level to another, can lead to sudden and unexpected collapses: fracture-critical failures. That such failures almost never occur in nature stems from the holon-like connections within and among ecosystems, distributing stresses and mitigating impacts so that the whole remains healthy even as some parts wane and others thrive. The flaw in fracture-critical systems has as much to do with our thinking as with our actions. Whenever we see a system, at any level, as separate from others either larger or smaller in scale, we set ourselves up for the catastrophes we have begun to experience with ever-greater frequency. And the way to avoid disasters in the future lies in reconnecting the parts and wholes of the holon that comprises the world.



Over-emphasis on the whole leads to neglect of the parts.



Over-emphasis on the parts leads to neglect of the whole.

Figure 30.2 Totalitarian systems focus too strongly on the whole, without enough attention paid to the parts that comprise it, while libertarian systems pay too much attention to the parts without seeing their dependence on the larger whole. Both lead to disaster.

That seems so simple. Why, then, don't we make these connections and be done with it? The answer lies in the fact that maintaining a disconnect among the different scales and in the different realms in which we live provides an advantage to some over others. As humans, for example, we have long focused on our species and viewed other species as available for our use and exploitation, a disconnection with the world around us that has begun to threaten us as the ecosystems upon which we depend for our food and water have begun to collapse. By not seeing ourselves as part of the larger whole of the planet, our wholeness as a species has become endangered.

The same occurs at smaller scales as well. Individuals, who seek to take advantage of others, legally or illegally, have disconnected themselves, at least in their own minds, from the larger consequences of that behavior. People can try to justify the exploitation of others in the name of free-market competition or the survival of the fittest, but in the end the holonistic nature of reality means that, eventually, the negative effects of their actions turn on them. Of course, the word “eventually” matters a lot in many people’s minds. If they can achieve a short-term gain at the expense of others, they will take their chances over the long term that they can avoid future losses or put them off long enough that it won’t matter.

That may have worked in the nineteenth and early twentieth centuries, when travel and communication still took a long time. People could distance themselves from the negative consequences of bad behavior and ignore the “moral sentiment”—to use Adam Smith’s term—that kept such behavior in check when people lived within sight of those who they might want to exploit.⁴ But global communications have made it ever harder to escape the effects of predatory actions. Look at how quickly an incendiary act in one part of the world can go viral and prompt angry protests in another, as happened when the minister of a tiny church in Florida, proposing to burn a stack of Korans, ignited global protests.⁵ At the same time, the scale at which we now work in the modern world magnifies the consequences of bad behavior. What might have had limited impact in previous eras can now, because of our technological prowess, have large-scale and long-term devastating effects on millions of people. Consider the impact that the collapse of a couple of New York investment banks had on the global financial system.

In the end, the fracture-critical catastrophes we have endured raise ethical questions as much as they do design issues. The fundamental charge in ethics of seeing the world from the perspective of another and treating others as we would want them to treat us leads almost inevitably toward a holonistic way of thinking about design. By seeing the world as a continuously linked reality, in which every action affects every part that comprises the whole as well as the larger whole of which it is a part, we recognize how much everything we do affects us as well as others, and that, in the end,

we can never escape the negative consequences of our actions for ourselves.

Designing Our Future

What does this mean for architects and designers? While the architectural and design community remains broadly interested and generally engaged in sustainable design, the issue of equity poses an awkward dilemma. Because most architects and designers depend upon the wealthy and powerful for work, we have little incentive to embrace the idea that we may never achieve a more sustainable future unless we also create a more equitable one. When ecologist William Rees gave a talk at the national convention of the American Institute of Architects (AIA), he told the crowd of several thousand architects they need to reduce the environmental impact of buildings by 90 percent over the next fifty years.¹ He received enthusiastic applause from the audience of architects, but from what I could see and hear from the conversations afterward, it seemed as if the enormity of what Rees said did not register with most in the audience.

Achieving such reductions will take much more than increasing the use of “green” materials or of energy-conserving mechanical systems or appliances. A 90 percent reduction demands a wholesale change in how we live and how much we consume, an issue that few architects probably want to raise with our clients. Many in the profession might agree with Tony Judt of the Remarque Institute: “The American pursuit of wealth, size, and abundance—as material surrogates for happiness—is aesthetically unpleasing and ecologically catastrophic.”² But architects are often complicit in creating those material surrogates—buildings of great cost, size, and

abundance—with our fees often going up accordingly. To create a more sustainable, equitable world, we may need to begin by taking a hard look at how we practice and at how we, as a profession, contribute to the problem.

Richard Farson mused as he stepped down as the public member of the AIA board in 2003:

I sometimes wonder what an American architect would say if approached by the leader of China seeking his or her help for the 800 million ill-housed, struggling Chinese. “Well, the way we believe residential architecture should be practiced is that each home should be custom designed, the architect should be an integral part of the process for each structure, from beginning to end, carefully surveying the site, designing a structure that is particularly suited for that site, working intensively with the client to understand that individual’s special needs, making sure that the contractors are performing, and that the project is completed on budget. Normally it takes us about a year or so to finish such a project, and we can undertake perhaps ten a year. We don’t condone selling stock plans. But we could bring a thousand architects to work with you.” The leader would shake his head, concluding that such a program, even if China could afford it, would take 800 years.³

Farson ended his talk by calling for architects to become “metadesigners,” focused less on the design of individual buildings and more on orchestrating a wide range of other disciplines to help address the problems of the built environment. Even more controversially, he argued: “architecture should be publicly supported in the same way that education and medicine are. Our professional strategies should include making a case for major public funding, to the tune of trillions of dollars over time.”⁴

Large-scale public funding of the profession is not likely to happen soon, but Farson’s observations show how our dominant mode of practice may no longer align with what the world needs from us. The architect–client relationship works well in situations that call for custom design in response to individual needs, but in cases like the

Chinese example Farson gives—or now, given China’s rise, Africa or other parts of Asia—that form of practice seems wildly impractical. What we need, instead, is a variant of architecture and design that produces building and infrastructure-scale prototypes within meta-designed systems and organizations that can adapt to particular places and to the capacities of particular groups of people. The design professions, however, have yet to design the mechanisms that could make this happen at a large scale. It requires some combination of industrial design, architecture, engineering, anthropology, and global studies, able to develop widely applicable, culturally appropriate, and locally produced prototypes and projects.

