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INTRODUCTION**the power of design thinking****an end to old ideas**

Practically everyone who has visited England has experienced the Great Western Railway, the crowning achievement of the great Victorian engineer Isambard Kingdom Brunel. I grew up within earshot of the GWR, and as a child in rural Oxfordshire I often bicycled alongside the line and waited for the great express trains to roar past at more than one hundred miles an hour. The train ride is more comfortable today (the carriages now sport springs and cushioned seats) and the scenery has certainly changed, but a century and a half after it was built the GWR still stands as an icon of the industrial revolution—and as an example of the power of design to shape the world around us.

Although he was the engineer's engineer, Brunel was not solely interested in the technology behind his creations. While considering the design of the system, he insisted upon the flattest possible gradient because he wanted passengers to have the sense of "floating across the countryside." He constructed bridges, viaducts, cuttings, and tunnels all in the cause of creating not just efficient transportation but the best possible expe-

balance tech, commercial, human
efficiency? efficiency

CHANGE BY DESIGN

CP 1

rience. He even imagined an integrated transport system that would allow the traveler to board a train at London's Paddington Station and disembark from a steamship in New York. In every one of his great projects Brunel displayed a remarkable—and remarkably prescient—talent for balancing technical, commercial, and human considerations. He was not just a great engineer or a gifted designer; Isambard Kingdom Brunel was one of the earliest examples of a *design thinker*.

Since the completion of the Great Western Railway in 1841, industrialization has wrought incredible change. Technology has helped lift millions out of poverty and has improved the standard of living of a considerable portion of humanity. As we enter the twenty-first century, however, we are increasingly aware of the underside of the revolution that has transformed the way we live, work, and play. The sooty clouds of smoke that once darkened the skies over Manchester and Birmingham have changed the climate of the planet. The torrent of cheap goods that began to flow from their factories and workshops has fed into a culture of excess consumption and prodigious waste. The industrialization of agriculture has left us vulnerable to natural and man-made catastrophes. The innovative breakthroughs of the past have become the routine procedures of today as businesses in Shenzhen and Bangalore tap into the same management theories as those in Silicon Valley and Detroit and face the same downward spiral of commoditization.

Technology still has not run its course. The communications revolution sparked by the Internet has brought people closer together and given them the opportunity to share perspectives and create

tech & mgmt innovation not enough
need design thinking

THE POWER OF DESIGN THINKING

new ideas as never before. The sciences of biology, chemistry, and physics have merged in the forms of biotechnology and nanotechnology to create the promise of lifesaving medicines and wondrous new materials. But these spectacular achievements are unlikely to help us reverse our ominous course. Just the opposite.

we need new choices

A purely technocentric view of innovation is less sustainable now than ever, and a management philosophy based only on selecting from existing strategies is likely to be overwhelmed by new developments at home or abroad. What we need are new choices—new products that balance the needs of individuals and of society as a whole; new ideas that tackle the global challenges of health, poverty, and education; new strategies that result in differences that matter and a sense of purpose that engages everyone affected by them. It is hard to imagine a time when the challenges we faced so vastly exceeded the creative resources we have brought to bear on them. Aspiring innovators may have attended a “brainstorming” session or learned a few gimmicks and tricks, but rarely do these temporary placeholders make it to the outside world in the form of new products, services, or strategies.

What we need is an approach to innovation that is powerful, effective, and broadly accessible, that can be integrated into all aspects of business and society, and that individuals and teams can use to generate breakthrough ideas that are implemented and that therefore have an impact. Design thinking, the subject of this book, offers just such an approach.

broadly accessible

tech, biz, human
 intuition
 pattern rec
 idea + emotion & fun
 multi media

3P Design thinking begins with skills designers have learned over many decades in their quest to match human needs with available technical resources within the practical constraints of business. By integrating what is desirable from a human point of view with what is technologically feasible and economically viable, designers have been able to create the products we enjoy today. Design thinking takes the next step, which is to put these tools into the hands of people who may have never thought of themselves as designers and apply them to a vastly greater range of problems.

Design thinking taps into capacities we all have but that are overlooked by more conventional problem-solving practices. It is not only human-centered; it is deeply human in and of itself. Design thinking relies on our ability to be intuitive, to recognize patterns, to construct ideas that have emotional meaning as well as functionality, to express ourselves in media other than words or symbols. Nobody wants to run a business based on feeling, intuition, and inspiration, but an overreliance on the rational and the analytical can be just as dangerous. The integrated approach at the core of the design process suggests a "third way."

swimming upstream

I was trained as an industrial designer, but it took me a long time to realize the difference between *being* a designer and *thinking like* a designer. Seven years of undergraduate and graduate education and fifteen years of professional practice went by before I had any real inkling that what I was doing was more than



Design: fr link to hub
 in chain of wheel

simply a link in a chain that connected a client's engineering department to the folks upstairs in marketing.

The very first products I designed as a design professional were for a venerable English machinery manufacturer called Wadkin Bursgreen. The people there invited a young and untested industrial designer into their midst to help improve their professional woodworking machines. I spent a summer creating drawings and models of circular saws that were better looking and spindle molders that were easier to use. I think I did a pretty good job, and it's still possible to find my work in factories thirty years later. But you will no longer find the Wadkin Bursgreen company, which has long since gone out of business. As a designer I didn't see that it was the future of the woodworking industry that was in question, not the design of its machines.

Only gradually did I come to see the power of design not as a link in a chain but as the hub of a wheel. When I left the protected world of art school—where everyone looked the same, acted the same, and spoke the same language—and entered the world of business, I had to spend far more time trying to explain to my clients what design was than actually doing it. I realized that I was approaching the world from a set of operating principles that was different from theirs. The resulting confusion was getting in the way of my creativity and productivity.

I also noticed that the people who inspired me were not necessarily members of the design profession: engineers such as Isambard Kingdom Brunel, Thomas Edison, and Ferdinand Porsche, all of whom seemed to have a human-centered rather than technology-centered worldview; behavioral scientists such as Don Norman, who asked why products are so needlessly

[one lang] design → biz [many lang]

design doing ~~to~~ make object
→
big D design

CHANGE BY DESIGN

confusing; artists such as Andy Goldsworthy and Antony Gormley, who seemed to engage their viewers in an experience that made them part of the artwork; business leaders such as Steve Jobs and Akio Morita, who were creating unique and meaningful products. I realized that behind the soaring rhetoric of "genius" and "visionary" was a basic commitment to the principles of design thinking.

A few years ago, during one of the periodic booms and busts that are part of business as usual in Silicon Valley, my colleagues and I were struggling to figure how to keep my company, IDEO, meaningful and useful in the world. There was plenty of interest in our design services, but we also noticed that we were increasingly being asked to tackle problems that seemed very far away from the commonly held view of design. A health care foundation was asking us to help restructure its organization; a century-old manufacturing company was asking us to help it better understand its clients; an elite university was asking us to think about alternative learning environments. We were being pulled out of our comfort zone, but this was exciting because it opened up new possibilities for us to have more impact in the world.

We started to talk about this expanded field as "design with a small d" in an attempt to move beyond the sculptural *objet* displayed in lifestyle magazines or on pedestals in museums of modern art. But this phrase never seemed fully satisfactory. One day I was chatting with my friend David Kelley, a Stanford professor and the founder of IDEO, and he remarked that every time someone came to ask him about design, he found himself inserting the word "thinking" to explain what it was that designers do. The term "design thinking" stuck. I now use

indus
manuf
make ideas pretty →

design thinking # solve complex problems
THE POWER OF DESIGN THINKING
small d design

it as a way of describing a set of principles that can be applied by diverse people to a wide range of problems. I have become a convert and an evangelist of design thinking.

And I am not alone. Today, rather than enlist designers to make an already developed idea more attractive, the most progressive companies are challenging them to create ideas at the outset of the development process. The former role is tactical; it builds on what exists and usually moves it one step further. The latter is strategic; it pulls "design" out of the studio and unleashes its disruptive, game-changing potential. It's no accident that designers can now be found in the boardrooms of some of the world's most progressive companies. As a thought process, design has begun to move upstream.

Moreover, the principles of design thinking turn out to be applicable to a wide range of organizations, not just to companies in search of new product offerings. A competent designer can always improve upon last year's new widget, but an interdisciplinary team of skilled design thinkers is in a position to tackle more complex problems. From pediatric obesity to crime prevention to climate change, design thinking is now being applied to a range of challenges that bear little resemblance to the covetable objects that fill the pages of today's coffee-table publications.

The causes underlying the growing interest in design are clear. As the center of economic activity in the developing world shifts inexorably from industrial manufacturing to knowledge creation and service delivery, innovation has become nothing less than a survival strategy. It is, moreover, no longer limited to the introduction of new physical products but includes new sorts of processes, services, interactions, entertainment forms,

know
with
make ideas.

and ways of communicating and collaborating. These are exactly the kinds of human-centered tasks that designers work on every day. The natural evolution from *design doing* to *design thinking* reflects the growing recognition on the part of today's business leaders that design has become too important to be left to designers.

Change by Design is divided into two parts. The first is a journey through some of the important stages of design thinking. It is not intended as a "how-to" guide, for ultimately these are skills best acquired through doing. What I hope to do is to provide a framework that will help the reader identify the principles and practices that make for great design thinking. As I suggest in chapter 6, design thinking flourishes in a rich culture of storytelling, and in that spirit I will explore many of these ideas by telling stories drawn from IDEO and other companies and organizations.

The first part of the book focuses on design thinking as applied to business. Along the way we will see how it has been practiced by some of the most innovative companies in the world, how it has inspired breakthrough solutions, and where, on occasion, it has overreached (any business book that claims an unbroken record of success belongs on the "fiction" shelf). Part two is intended as a challenge for all of us to Think Big. By looking at three broad domains of human activity—business, markets, and society—I hope to show how design thinking can be extended in new ways to create ideas that are equal to the challenges we all face. If you are managing a hotel, design thinking can help you to rethink the very nature of hospitality.

linear sequences
to c

connectin
mind map

If you are working with a philanthropic agency, design thinking can help you grasp the needs of the people you are trying to serve. If you are a venture capitalist, design thinking can help you peer into the future.

another way to look at it

Ben Loehnen, my excellent editor at Harper Business, advised me that a proper book needs a proper table of contents. I have done my best to oblige. The truth is, however, that I see things a bit differently. Design thinking is all about exploring different possibilities, so I thought I would start by introducing the reader to another way of visualizing the contents of the book. There are times when linear thinking is called for, but at IDEO we often find it more helpful to visualize an idea using a technique with a long, rich history, the mind map.