This “public-interest design,” as some have called it,⁵ is not only relevant to the most impoverished nations. With ever-more intense weather brought on by global climate change affecting most parts of the world, people all over the planet will soon find themselves in need of such humanitarian efforts. As MIT scientist Kerry Emanuel has shown, tropical storms now last half as long again and generate winds 50 percent more powerful than just a few decades ago, the result of ever-warmer tropical seas.⁶ And with rapidly increasing populations living in vulnerable areas, we could see a whole new category of the homeless, “environmental refugees,” as Oxford scientist Norman Myers calls them, with “as many as 200 million people overtaken by disruptions of monsoon systems and other rainfall regimes, by droughts of unprecedented severity and duration, and by sea-level rise and coastal flooding.”⁷

How should we respond to such a sobering prospect, affecting developed, developing, and undeveloped countries alike? It may be, at least in the short term, that architects can work best as independent, creative entrepreneurs in partnership with the public and non-profit entities dedicated to helping the growing number of people rendered homeless or placeless because of environmental or economic dislocation. Some architects have begun to do just that. They have addressed different aspects of the sustainability-and-equity problem—the infrastructure needs of slum dwellers, the shelter needs of the homeless, the material needs of those with few resources, and the habitation needs of those on the move. What unites their work is not just a commitment to environmental

sustainability and social equity, but also an underlying and often unstated vision of the future that brings us back to where we have spent most of our history as a species: living in a highly mobile and nimble way, building with what is at hand, improving the environment around us, and occupying the land so lightly that we hardly leave a trace.

The United Nations' Millennium Development Goals call for significant improvement of the lives of at least 100 million of the world's two billion slum dwellers by 2020, focusing on access to safe drinking water and sanitation.⁸ With those goals in mind, architect John Gavin Dwyer and his former firm, Shelter, have designed a self-contained structure able to provide global slum-dwellers what they often need the most: access to electricity, clean water, and toilet and bathing facilities.⁹ Called the "Clean Hub," the 10 foot by 20 foot unit has a metal roof that collects rainwater, an adjustable array of photovoltaic panels able to generate up to 2,640 watts of electricity, a reverse-osmosis water system that cleans water stored in a belowground reservoir, showers and sinks whose grey water gets recycled back to the reservoir, and waterless, self-composting toilets. The building itself has impact-resistant stress-skin walls and has secure entry doors, supported by a steel-tube and concrete-pier foundation that can adjust to sloped terrain and poor soil. The Clean Hub's expected thirty-year life makes it most suitable for the many semi-permanent slums around the world that lack basic infrastructure.

Addressing the needs of people who have lost their housing during hurricanes and earthquakes involves another kind of response. Cameron Sinclair and Kate Stohr's organization Architecture for Humanity has shown how much architects have to contribute in the wake of these disasters.¹⁰ When Hurricane Ivan destroyed 85 percent of Grenada in 2004, and Hurricane Emily did further damage in 2005, for example, Architecture for Humanity participated in a team that included Arquitectonica, Ferrara Design, and Grenada Relief, Recovery and Reconstruction (GR3), producing seventy prototype transitional housing units. Called Global Village Shelters and designed by Daniel and Mia Ferrara of Ferrara Design, the temporary houses are made from recycled corrugated cardboard impregnated to be fire retardant and laminated for water resistance.

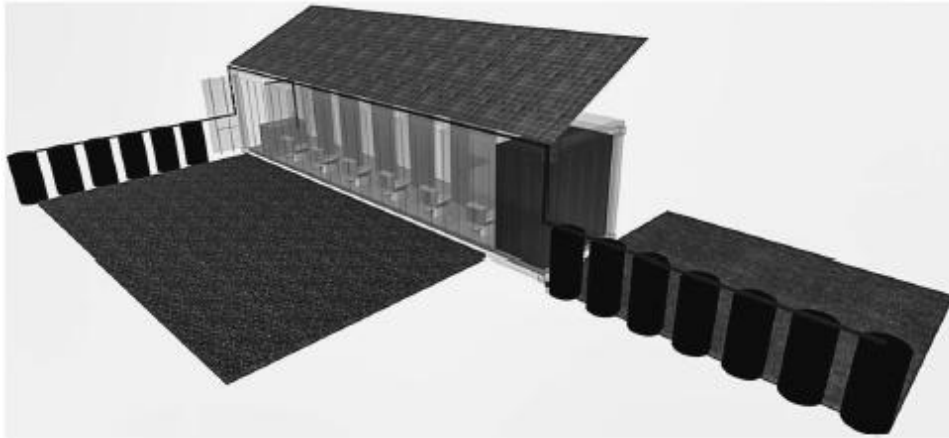


Figure 31.1 The “Clean Hub” is a 10 foot by 20 foot unit with a metal roof that collects rainwater, an adjustable array of photovoltaic panels to generate electricity, a reverse-osmosis water system to clean water, showers and sinks whose grey water gets recycled, and waterless, self-composting toilets.

Architecture for Humanity has also addressed the needs of people suffering from war or disease. In the organization’s 1999 competition for housing for returning wartime refugees in Kosovo, architects such as Sean Godsell developed his “future shack,” using a standard shipping container and an unfolding roof to provide shade. In 2003, Architecture for Humanity sponsored a design competition for a mobile HIV/AIDS clinic for Africa, with KHRAS Architects designing the first place entry, with a metal-framed, self-contained, lockable structure that also incorporates local materials. And, with students from the University of Minnesota’s School of Architecture, they designed and arranged to build a prototypical laundry building in Mississippi, to serve people living without washers and dryers in emergency trailers after Katrina and to provide a gathering place in communities that had lost their public infrastructure.



Figure 31.2 With students from the University of Minnesota, Architecture for Humanity designed and arranged to build a prototypical laundry building in Lakeland, Mississippi, to serve people after Katrina and to provide a gathering place in communities that had lost their public infrastructure.

Other organizations, such as Design Corps, founded by Bryan Bell, and Public Architecture, established by John Peterson, have focused more of their efforts on the chronically impoverished in the United States. Design Corps has developed prototypical farmworker housing that is as easily moved as the migrant laborers it seeks to accommodate. By engaging in community design, offering design build courses for students, and organizing an annual conference for those working in this area, Design Corps has also become a major force in the public-interest architecture movement.¹¹

John Peterson's Public Architecture has taken a somewhat different tack. It has tried to leverage the talents of the U.S. architectural community to do pro bono work through the 1 percent program, which asks architects to give one percent of their time to public-interest design. The success of that effort has been extraordinary, and it shows how much people want to contribute if given the chance. Public Architecture has also conducted some notable competitions for facilities that almost never get the attention

of the design community, such as the day laborer stations that will provide shelter, off-the-grid power, and employment and meeting space for this important workforce.¹²

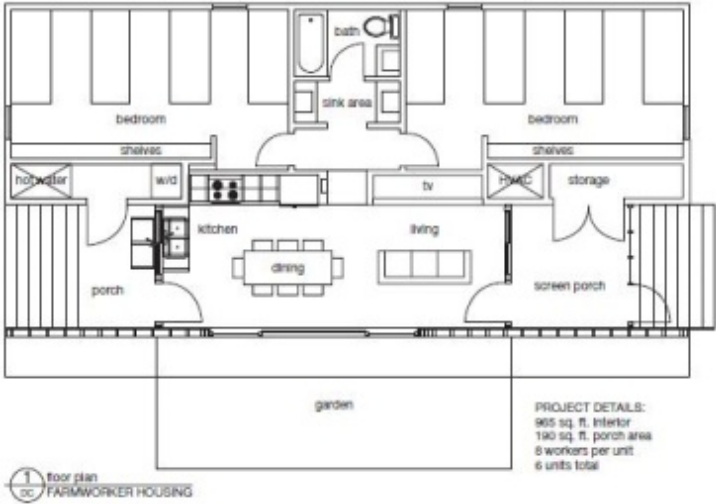


Figure 31.3 Design Corps has developed prototypical farmworker housing as mobile as the migrant laborers it accommodates. By engaging in community design and by offering design build courses and an annual conference, Design Corps has also become a major force in the public-interest design movement.