Linear thinking is about sequences; mind maps are about connections. This visual representation helps me see the relationships between the different topics I want to talk about, it gives me a more intuitive sense of the whole, and it helps me to think about how best to illustrate an idea. Linear thinkers like Ben are welcome to use the table of contents; more venture-some readers may wish to consult the inside cover and view the whole of *Change by Design* in one place. It may prompt you to jump to a particular section of interest. It may help you retrace your steps. It may remind you of the relationships among different topics of design thinking and may even help you to think of topics that are not covered here but should be.

Experienced design thinkers may find that the mind map is

all you need to capture my point of view. I hope that for everyone else the ten chapters that follow will provide a worthwhile insight into the world of design thinking and the potential it has for us to create meaningful change. If that proves to be the case, I hope you will let me know.

TIM BROWN

Palo Alto, California, May 2009



PART I

what is design thinking?

getting under your skin, or how design thinking is about more than style

In 2004 Shimano, a leading Japanese manufacturer of bicycle components, was experiencing flattening growth in its traditional high-end road racing and mountain bike segments in the United States. The company had always relied on new technology to drive its growth. It had invested heavily in an effort to anticipate the next innovation. In the face of the changing market it seemed prudent to try something new, so Shimano invited IDEO to collaborate.

What followed was an exercise in designer-client relations that looked very different from what such an engagement might have looked like a few decades or even a few years earlier. Shimano did not hand us a list of technical specifications and a binder full of market research and send us off to design a bunch of parts. Rather, we joined forces and set out together to explore the changing terrain of the cycling market.

During the initial phase, we fielded an interdisciplinary team of designers, behavioral scientists, marketers, and engineers whose task was to identify appropriate constraints for the project. The team began with a hunch that it should not focus on the high-end market. Instead, they fanned out to learn why 90 percent of American adults don't ride bikes—despite the fact that 90 percent of them did as kids! Looking for new ways to think about the problem, they spent time with consumers from across the spec-

trum. They discovered that nearly everyone they met had happy memories of being a kid on a bike but many are deterred by cycling today—by the retail experience (including the intimidating, Lycra-clad athletes who serve as sales staff in most independent bike stores); by the bewildering complexity and excessive cost of the bikes, accessories, and specialized clothing; by the danger of cycling on roads not designed for bicycles; and by the demands of maintaining a sophisticated machine that might be ridden only on weekends. They noted that everyone they talked to seemed to have a bike in the garage with a flat tire or a broken cable.



This human-centered exploration—which looked for insights from bicycle aficionados but also, more important, from people outside Shimano’s core customer base—led to the realization that a whole new category of bicycling might reconnect American consumers to their experiences as children. A huge, untapped market began to take shape before their eyes.

The design team, inspired by the old Schwinn coaster bikes that everyone seemed to remember, came up with the concept of “coasting.” Coasting would entice lapsed bikers back into an activity that was simple, straightforward, healthy, and fun. Coasting bikes, built more for pleasure than for sport, would have no controls on the handlebars, no cables snaking along the frame, no nest of precision gears to be cleaned, adjusted, repaired, and replaced. As we remember from our earliest bikes, the brakes would be applied by backpedaling. Coasting bikes would feature comfortable padded seats, upright handlebars, and puncture-resistant tires and require almost no maintenance. But this is not simply a retrobike: it incorporates sophisticated engineering with an automatic transmission that shifts the gears as the bicycle gains speed or slows.

Handwritten note: *Coasting exp. => new bike category*

Handwritten notes at the top of page 15: *entirely 'cycling'*, *novice*, *coast*, and the printed text **GETTING UNDER YOUR SKIN**.

Three major manufacturers—Trek, Raleigh, and Giant—began to develop new bikes incorporating innovative components from Shimano, but the team didn’t stop there. *Designers* might have ended the project with the bike itself, but as holistic *design thinkers* they pressed ahead. They created in-store retailing strategies for independent bike dealers, in part to mitigate the discomfort that novices felt in retail settings built to serve enthusiasts. The team developed a brand that identified coasting as a way to enjoy life (“Chill. Explore. Dawdle. Lollygag. First one there’s a rotten egg.”). In collaboration with local governments and cycling organizations, it designed a public relations campaign including a Web site that identified safe places to ride.

Many other people and organizations became involved in the project as it passed from inspiration through ideation and on into the implementation phase. Remarkably, the first problem the designers would have been expected to address—the look of the bikes—was deferred to a late stage in the development process, when the team created a “reference design” to show what was possible and to inspire the bicycle manufacturers’ own design teams. Within a year of the bike’s successful launch, seven more manufacturers had signed up to produce coasting bikes. An exercise in design had become an exercise in design thinking.

three spaces of innovation

Although I would love to provide a simple, easy-to-follow recipe that would ensure that every project ends as successfully as

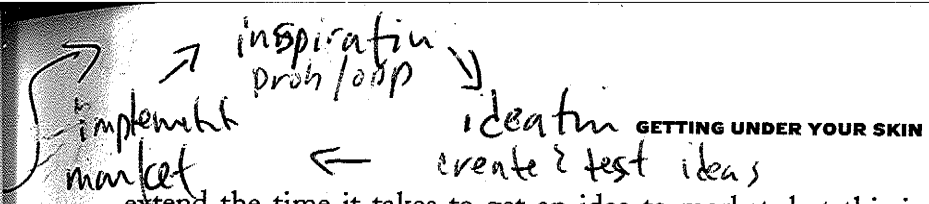
CHANGE BY DESIGN

Sci mgmt
one best way
seq of orderly steps
one time
many ways
iterative

this one, the nature of design thinking makes that impossible. In contrast to the champions of scientific management at the beginning of the last century, design thinkers know that there is no "one best way" to move through the process. There are useful starting points and helpful landmarks along the way, but the continuum of innovation is best thought of as a system of overlapping spaces rather than a sequence of orderly steps. We can think of them as *inspiration*, the problem or opportunity that motivates the search for solutions; *ideation*, the process of generating, developing, and testing ideas; and *implementation*, the path that leads from the project room to the market. Projects may loop back through these spaces more than once as the team refines its ideas and explores new directions.