Figure 31.4 Public Architecture has focused on the design of facilities that almost never get the attention of the design community, such as the day laborer stations that will provide shelter, off-the-grid power, and employment and meeting space for this important workforce.

Other architects have begun to look at unconventional materials as low-cost, sustainable alternatives to what the market has to offer. Richard Kroeker and students at Dalhousie and Minnesota have worked with aboriginal and native communities to adopt indigenous approaches to construction using pliable wood materials in various woven and tied configurations drawn from what is immediately available on or near a site. He has also begun to look at materials in the modern waste stream, such as unused telephone books held in compression to form bearing walls of a “phone book building.”¹³

Another architect working in this area is Wes Janz, whose students at Ball State, along with I-Beam Design, have developed ways to use the 1.9 million wood pallets destined for landfills in the United States for housing, drawing on the widespread use of pallets in squatter housing around the world. These examples and others in his exhibition and book, *OneSmallProject*, revise the ancient idea that we build with what we have at hand, and that we empower people to build for themselves.¹⁴





Figure 31.5 Richard Kroecker and his students at Dalhousie University have begun to look at materials in the modern waste stream, such as unused telephone books held in compression to form bearing walls of a “phone book building,” whose massive walls also provide ample insulation.

All of these efforts suggest a new kind of practice for architects, based on advocacy, activism, and attention to what the rest of the world wastes. However, these architectural inventions have, so far, remained largely research. If we are going to create a more sustainable and equitable world, we need to apply these lessons on a broader scale, to people of all types. How might these examples serve not only the world’s billions of slum dwellers, and potentially its millions of environmental refugees, but also the developed world, where some of the greatest inequity and unsustainability occur? For that, we need to rethink the social contract we have related to equity and the environment.



Figure 31.6 House with Sleeping Loft, Pallet Structure #3. Wes Janz's students at Ball State University, along with I-Beam Design, have developed ways to use the 1.9 million wood pallets destined for landfills in the United States for housing, drawing on the widespread use of pallets in squatter housing around the world.

What We Can Live Without

Historically, we have thought of that social contract in two very different ways. The seventeenth-century philosopher Thomas Hobbes imagined a life in the “state of nature” as one that he famously characterized as “nasty, brutish, and short,” a condition of constant warfare “of every man, against every man.”¹ He argued that, because of these inequalities in nature, humans entered into a social contract to create powerful central authorities—the Leviathan, as he called it—in order to achieve the equality and security that he thought impossible living close to nature.

The eighteenth-century philosopher Jean-Jacques Rousseau imagined just the opposite. He envisioned the “state of nature” as one characterized by the peaceful co-existence of equals, who lived with abundance and with little need for property. Conflict arose, according to Rousseau, the first time someone put a stake in the ground and claimed land as their own, leading to the inequities of property ownership and the need for a social contract that would protect people’s rights, while maximizing our personal freedom.²

Political theorists still study Hobbes and Rousseau, finding in their work justification for authoritarian or libertarian ideologies, respectively. But we can learn something else from them: what it means to imagine a “state of nature” in today’s world, given the unsustainable and inequitable ways in which we now live in North America. Both Hobbes and Rousseau saw nature in much the same way: as a near infinite resource that is there for our use. And both

saw equity in terms of property and political power, a matter of law and regulation. We now know, however, that the natural environment is anything but infinite, and that our fate, as a species, is intimately connected with its health. At the same time, we now know that equity takes many different forms, only some of which have to do with property and political power.

A new social contract, based on how we know the world to be, would have almost the opposite characteristics of those we have inherited from Hobbes and Rousseau. It would be a contract that recognizes and rewards people according to how well they husband finite resources, improve the natural environment, serve those most in need, and give as much as possible to others. Equity would no longer be, as it was for Hobbes and Rousseau, primarily a matter of keeping greed in check, since that assumes that the primary motive of human action is to acquire as much property or power as possible. In the new social contract, freedom would not consist of how much property we can own, instead it would be a matter of how much we can live without, as Thoreau said,³ and equity would be a matter of how much we can “live simply so that others may simply live,” as Gandhi is credited with having said. In a future in which many of us may be on the move, living lightly has real advantages.

This, of course, sounds impractical, idealistic, and naive in our ego-driven, winner-takes-all world, but it is anything but that. It is the most practical, pragmatic, and realistic alternative we have at a time when we have just a few generations to avoid the kind of environmental collapse and subsequent social turmoil that an increasing number see in our future. If we are to meet William Rees’s challenge of reducing our impact on the environment by 90 percent in fifty years, and if we are to make marked improvements on the dozen factors Jared Diamond sees as our greatest threats, we need to transform what we value, how we share, and who we embrace in the global community.

Our history and recent practices suggest that we will default to either Hobbes’s or Rousseau’s idea of the social contract, with some advocating for a strong authority imposing controls through strict regulation and others calling for a libertarian loosening of restrictions in order to maximize individual freedom. But at a time of rapidly

growing population—estimated to be roughly nine billion people before the end of the twenty-first century—and rapidly diminishing resources, neither of these older social contracts work.⁴ There will be too large and diverse a population for a singular authority and too few, finite resources for an expansion of personal liberty. The new social contract will require us to internalize that authority and that freedom: to learn, as an essential part of being human, how to value the group as much as the individual, future generations as much as the present, and other species as much as ourselves.

This new contract isn't really new. The three dominant ethical traditions in the West all align with this shift in thinking, as does the work of a growing number of architects. Virtue ethics, with its focus on character traits such as a prudence and justice, demands that we look to the wellbeing of others, and that we live modestly and with humility. The work of the late Samuel Mockbee exemplifies this architecturally. His Rural Studio for Auburn University students has created a number of houses and public buildings for some of the most needy people in one of the poorest counties in the United States. Using recycled materials—such as used tires for walls, reused windshields for windows, and discarded license plates for cladding—the Rural Studio has designed and built some of the most powerful projects of the late twentieth century, showing how what Mockbee called the “old-fashioned virtue” of giving to others can be the basis for the creation of community.⁵

Deontological ethics, with its concern for doing what is right regardless of consequences, reinforces our responsibility toward other species and future generations, and our obligation to act with them always in mind. Such an ethic underlies most utopian thinking, and that tradition remains as a way of showing what a new social contract might look like. Michael Sorkin has taken such an approach, exploring, in a number of urban designs, new forms of sustainable communities.⁶ For example, his Penangs Peaks project—a mixed-use community of housing, offices, and various public and commercial facilities—will be self-sufficient in terms of water and waste management. The project envisions a series of foliage-clad towers arranged around a large park, showing how large numbers of

people can live in urban settings with a minimal impact on the local environment.



Figure 32.1 The Rural Studio at Auburn University has created a number of houses and public buildings for some of the most needy people in one of the poorest counties in the United States. Their design of a \$20,000 house shows how good design can produce more value for less money than a mobile home.

Finally, utilitarianism, with its goal of maximizing the happiness of as many as possible, demands that we include all other beings in its calculus of the greatest good for the greatest number, with attention to the process and consequences of all that we do. A socially active architect such as Thomas Dutton demonstrates that in his work in Cincinnati's Over-the-Rhine district, with the Over-the-Rhine Housing Network, representing a more participatory approach.⁷ He and his Miami University students have designed and renovated a number of

living and commercial spaces, including a laundromat, two single-family townhouses, and a number of apartments, with budgets in the \$5,000 to \$10,000 range. Dutton's students have also explored a kind of guerilla urbanism, using utility trucks to bring information related to poverty to well-to-do parts of town, and using public parks for temporary exhibitions on social justice issues.

Nor is the underpinning for this new social contract strictly secular and ethical. All of the major religious and spiritual traditions in both the East and the West recognize the values we now need to embrace if we are to avoid a global collapse, values such as moderation and self-restraint, charity and mercy. At the heart of almost every religious text lies the message that happiness that comes from giving away what we don't absolutely need, serving as often as possible the poorest and most disadvantaged, and helping others as much as possible, without expectations of anything in return. Myriad religious communities remain the mainstays of housing the homeless, and in so doing show us what we will have to deal with as hundreds of millions of environmental refugees face similar conditions.

The social contract underlying such work will serve us particularly well in what lies ahead. As we saw in the aftermath of the flooding of New Orleans, it was charitable individuals who initially came to the aid of others without regard for who they were. Rugged individualism and enlightened self-interest may work as a social ethic in periods of abundance, but in the coming era of scarce resources, those who value cooperation, interdependence, and mutual aid and who see wealth in non-material, ethical, and spiritual terms, will be the ones who thrive. Such were the values and the wealth of the indigenous people of North America, and if we want to live sustainably on this continent for generations to come, they will need to become ours as well.

And such values also lie deep in Western culture, as the historian David Shi has argued: "the most important historical influence on American simplicity has been the combined heritage of Greco-Roman culture and Judeo-Christian ethics. Most Greek and Roman philosophers were emphatic in their praise of simple living, as were the Hebrew prophets and Jesus."⁸ Shi warns that "proponents of the

simple life have frequently been overly nostalgic about the quality of life in olden times, narrowly anti-urban in outlook, and too disdainful of the benefits of prosperity and technology,” and he calls, instead, for “an ethic of self-conscious material moderation... [that] requires neither a log cabin nor a hairshirt, but a deliberate ordering of priorities so as to distinguish between the necessary and superfluous, useful and wasteful, beautiful and vulgar.”

Architecture and design generally should lead in this ethic of selfconscious material moderation. After all, good design begins with questions of what is necessary, useful, and beautiful in each situation and with each project, just as bad design often has superfluous, wasteful, and vulgar aspects to it. Where design has often failed us, and where it needs to lead us in the future, lies in its ability to temper the sheer quantity of material goods and sheer size of the physical environments that so many people have come to expect and see as normal. An ethic of material moderation needs to extend beyond the individual object or space, to encompass the amount of such things we think we need, as in architect Ross Chapin’s designs for cottages in pocket neighborhoods.⁹



Figure 32.2 Conover Commons, Redmond, WA. Ross Chapin Architects. The Cottage Company developer. An ethic of material moderation needs to extend beyond the individual object or space, to encompass an entire community. Ross Chapin's designs for pocket neighborhoods reveal the richness possible, with very small "cottages" sharing ample outdoor community space.

This is counter to the idea that runs deep in Western culture, that each individual has the right to live as they see fit, even if that means living excessively and wastefully. As Shi acknowledges, "What meaningful simple living does require is a person willing it for himself. Attempts to impose simple living have been notoriously ephemeral in their effects. For simplicity to be both fulfilling and sustaining, one must choose it, or, as the Puritans might have said, one must be chosen for it."¹⁰ But design plays a powerful role in what people will for themselves, and architects and designers have much more influence than often assumed.

Designer Philippe Starck, for example, envisioned a series of products for a major U.S. retailer in which every product, designed to have a very low cost, had another use built into it: a wastebasket that became a stool, a pen that became a light, etc. Starck has also said in lectures that while he has designed chairs that cost \$100, his goal is to design a \$1 chair, so inexpensive that every person on the planet could afford one.¹¹ Starck's approach shows the two-pronged way in which design can move us to a world based on material moderation. On one hand, designers can build multiple purposes and continual reuse into everything we do, so that people simply need fewer things in order to meet their daily needs. And on the other, designers can invert the unfortunate equation of design with costliness and, instead, make every design as absolutely inexpensive as possible.

The economist Robert Frank has shown how people will spend excessively in pursuit of status and feel deprived unless they, too, have what those whose status they aspire to also have, an endless upward spiral of empty aspiration that Frank calls "positional arms races."¹² The challenge—and opportunity—for architects and designers lies in using this search for status to reverse the spiral and have people aspire to having as little as possible and living as simply

as possible, not by imposing it on them, but by helping them will it for themselves. This has happened before. The history of design shows how periods of excess—the Rococo period of the eighteenth century, the Victorian period of the nineteenth century—often precede periods of great restraint—Neo-Classicism, Modernism. Never have we needed an extended period of restraint more than now, and it may, once again, fall on the design community to help lead us to that place by making the question of what we can live without the question that everyone will now have to begin to live with.