The reason for the iterative, nonlinear nature of the journey is not that design thinkers are disorganized or undisciplined but that design thinking is fundamentally an exploratory process; done right, it will invariably make unexpected discoveries along the way, and it would be foolish not to find out where they lead. Often these discoveries can be integrated into the ongoing process without disruption. At other times the discovery will motivate the team to revisit some of its most basic assumptions. While testing a prototype, for instance, consumers may provide us with insights that point to a more interesting, more promising, and potentially more profitable market opening up in front of us. Insights of this sort should inspire us to refine or rethink our assumptions rather than press onward in adherence to an original plan. To borrow the language of the computer industry, this approach should be seen not as a system reset but as a meaningful upgrade.

The risk of such an iterative approach is that it appears to



extend the time it takes to get an idea to market, but this is often a shortsighted perception. To the contrary, a team that understands what is happening will not feel bound to take the next logical step along an ultimately unproductive path. We have seen many projects killed by management because it became clear that the ideas were not good enough. When a project is terminated after months or even years, it can be devastating in terms of both money and morale. A nimble team of design thinkers will have been prototyping from day one and self-correcting along the way. As we say at IDEO, "Fail early to succeed sooner."

FAIL EARLY TO SUCCEED SOONER

Insofar as it is open-ended, open-minded, and iterative, a process fed by design thinking will feel chaotic to those experiencing it for the first time. But over the life of a project, it invariably comes to make sense and achieves results that differ markedly from the linear, milestone-based processes that define traditional business practices. In any case, predictability leads to boredom and boredom leads to the loss of talented people. It also leads to results that rivals find easy to copy. It is better to take an experimental approach: share processes, encourage the collective ownership of ideas, and enable teams to learn from one another.

A second way to think about the overlapping spaces of innovation is in terms of boundaries. To an artist in pursuit of beauty or a scientist in search of truth, the bounds of a project may appear as unwelcome constraints. But the mark of a designer, as the legendary Charles Eames said often, is a willing embrace of constraints.

Without constraints design cannot happen, and the best design—a precision medical device or emergency shelter for

2 dt: embrace of competing constraints

CHANGE BY DESIGN

disaster victims—is often carried out within quite severe constraints. For less extreme cases we need only look at Target's success in bringing design within the reach of a broader population for significantly less cost than had previously been achieved. It is actually much more difficult for an accomplished designer such as Michael Graves to create a collection of low-cost kitchen implements or Isaac Mizrahi a line of ready-to-wear clothing than it is to design a teakettle that will sell in a museum store for hundreds of dollars or a dress that will sell in a boutique for thousands.

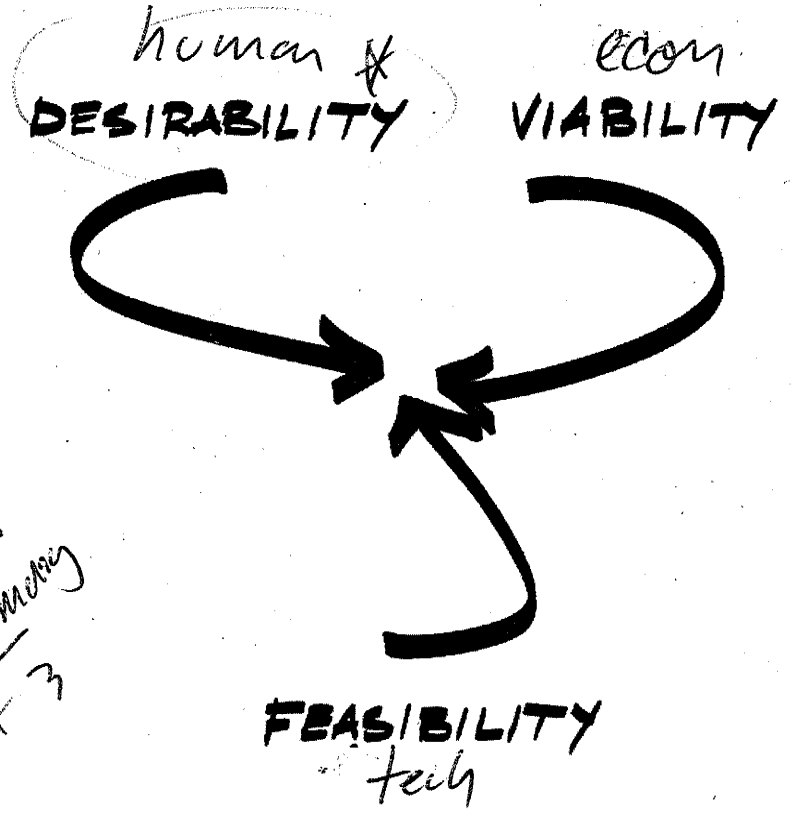
The willing and even enthusiastic acceptance of competing constraints is the foundation of design thinking. The first stage of the design process is often about discovering which constraints are important and establishing a framework for evaluating them. Constraints can best be visualized in terms of three overlapping criteria for successful ideas: feasibility (what is functionally possible within the foreseeable future); viability (what is likely to become part of a sustainable business model); and desirability (what makes sense to people and for people).