The Adulthood of the Species

In *The Sociology of Intellectual Life*, sociologist Steve Fuller lays out an agenda for academics—and indeed, all professionals whose livelihood depends upon the discovery or application of knowledge—that pertains to the new demands we face as civilization and a species. “Intellectuals,” writes Fuller, “differ from ordinary academics in holding that the truth is best approached not by producing new knowledge, but by destroying old beliefs... The intellectual’s ethic is both exhilarating and harsh, for it places the responsibility for thinking squarely on the thinker’s shoulders. Every act of deference thus becomes an abdication of one’s own intellectual authority.”¹ He goes on to argue that the overly deferential behavior of too many academics and professionals comes from being “rewarded for feats of ventriloquism, that is, an ability to speak through the authority of others. The result is institutionalized cowardice,” epitomized in the design community by the effete architect and educator in Charles Dickens’s novel *Martin Chuzzlewit*—Mr. Pecksniff—who never does anything that others haven’t done before.²

While such over-cautiousness may not matter much in a period of stability and security, it becomes highly destabilizing in a time of rapid change and great flux such as now. The very intellectuals who should lead the way forward have too often become followers, suggests Fuller, having become too timid to take on the very institutions and professions that have granted the tenure or license that intellectuals supposedly need in order to speak out against the

status quo. And just as ironically, the public has begun to question the need for the protections of tenure and licensure if those who benefit from it do not use it on behalf of the public interest. Why have such institutionalized protections if tenured academics or licensed professionals never put their position to the test by speaking out about issues that matter to the public and communicating in venues and in ways that the public will hear and understand?

Fuller gives a humorous, step-by-step guide on how to overcome the public stage fright of academics. The first step: “Whatever has already been said... whatever you do, don’t say those things.” And of the significant ideas that have not been said, “which ones come with a pretext likely to promote maximum exposure, participation, and impact? That’s what you say.” This process involves learning “how to improvise on the world-historic stage,” as Fuller calls it, echoing Hegel, and how to “say what needs to be said in a situation where you are well positioned to say it.”³ Were we to follow that advice, what ideas seem most likely to have the greatest impact? Let me suggest two.

The first involves recognizing that we remain an immature species and that we will need to mature very quickly if we hope to survive into the adulthood of our species. This is not a new idea. The Native American Ojibway think of human beings as infants, dependent upon and responsible for the care of Mother Earth, relying, as children do parents, on other species, who can live quite well without us.⁴ That idea underscores the hubris of humans putting ourselves at the peak of the pyramid of life, and the childishness of our exploitation and willful extinction of so many of the other species upon which we depend. And it clarifies the challenge we face: will we, as the children of this planet, grow up and learn to respect each other and our elders, as the Ojibway call other animals and plants, or will we, like tragically reckless youth, destroy what we most need in order to survive?

Our non-survival as a species seems so remote a possibility that we rarely raise it, in large part because we have convinced ourselves that our intelligence and technology have granted us a kind of invincibility. And yet, like careless teenagers careening down a hazardous road while believing they will live forever, the human

species remains among the most vulnerable of all. Human societies have never been more globally interconnected and technologically efficient, and less resilient: less able to handle, physically and psychologically, the disruptive changes we will likely face as we encounter planetary tipping points in the decades ahead.

We already know where some of those tipping points lie: prolonged droughts that we cannot prevent, widespread crop failures we cannot stop, and global pandemics for which we have no cure. And we have seen how human communities can drive themselves into near extinction, as happened on Easter Island after the native population denuded the landscape, in part to erect their famous statues, and had no way of constructing the canoes they needed to fish and feed themselves.

It seems ironic, in light of this, that people spend so much time arguing about our origin as a species, people who have overwhelming evidence to back up Darwin's claim of our evolution from other species and people who see humanity resulting from intelligent design, based either in faith or in facts that don't seem to fit evolutionary theory.⁵ A more productive debate would focus not on Darwin's idea of the origin of the species, but instead on another Darwinian idea: the survival of the species—our own.

We might well ask, for example: what adaptive benefit arises from our remarkable ability as humans to delude ourselves about our vulnerability as a species? Knowing full well that all other species depend on the right environmental conditions in order to survive, why do we hold to the illusion that we, of all species, can avoid that fact? And clearly comprehending the finite nature of the resources on this planet, why do we continue to act as if they were infinite and to hold to political ideologies and economic incentives that perpetuate our over-consumption of what we know cannot last? When, in short, will we rouse ourselves from our technologically induced and socially enforced stupor long enough to acknowledge the immaturity of our relationship with the planet and with each other, before we go the way of the dodo bird?

Reaching the adulthood of our species will demand that we leave our collective adolescence behind and grow up. This will entail self-sacrifice: consuming no more than what we absolutely need to

live. It will demand delayed gratification: stewarding the resources we will need indefinitely to survive. And it will require service to others before ourselves: protecting all those who we depend on—be they other people or all the plant and animal populations with whom we share the planet—that future generations of humans will need to thrive. We know how to do this as individual adults, partners, parents, and friends, but we have yet to achieve this as a species, to put in place a human society in which justice and the good of others reign. And we have yet to speak the truth to all those who would call such sentiments childish or naive or who elevate greed, selfishness, or power as worthy ends. They are the true juveniles among us, too immature to see the self-destructiveness in what they espouse.

The adulthood of our species will also require that we see the connections among things often kept separate and thought of as distinct, resisting the temptation to reduce the world to established categories, fixed identities, or defined territories, while embracing the dynamic complexity, heterogeneity, and non-linearity that characterizes healthy ecosystems. Our maturation will also come with the recognition that what makes youth truly valuable is not the envy and selfishness around which we have built so much of our current economy and society, but instead the creativity, imagination, and openness to new experiences and to the construction of new identities.

No one likes to be called childish, least of all the children who like to pass for adults. For that reason, the maturing of the human species to the point where we can inhabit the planet with the same equanimity as all the other species we share it with will take real parenting skill. We may need to use some reverse psychology, not using words like “equity” or “sustainability” in some settings, since they tend to set off the teenage adults among us. And we may need to accept that bottom-up peer pressure will be more effective than top-down rules and regulations, which no one in the teenage of humanity will want to follow. Throughout it all, we will need to keep in mind the question that Gilles Deleuze and Felix Guattari so aptly asked, “Why do men fight for their servitude as stubbornly as though it were their salvation?”⁶ Revealing the servitude that lies at the heart of humanity’s unsustainable practices and exposing the almost

Orwellian misuse of terms like “freedom” and “happiness” in our current global economy and political culture remains one of the most important tasks ahead of us, as we finally grow up as a species—and none too soon.

Media, Metaphor, and Meaning

Marshall McLuhan's well-known phrase, "the medium is the message" has taken on new meaning in our times.¹ Gutenberg's invention of movable type in the mid-fifteenth century led to profound changes in almost every aspect of modern culture, including the rise of the protestant reformation in the sixteenth century, the scientific revolution in the seventeenth century, the democratic revolutions in the eighteenth century, and the industrial revolution in the nineteenth century. It also helped give rise to the machine as a metaphor for reality. The mechanism of the printing press, in other words, helped spawn a conception of the world and everything in it as obeying mechanical laws and operating like a machine. That idea, while a powerful engine behind many of the innovations that have come to characterize the modern world, has also helped prompt the widely held presumption that we, as the makers of machines, have the right to treat the rest of reality as an extension of—and indeed, the very fuel for—the mechanisms we create for ourselves.