A competent designer will resolve each of these three constraints, but a *design thinker* will bring them into a harmonious balance. The popular Nintendo Wii is a good example of what happens when someone gets it right. For many years a veritable arms race of more sophisticated graphics and more expensive consoles has been driving the gaming industry. Nintendo realized that it would be possible to break out of this vicious circle—and create a more immersive experience—by using the new technology of gestural control. This meant less focus on the resolution of the screen graphics, which in turn led to a less expensive console and better margins on the product. The Wii

3 constraints (perf!)

[P]

GETTING UNDER YOUR SKIN



strikes a perfect balance of desirability, feasibility, and viability. It has created a more engaging user experience and generated huge profits for Nintendo.

This pursuit of peaceful coexistence does not imply that all constraints are created equal; a given project may be driven disproportionately by technology, budget, or a volatile mix of human factors. Different types of organizations may push one or another of them to the fore. Nor is it a simple linear process. Design teams will cycle back through all three considerations throughout the life of a project, but the emphasis on fundamental human needs—as distinct from fleeting or artificially manipulated desires—is what drives design thinking to depart from the status quo.

for it = a key vs b key or f key
 harmony → conformity incremental
 CHANGE BY DESIGN
 20
 innovate

Though this may sound self-evident, the reality is that most companies tend to approach new ideas quite differently. Quite reasonably, they are likely to start with the constraint of what will fit within the framework of the existing business model. Because business systems are designed for efficiency, new ideas will tend to be incremental, predictable, and all too easy for the competition to emulate. This explains the oppressive uniformity of so many products on the market today; have you walked through the housewares section of any department store lately, shopped for a printer, or almost gotten into the wrong car in a parking lot?

A second approach is the one commonly taken by engineering-driven companies looking for a technological breakthrough. In this scenario teams of researchers will discover a new way of doing something and only afterward will they think about how the technology might fit into an existing business system and create value. As Peter Drucker showed in his classic study *Innovation and Entrepreneurship*, reliance on technology is hugely risky. Relatively few technical innovations bring an immediate economic benefit that will justify the investments of time and resources they require. This may explain the steady decline of the large corporate R&D labs such as Xerox PARC and Bell Labs that were such powerful incubators in the 1960s and '70s. Today, corporations instead attempt to narrow their innovation efforts to ideas that have more near-term business potential. They may be making a big mistake. By focusing their attention on near-term viability, they may be trading innovation for increment.

Finally, an organization may be driven by its estimation of basic human needs and desires. At its worst this may mean dreaming up alluring but essentially meaningless products des-

desirability
 desirability
 viability

too much
 [empty fluff]

...tined for the local landfill—persuading people, in the blunt words of the design gadfly Victor Papanek, “to buy things they don’t need with money they don’t have to impress neighbors who don’t care.” Even when the goals are laudable, however—moving travelers safely through a security checkpoint or delivering clean water to rural communities in impoverished countries—the primary focus on one element of the triad of constraints, rather than the appropriate balance among all three, may undermine the sustainability of the overall program.

fr problem → project
the project
 concept → reality

Designers, then, have learned to excel at resolving one or another or even all three of these constraints. *Design thinkers*, by contrast, are learning to navigate between and among them in creative ways. They do so because they have shifted their thinking from *problem* to *project*.

The project is the vehicle that carries an idea from concept to reality. Unlike many other processes we are used to—from playing the piano to paying our bills—a design project is not open-ended and ongoing. It has a beginning, a middle, and an end, and it is precisely these restrictions that anchor it to the real world. That design thinking is expressed within the context of a project forces us to articulate a clear goal at the outset. It creates natural deadlines that impose discipline and give us an opportunity to review progress, make midcourse corrections, and redirect future activity. The clarity, direction, and limits of a well-defined project are vital to sustaining a high level of creative energy.

project: beg-mid-end
 clear goal

The “Innovate or Die Pedal-Powered Machine Contest” competition is a good example. Google teamed up with the bike company Specialized to create a design competition whose modest challenge was to use bicycle technology to change the world. The winning team—five committed designers and an extended family of enthusiastic supporters—was a late starter. In a few frenzied weeks of brainstorming and prototyping, the team was able to identify a pressing issue (1.1 billion people in developing countries do not have access to clean drinking water), explore a variety of alternative solutions (mobile or stationary? trailer or luggage rack?) and build a working prototype: The Aquaduct, a human-powered tricycle designed to filter drinking water while transporting it, is now traveling the world to help promote clean water innovation. It succeeded because of the inflexible constraints of technology (pedal power), budget (\$0.00), and inflexible deadline. The experience of the Aquaduct team is the reverse of that found in most academic or corporate labs, where the objective may be to extend the life of a research project indefinitely and where the end of a project may mean nothing more than the funding has dried up.

the brief

The classic starting point of any project is the brief. Almost like a scientific hypothesis, the brief is a set of mental constraints that gives the project team a framework from which to begin, benchmarks by which they can measure progress, and a set of objectives to be realized: price point, available technology, market segment, and so on. The analogy goes even further.