Such an idea remains so firmly embedded in the modern world that it will take a long time to change, as it took a long time for the medieval mindset to moderate in the wake of the machine metaphor. But change it will with the profound change in medium we have embarked upon. The digital revolution, as many have observed, constitutes not just an extension of the printed book that has existed since Gutenberg, but also a dramatic change in how we gather data, convey information, and share knowledge. And with it has come an

equally dramatic shift in the dominant view of reality, moving from a mechanistic model to a biological one, from a machine-like to a web-like metaphor, from vertical hierarchies to networked systems.²

Unlike a machine, designed from the start and operated from above as a coordinated system, a web comprises a self-organizing, evolving set of relationships that resist outside control and that operate across myriad nodes and links with no single designer or operator. The worldwide web epitomizes that web-like structure, but so does the “web of life,” as ecologists have come to call nature’s ecosystems, and the social networks that social scientists see as fundamental to human communities.³ That we still see mistaken efforts at top-down control on the part of leaders, misplaced notions of efficiency on the part of managers, and misunderstood conceptions of systems on the part of designers shows how resilient that unresilient way of thinking remains. But we have seen how much such thinking has undermined governments, destroyed companies, and fractured infrastructure, all signs that the several-hundred-year-old mechanistic metaphor has begun to fail us. And we have also seen enough of the success of socially mediated political campaigns, of entrepreneurial web-based businesses, and of invincible networks of like-minded advocates-for-a-cause to know how powerful this new metaphor can be. No one needs to impose it or decree it. As happened with the printed book, the digital web will prevail through its sheer ability to empower those left out of the previous reign.

This change in media and metaphor will also bring a change in methods, as happened in the wake of Gutenberg. For instance, a web-like world will likely see those forces that arose in the wake of the Enlightenment diminish, and less hierarchical and less clearly defined structures emerge. We may see the waning of competitive or adversarial relationships and the emerging of cooperative and collaborative ones, as the work of game theorists like John Nash has suggested;⁴ the withering of national economies and the growing of metropolitan ones, as economic analysts such as Jane Jacobs have argued;⁵ the weakening of literacy and the strengthening of visual culture, as the work of theorists such as Ivan Illich has asserted;⁶

and the wasting away of expert-based authority and the rise of vernacular culture and the amateur, as cultural observers like Charles Leadbeater have posited.⁷

Changes in the meaning of what we do will also likely occur as a result of this shift. The modern world has focused on the creation of jobs, and developed public policies around having a job and helping those without jobs get them. And as economist Jeremy Rifkin has shown, we have entered a period characterized by the disappearance of jobs, which undermines the very idea of jobs as the basis for one's identity and meaning.⁸ Instead, we seem headed to a time in which doing meaningful work will prevail over having a good-paying job. Jobs can disappear or dwindle, but there remains an almost infinite amount of work to do in the world, and as a result an almost infinite number of opportunities for people seeking personal satisfaction through service to others.

In the design fields, for example, the global economy has led to a dramatic decrease in the number of jobs, as computer tools have greatly increased the productivity of people and the geographical reach of professionals. At the same time, with billions of people poorly housed and unsafely situated, the amount of work for designers to do has grown enormously. This represents a turning point for the design professions akin to that faced by the health fields in the nineteenth century and the legal fields in the twentieth.

The legal profession's transformation in the twentieth century offers one way of thinking about this.⁹ Prior to the Great Depression, legal education focused primarily on preparing lawyers for trying cases in court. But as the supply of trial lawyers outgrew the demand and as social and economic change brought new opportunities, there arose a new conception of the law—legal realism—that viewed the law as an interdisciplinary, value-laden, and socially consequential field. In its wake, legal education began to move away from the formal analysis of cases and the narrow focus on principles toward an emphasis on legal thinking and on the broad application of that thinking in the world. As a result, the legal profession has become involved (for better or worse) in almost all aspects of our lives, with many lawyers never setting foot in a courtroom.

Other fields, including the design professions, seem in the midst of a similar transformation. Since the 1960s and the rise of activism, professional education has expanded to embrace a wide range of once-radical activities, including critical theory, community participation, evidence-based decision-making, integrated practice, environment-behavior research, and sustainability studies, among many others.¹⁰ Like legal realism, these diverse areas of investigation sometimes seem at odds with each other, but they all share a realist commitment to addressing social, environmental, and economic inequities and to changing rather than simply embellishing the world as it is.

This expansion of purview does not negate the value of traditional professional education. Just as law schools still produce trial lawyers, so too will those in other fields like design still educate students to practice in ways that serve fee-paying clients. But the shift in approach that happened in legal education in the twentieth century will—and has already begun to—occur in most other professions in the twenty-first, in response to the overwhelming disparity between the demands of billions of people in need and the supply of professionals able to address those needs.

As happened with legal realism, this shift will likely lead to a more interdisciplinary form of education, preparing graduates for much wider applications of their knowledge. On one hand, that may prompt a new emphasis on epistemology—on how we think—and a de-emphasis on defining our fields according to the traditional results of practice. On the other hand, this shift may lead to more specialization, based not on conventional categories, but on the changing nature of people's needs and the problems they face. Both of these trends—the broader application and narrower specialization of knowledge—will, in turn, demand a greater emphasis on research in professional fields like design. Understanding the nature of the needs of people and the planet and the most appropriate and resilient response to them will become paramount as we go through challenging and sometimes catastrophic changes in the century ahead of us.

The Nature of Things to Come

As we have seen throughout this book, the fracture-critical nature of the world that we have constructed and the more resilient future that we need to create both revolve around the question of scale. It may seem from the discussion so far that large-scale systems remain inherently vulnerable to catastrophic collapse and that small-scale systems can resist such consequences, or at least prevent a collapse from affecting a large number of people. But the real problem lies in the disjunction between the scale of our thinking and our action. Most fracture-critical systems and structures represent large-scale actions arising from small-scale thinking—from looking at the shortest paybacks, the narrowest benefits, and the most immediate returns to those with the most invested. “The essential problem,” wrote historian Alfred Zimmern, “is how to govern a large-scale world with small-scale local minds.”¹

We cannot change the scale of the world, but we can change the scale of our thinking about it. As the sociologist of disasters Enrico Quarantelli has compellingly argued, disasters are fundamentally social events that not only disrupt and alter human activities and relationships, but also arise out of how we construct the physical world.² Natural events like tremors, hurricanes, or volcanoes do not constitute disasters until we have made ourselves vulnerable to their effects, according to where we situate and how we accommodate ourselves. As the saying goes, “Earthquakes don’t kill people. Buildings do.”