The Brief: mental constraints, benchmarks, set of objectives
 w/wh/ to begin
 to measure progress
 GETTING UNDER YOUR SKIN
 not set of instructions

Just as a hypothesis is not the same as an algorithm, the project brief is not a set of instructions or an attempt to answer a question before it has been posed. Rather, a well-constructed brief will allow for serendipity, unpredictability, and the capricious whims of fate, for that is the creative realm from which breakthrough ideas emerge. If you already know what you are after, there is usually not much point in looking.

When I first started practicing as an industrial designer, the brief was handed to us in an envelope. It usually took the form of a highly constrained set of parameters that left us with little more to do than wrap a more or less attractive shell around a product whose basic concept had already been decided elsewhere. One of my first assignments was to design a new personal fax machine for a Danish electronics manufacturer. The technical aspects of the product took the form of a set of components that were being supplied by another company. Its commercial viability had been established by “management” and was geared to an existing market. Even its desirability had largely been predetermined by precedent, as everybody supposedly knew what a fax machine was supposed to look like. There was not a lot of room for maneuver, and I was left to try to make the machine stand out against those of other designers who were trying to do the same thing. It is no wonder that as more companies mastered the game, the competition among them became ever more intense. Nor have things changed much over the years. As one frustrated client recently lamented, “We are busting our ass for a few tenths of a percent of market share.” The erosion of margin and value is the inevitable result.

The proof of this can be found at any consumer electronics store, where, under the buzz of the fluorescent lights, thousands

brief < too open: team in fog
too close: outcome incremental
race to bottom

of products are arrayed on the shelves, clamoring for our attention and differentiated only by unnecessary if not unfathomable features. Gratuitous efforts at styling and assertive graphics and packaging may catch our eye but do little to enhance the experience of ownership and use. A design brief that is too abstract risks leaving the project team wandering about in a fog. One that starts from too narrow a set of constraints, however, almost guarantees that the outcome will be incremental and, most likely, mediocre. It transfers to the design realm what economists like to call "the race to the bottom." Not for nothing did its founders call economics "the dismal science."

es. P&G

The art of the brief can raise the bar and set great organizations apart from moderately successful ones. Procter & Gamble is a good example. In 2002 the company embarked on an initiative to use design as a source of innovation and growth. Driven by Chief Innovation Officer Claudia Kotchka, each of P&G's divisions began to add design-led innovation to the strong technical R&D efforts for which the company was justly famous.

Karl Ronn, the head of R&D for P&G's Home Care Division, was one of the first senior executives to see the potential of this approach. His stated goal was not to produce incremental additions to existing products and brands but to inspire innovation that would generate significant growth. This led him to IDEO with a brief that was the ideal mix of freedom and constraint: reinvent bathroom cleaning with an emphasis on what was enigmatically called "the everyday clean." Ronn didn't show up with the latest technology from the lab and instruct the team to package it in streamlines and tail fins. He didn't ask us to grow an existing market by a couple of percentage points.

ideal brief: mix of freedom & constraint => big innovation
conceptual concreteness

Without making the brief too concrete, he helped the team establish a realistic set of goals. Without making it too broad, he left us space to interpret the concept for ourselves, to explore and to discover.

As the project progressed and new insights accumulated, it seemed advisable to adjust the initial plan by introducing additional constraints: a revised price point; a restriction that there be "no electric motors." Such midcourse adjustments are common and are a natural feature of a process that is healthy, flexible, and dynamic. The modifications to the original brief helped Ronn to specify the level of cost and complexity that was appropriate for his business.

mid course
constraints
beg. price pt, tech const.

Simultaneously, these continual refinements of the initial plan helped guide the project team toward the right balance of feasibility, viability, and desirability. Over the course of about twelve weeks, this well-crafted brief led to a staggering 350 product concepts, more than 60 prototypes, and 3 ideas that advanced to development. One of them—Mr. Clean Magic Reach, a multifunctional tool that met every one of the stated criteria—went into production eighteen months later.

guide balance of F&D

The message here is that design thinking needs to be practiced on both sides of the table: by the design team, obviously, but by the client as well. I cannot count the number of clients who have marched in and said, "Give me the next iPod," but it's probably pretty close to the number of designers I've heard respond (under their breath), "Give me the next Steve Jobs." The difference between a design brief with just the right level of constraint and one that is overly vague or overly restrictive can be the difference between a team on fire with breakthrough ideas and one that delivers a tired reworking of existing ones.

300 => 60 => 3 => 1 market



PROJECT TEAMS: interdisc

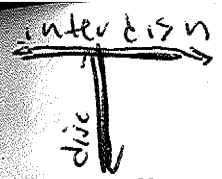
CHANGE BY DESIGN

vs. lone designer
smart teams

The next ingredient is clearly the *project team*. Though it is possible to operate as an individual (the garages of Silicon Valley are still full of lone inventors aspiring to become the next Bill Hewlett or Dave Packard), the complexity of most of today's projects is fast relegating this type of practice to the margins. Even in the more traditional design fields of industrial and graphic design, not to say architecture, teams have been the norm for years. An automobile company has dozens of designers working on each new model. A new building may involve hundreds of architects. As design begins to tackle a wider range of problems—and to move upstream in the innovation process—the lone designer, sitting alone in a studio and meditating upon the relation between form and function, has yielded to the interdisciplinary team.

Although we will never, I hope, lose respect for the designer as inspired form giver, it is common now to see designers working with psychologists and ethnographers, engineers and scientists, marketing and business experts, writers and filmmakers. All of these disciplines, and many more, have long contributed to the development of new products and services, but today we are bringing them together within the same team, in the same space, and using the same processes. As MBAs learn to talk to MFAs and PhDs across their disciplinary divides (not to mention to the occasional CEO, CFO, and CTO), there will be increasing overlap in activities and responsibilities.

There is a popular saying around IDEO that "all of us are smarter than any of us," and this is the key to unlocking the creative power of any organization. We ask people not simply



interdisciplinary: true mix
collective ownership
GETTING UNDER YOUR SKIN

multidisc-advocates of partic field: indiv. ownership

to offer expert advice on materials, behaviors, or software but to be active in each of the spaces of innovation: inspiration, ideation, and implementation. Staffing a project with people from diverse backgrounds and a multiplicity of disciplines takes some patience, however. It requires us to identify individuals who are confident enough of their expertise that they are willing to go beyond it.

To operate within an interdisciplinary environment, an individual needs to have strengths in two dimensions—the "T-shaped" person made famous by McKinsey & Company. On the vertical axis, every member of the team needs to possess a depth of skill that allows him or her to make tangible contributions to the outcome. This competence—whether in the computer lab, in the machine shop, or out in the field—is difficult to acquire but easy to spot. It may be necessary to sift through literally thousands of résumés to find those unique individuals, but it is worth the effort.

But that is not enough. Many designers who are skilled technicians, craftsmen, or researchers have struggled to survive in the messy environment required to solve today's complex problems. They may play a valuable role, but they are destined to live in the downstream world of design execution. Design thinkers, by contrast, cross the "T." They may be architects who have studied psychology, artists with MBAs, or engineers with marketing experience. A creative organization is constantly on the lookout for people with the capacity and—just as important—the disposition for collaboration across disciplines. In the end, this ability is what distinguishes the merely *multidisciplinary* team from a truly *interdisciplinary* one. In a multidisciplinary team each individual becomes an advocate for his or her own

dt: liberates creativity
groupthink: suppresses creativity

technical specialty and the project becomes a protracted negotiation among them, likely resulting in a gray compromise. In an interdisciplinary team there is collective ownership of ideas and everybody takes responsibility for them.

networks of teams
still looking!
electronic collaboration & remote collab.

teams of teams

Design thinking is the opposite of group thinking, but paradoxically, it takes place in groups. The usual effect of "groupthink," as William H. Whyte explained to the readers of *Fortune* back in 1952, is to suppress people's creativity. Design thinking, by contrast, seeks to liberate it. When a team of talented, optimistic, and collaborative design thinkers comes together, a chemical change occurs that can lead to unpredictable actions and reactions. To reach this point, however, we have learned that we must channel this energy productively, and one way to achieve this is to do away with one large team in favor of many small ones.

Though it is not uncommon to see large creative teams at work, it is nearly always in the implementation phase of the project; the inspiration phase, by contrast, requires a small, focused group whose job is to establish the overall framework. When Chief Designer Tom Matano presented the Miata concept to Mazda's leadership in August 1984, he was accompanied by two other designers, a product planner, and a couple of engineers. By the time the project neared completion, his team had grown to thirty or forty. The same can be said of any major architectural project, software project, or entertainment project. Look at the credits on your next movie rental, and check out the preproduction phase. There will invariably be a small

vs one of lots of networks of small teams
big team implementation vs small teams inspiration e-collab
team consisting of director, writer, producer, and production designer who have developed the basic concept. Only later do the "armies" arrive.

As long as the objective is simple and limited, this approach works. Faced with more complex problems, we may be tempted to increase the size of the core team early on, but more often than not this leads to a dramatic reduction in speed and efficiency as communications within the team begin to take up more time than the creative process itself. Are there alternatives? Is it possible to preserve the effectiveness of small teams while tackling more complex, system-level problems? It is increasingly clear that new technology—properly designed and wisely deployed—can help leverage the power of small teams.

The promise of electronic collaboration should not be to create dispersed but ever-bigger teams; this tendency merely compounds the political and bureaucratic problems we are trying to solve. Rather, our goal should be to create interdependent networks of small teams as has been done by the online innovation exchange Innocentive. Any company that has an R&D problem can post a challenge on Innocentive and it will be exposed to tens of thousands of scientists, engineers, and designers who can choose to submit solutions. The Internet, in other words, characterized by dispersed, decentralized, mutually reinforcing networks, is not so much the *means* as the *model* of the new forms of organization taking shape. Because it is open-sourced and open-ended, it allows the energy of many small teams to be brought to bear on the same problem.

Progressive companies are now grappling with a second, related problem. As the issues confronting us become more complex—intricate, multinational supply chains; rapid changes

not just means innovation

X remote collaboration
 email? video conf?

in technology platforms; the sudden appearance and disappearance of discrete consumer groups—the need to involve a number of specialists grows. This challenge is difficult enough when a group is physically in the same place, but it becomes far more challenging when critical input is required from partners dispersed around the globe.