Why we continue to put ourselves in harm's way may have a lot to do with what sociologist Lee Clarke describes as “probabilist” as opposed to “possibilist” thinking.³ Many of those in positions of power and authority tend to be probabilists when it comes to disasters, argues Clarke, accepting a high degree of risk because of the benefits it can accrue for the very elites doing the disaster planning. The stressing of systems to the point of collapse exemplifies this behavior. Business and political elites often have much to gain and little to lose on the way up the exponential stress curves we have seen, while everyone else has the most to lose on the rapid descent once rupture occurs. Clarke calls, instead, for “possibilist” thinking, imagining the worst that can happen and realistically planning for that. Such “possibilist” thinking underpins this book and links disaster planning to design thinking: the iterative and participatory process of imagining future scenarios and critiquing them according to all that could possibly go wrong or fail to perform as expected.

Design thinking also involves getting things in their correct scale, and accounting for possible problems at all scales. Too much disaster planning produces what Clarke calls “fantasy documents,” that often propose either overly simplistic solutions—assuming that everyone could evacuate New Orleans by car in the event of a levee break, for example—or overly complex ones—having so many emergency systems and procedures on the Deepwater Horizon, for instance, that no one knew how to proceed prior to the BP oil spill. The same fracture-critical thinking that led to these disasters, in other words, too often underpins our response to them, recalling the observation of Albert Einstein that “We can’t solve problems by using the same kind of thinking we used when we created them.”⁴

Resilient thinking, like design thinking when done well, ensures that the best possible solution to a problem has the appropriate degree of complexity at the proper scale, while assessing effects at a range of other scales, both smaller and larger than the one the problem seems to involve. Just as New Orleans needed a much more redundant levee system, with many more layers and easily containable compartments in the case of a break, so too did New Orleans need a much more robust evacuation system, with many

more modes of transporting people to safety and places of refuge for those who could not escape. At the same time, the larger-scale destruction of Louisiana's delta wetlands and the smaller-scale destruction of community in some of New Orleans's more impoverished areas both had direct bearing not only on the levee system's ability to protect people, but also on the city's ability to evacuate people. Disaster response, like a good design response, considers possible consequences at a number of scales and the impacts of systems that may seem unrelated to the problem at hand.

And, going forward, good design and planning should start with the assumption that nothing will work as intended—or even at all.⁵ We should, in other words, take nothing for granted and act as if we have only those within our community and that within our control to depend on. That may seem excessively alarmist or pessimistic, but it is, in fact, the only way to avoid the true alarm of being a victim of a catastrophic failure that we never saw coming and over which we have no control. And it is the only way to achieve the real optimism of knowing that we can survive, and indeed thrive, regardless of what may happen. We are at our best when we have imagined and accounted for the worst.

This ultimate principle of resilient design has several consequences. First, it unleashes the creativity, commitment, and community that seem to arise among groups of people as they deal with the aftermath of a catastrophe. As author Rebecca Solnit has documented in *A Paradise Built in Hell*, disasters, “demonstrate what is possible or, perhaps more accurately, latent: the resilience and generosity of those around us and their ability to improvise another kind of society. Second, they demonstrate how deeply most of us desire connection, participation, altruism, and purposefulness.”⁶ Solnit's analysis also shows how the elites of society, “hierarchies and institutions... are often what fails in such crises. Civil society is what succeeds, not only in an emotional demonstration of altruism and mutual aid but also in a practical mustering of creativity and resources to meet the challenges.”

Second, the principle of taking nothing for granted underscores the need for, and indeed the efficiency of, providing multiple independent and redundant ways of doing things. This may sound inefficient or

not cost effective, but history proves just the opposite. Humans have, for most of our history, created our world this way, built with what we had readily available and easily attainable, fueled by renewable resources that we could repeatedly harvest without diminishing them for future generations, and conceived of as multifunctional and quickly adaptable to the unforeseen circumstances that await us. We have come to see those older ways of living as primitive or impoverished. But we need to see the work of our ancestors anew, not as more rudimentary than our own, but quite the contrary as more resilient and resourceful, and more flexible and dependable than the extremely fragile, fracture-critical world that we have since created.

Finally, the principle of taking nothing for granted gives back to people the possibility of achieving true happiness. This may sound presumptive and even paradoxical given the unhappiness that often precedes and surely follows a disaster, but true happiness, according to the Roman stoics who lived in a time of serial catastrophes much like our own, lies in attending to that over which we have control: ourselves.⁷ Everything else, according to the stoics, lies beyond our control and so has no effect on our happiness. While seemingly austere or harsh, such stoicism offers not only a way for individuals to retain a sense of hope and even a sense of humor in a fracturecritical world, but also a practical way of withstanding whatever disaster may descend upon us.

As a design strategy, stoicism also gives us a very resilient way to proceed. Just as stoics urged people to imagine the very worst that could happen in order to prepare them for it and to help them appreciate the present, so too should we design the world as if the worst will happen. In such a thought experiment, we might begin by asking: what could possibly occur in any given situation and how would we deal with it, both physically and psychologically? How would we live, for example, in a world without affordable oil or available electricity, without global communications or transcontinental travel, without plentiful food or accessible water, without personal safety or political stability, without a secure income or a sure job?

Most of us, of course, don't want to think of such things, and hope that we never have to, even though we know that billions of people on the planet face some or all of those conditions every day. But, as philosopher John Rawls helped us see, we all live behind what he called the "veil of ignorance," unsure what our future holds and whether or not we will continue to have what we now do, going forward.⁸ Rawls argued that, as a result, every action we take should ensure that the least fortunate among us should benefit from whatever we do, since we may well be that person now or in the future. The same argument applies to the design of our world. We should assume that whatever we have now may not last and that whatever we assume is now available may not be so someday soon.

That ethic seems as far as it could be from that which underlies much of the modern world. As Solnit describes it, "Mobile and individualistic modern societies [argue that]... we are essentially selfish, and because you will not care for me, I cannot care for you. I will not feed you because I must hoard against starvation, since I too cannot count on others. Better yet, I will take your wealth and add it to mine—if I believe that my well-being is independent of yours or pitted against yours—and justify my conduct as natural law... Thus does everyday life become a social disaster."⁹ The irony in such an argument lies in using the possibility of disaster to create the true disaster of everyone for themselves and everyone else be damned.

The idea of modern societies as social disasters—slow-motion disasters—comes from the mistaken belief that we can control other people—"Better yet, I will take your wealth"—and other species—"I must hoard against starvation." This makes the fundamental error, as stoicism and indeed almost every religion has long recognized, of thinking we can control what isn't under our control, while missing the point that we can only control ourselves. Such self-control leads not to selfishness, but just the opposite: requiring very little, wanting nothing more, and stewarding whatever we have. That may sound like impoverishment to those who have become accustomed to needing a lot, wanting too much, and wasting much of what we have, but such values, which have helped fuel the exponentially stressed systems, structures, and environments that we depend on, also

leave us completely unprepared for the consequences of their collapse.

Hell or Paradise?

After studying people's behavior in the wake of five major catastrophes, Solnit shows that "the prevalent human nature in disaster is resilient, resourceful, generous, empathic, and brave." She concludes that "Disaster reveals what else the world could be like... reveals mutual aid as a default operating principle and civil society as something waiting in the wings when it's absent from the stage... The task before us is to recognize the possibilities visible through that gateway and endeavor to bring them in to the realm of the everyday."¹ Resiliency, in other words, lies latently in each one of us and is unleashed during and immediately after a disaster. The question that Solnit raises, though, is how to bring that into our everyday lives, how to cultivate resourceful resiliency as a valued trait, stoic self-control as an admired virtue, and unreciprocated generosity as a social norm. This may sound utopian—"the brief utopias that flash up in disaster," as Solnit puts it—but such characteristics will soon become all too real and present in our lives, as we stand here, at the dawn of the twenty-first century, and look ahead to a fracture-critical future full of the disasters we have designed for ourselves. Call it, as Solnit does, "a paradise built in hell," but whether it turns out to be paradise or simply hell depends upon how constructively, creatively, and selflessly we respond.

What might "paradise" look like? First, it would align the scales of event, thinking, and action so that for large-scale problems we would engage in large-scale thinking about possible solutions. For

example, a climate-change or disease-driven collapse of our global food system, as large scale a problem as we might imagine, would require that we think in large-scale terms about the social and environmental effects of feeding the human population. The local foods movement, in that sense, involves not just a small-scale solution to a very big problem, but also a large-scale way of thinking about how we can nourish some seven billion people in an environmentally responsible and socially resilient way. Hell comes from small-minded responses to big problems; paradise, from thinking as broad as the problem itself.

At the same time, small-scale problems require small-scale solutions, attuned to the needs of particular populations and places on the planet. Rather than seek large-scale, universal solutions to local problems, we need to enable people at the smallest and most immediate scale possible to find resolutions that fit their needs and capacities. The “extraordinary communities” that Solnit found arising in response to disasters almost always occurred in a spontaneous, participatory, and ad hoc way, and lasted only as long as required to do the work that had to be done.² We cannot plan such communities, which is precisely the point. Instead, we must find ways to allow them to happen, ideally not just after a disaster but as a way to prevent disasters from occurring in the first place, and of enabling people to form the bonds and to practice the mutual aid that will ensure their survival regardless of the situation they face.

A second feature of “paradise” draws on the first: encouraging webs of alliances and networks of allegiances among people to flourish. As Bill McKibben argues in his book *Eaarth*, we have waited too long to stem the changes we have wrought to our planet, and so our main task now involves preparing ourselves for the worst, building up our local reserves and human resources, while scaling back on our expectations of wealth and exploitation of natural resources.³ McKibben, though, also sees the Internet and its potential for global understanding and information sharing as the one innovation of our time worth preserving and extending. We need, in other words, to build local webs and the world wide web at the same time, and to see them as a continuous, resilient system across scales.

That leads to a third feature of the likely future in front of us: learning to live within our ecological footprint as a species. To understand what that means, consider the following two equations. The one, based on physics, has come to represent the twentieth century: Einstein's $E = mc^2$. Encapsulating the relationship of matter and energy, that equation also epitomizes the last century's pursuit of power, speed, and acceleration, which has helped fuel some of the exponential increases we have traced here. The other equation, based on biology, may come to represent the twenty-first century: $E = m^{3/4}$. As Geoffrey West describes it, "the metabolic rate varies as mass raised to the $3/4$... man is a little less than 100 watts in metabolism (a light bulb)—that's about 2000 calories a day."⁴

That relationship seems to apply to all animal species, with the exception of humans, whose use of technology has massively increased our absorption of energy, with each person now having the metabolism equivalent, according to West, greater than that of a blue whale.

How much energy does our lifestyle [in America] require? Well, when you add up all our calories and then you add up the energy needed to run the computer and the air-conditioner, you get an incredibly large number, somewhere around 11,000 watts. Now you can ask yourself: What kind of animal requires 11,000 watts to live? And what you find is that we have created a lifestyle where we need more watts than a blue whale. We require more energy than the biggest animal that has ever existed. That is why our lifestyle is unsustainable. We can't have seven billion blue whales on this planet. It's not even clear that we can afford to have 300 million blue whales.⁵

The great challenge of our time entails reducing the average human energy requirement by a factor of 110, from 11,000 watts per person to 100 watts. That may seem impossible, but only if we assume that the last hundred years—one-thousandth of our existence as a species—is the norm and all the rest of our history, an aberration. Once we realize that humans long thrived on 100 watts a day, we

can begin to imagine such a world again in the future, one in which people use tools rather than machines, muscle power rather than nuclear power, renewable rather than non-renewable resources, and food rather than the remains of fossils as fuel.

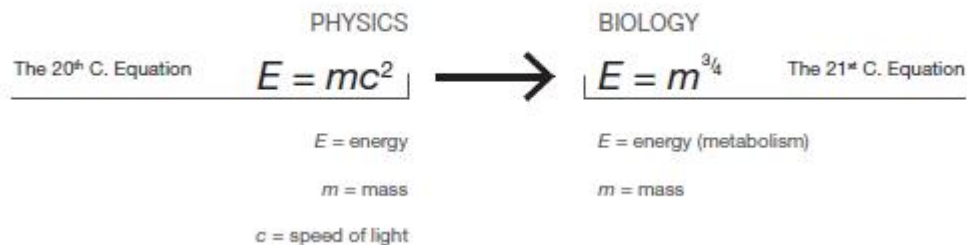


Figure 36.1 Just as Einstein's $E = mc^2$ epitomized the last century, the equation $E = m^{3/4}$ (metabolic rate equals mass raised to the $3/4$ power) may epitomize the twenty-first century.

Doing so leads us to a fourth and final feature of a possible paradise: rediscovering what we once knew. “The age of missing information,” as Bill McKibben called it in his book by that name⁶ has created the paradoxical situation of our having more information than humans have ever had in our history, and at the same time, more missing information than ever before. We have fooled ourselves into thinking that we know more and are better off than those who came before us, but we have confused the appearance of a more primitive existence by our ancestors with the reality that they mostly lived richer and more resilient lives than most of us do now. As McKibben writes, “We... live at a moment of deep ignorance, when vital knowledge that humans have always possessed about who we are and where we live seems beyond our reach. An Un-enlightenment. An age of missing information.”

The task before us amounts to relinquishing our attachment to the unhealthy and unsustainable path we have wandered down over the last two centuries and returning to the path we have long been on as a species, remembering what we once knew, and relishing the wealth, now so often overlooked, of all that is free and in infinite supply: family and friends, love and learning, cultivation and co-creation. In such relationships and activities lies our real resiliency as individuals and sustainability as a species. And to imagine what such

a world, built on such principles, would be like, we have only to look at what our ancestors have left behind for us and at what our progeny would undoubtedly want us to leave behind for them. Let's begin.