Much effort has gone into the problem of remote collaboration. Videoconferencing, although invented in the 1960s, became widespread once digital telephony networks became technically feasible in the 1980s. Only recently has it begun to show signs of taking hold as an effective medium of remote collaboration. E-mail has done little to support collective teamwork. The Internet helps move information around but has done little to bring people together. Creative teams need to be able to share their thoughts not only verbally but visually and physically as well. I am not at my best writing memos. Instead, put me in a room where somebody is sketching on a whiteboard, a couple of others are writing notes on Post-its or sticking Polaroid photos on the wall, and somebody is sitting on the floor putting together a quick prototype. I haven't yet heard of a remote collaboration tool that can substitute for the give-and-take of sharing ideas in real time.

So far, efforts to innovate around the topic of remote groups have suffered from a lack of understanding about what motivates creative teams and supports group collaboration. Too much has been focused on mechanical tasks such as storing and sharing data or running a structured meeting and not enough on the far messier tasks of generating ideas and building a consensus around them. Recently, however, there have been promising signs of change. The emergence of social networking sites has shown that people

telepresence?

are driven to connect, share, and “publish,” even if there is no immediate reward to be gained. No economic model could have predicted the success of MySpace and Facebook. Technological initiatives such as the new “telepresence” systems being developed by Hewlett-Packard and Cisco Systems, will represent a quantum leap over the videoconferencing systems currently in use.

Numerous smaller-scale tools are already available. “Always on” video links (also called “wormholes”) encourage spontaneous interactions among team members at different sites and increase a group's access to people with expertise located in another city, state, or continent. This capability is important because good ideas rarely come on schedule and may wither and die in the interludes between weekly meetings. Instant messaging, blogs, and wikis all allow teams to publish and share insights and ideas in new ways—with the advantage that an expensive IT support team is not necessary as long as someone on the team has a family member in junior high school. After all, none of these tools existed a decade ago (the Internet itself, as the technovisionary Kevin Kelly has remarked, is fewer than five thousand days old!). All are leading to new experiments in collaboration and hence to new insights into the interactions of teams. Anyone who is serious about design thinking across an organization will encourage them.

cultures of innovation

Google has slides, pink flamingos, and full-size inflatable dinosaurs. Pixar has beach huts. IDEO will erupt into a pitched FingerBlaster war on the slightest provocation.

It's hard not to trip over the evidence of the creative cultures for which each of these companies is famous, but these emblems of innovation are just that—emblems. To be creative, a place does not have to be crazy, kooky, and located in northern California. What *is* a prerequisite is an environment—social but also spatial—in which people know they can experiment, take risks, and explore the full range of their faculties. It does little good to identify the brightest T-shaped people around, assemble them in interdisciplinary teams, and network them to other teams if they are forced to work in an environment that dooms their efforts from the start. The physical and psychological spaces of an organization work in tandem to define the effectiveness of the people within it.

A culture that believes that it is better to ask forgiveness *afterward* rather than permission *before*, that rewards people for success but gives them permission to fail, has removed one of the main obstacles to the formation of new ideas. If Gary Hamel is correct in arguing that the twenty-first century will favor adaptability and continuous innovation, it just makes sense that organizations whose “product” is creativity should foster environments that reflect and reinforce it. Relaxing the rules is not about letting people be silly so much as letting them be whole people—a step many companies seem reluctant to take. Indeed, the fragmentation of individual employees is often just a reflection of the fragmentation of the organization itself. I have observed many situations in which the supposedly “creative” designers are sequestered from the rest of the company. Although they may have a merry time off in their studios, this isolation quarantines them and undermines the creative efforts of the organization from opposite angles: the designers are cut

off from other sources of knowledge and expertise, while everyone else is given the demoralizing message that theirs is the nine-to-five world of business attire and a sober business ethic. Would the U.S. auto industry have reacted faster to changes in the market if designers, marketers, and engineers had been sitting around the same table? Perhaps.

The concept of “serious play” has a long, rich history within American social science, but nobody understands it in more practical terms than Ivy Ross. As senior VP of design for girls' products at Mattel, Ross realized that Mattel had made it difficult for the various disciplines across the company to communicate and collaborate. To address this she created Platypus, the code name for a twelve-week experiment in which participants from across the organization were invited to relocate to an alternative space with the objective of creating new and out-of-the-box product ideas. “Other companies have skunk works,” Ross told *Fast Company*. “We have a platypus. I looked up the definition, and it said, ‘an uncommon mix of different species.’”

Indeed, the species at Mattel could hardly have been more different: people came from finance, marketing, engineering, and design. The only requirement was that they commit themselves full-time to Platypus for three months. Since many of them had never been involved in new product development before and few had any kind of creative training, the first two weeks of the session were spent in a “creativity boot camp.” There they heard from a spectrum of experts about everything from child development to group psychology and were exposed to a range of new skills including improvised acting, brainstorming, and prototyping. During the remaining ten weeks

they explored new directions for girls' play and came up with a series of innovative product concepts. By the end they were ready to pitch their ideas to management.

Although it was located literally in the shadow of the company's headquarters in El Segundo, California, Platypus created a space that challenged all of the corporate rules. Ross regularly brought new teams together and put them into an environment designed to let people experiment in ways they had never been able to in their normal jobs. As she predicted, many Platypus graduates went back to their respective departments determined to use the practices and ideas they had learned. They found, however, that the culture of efficiency to which they returned invariably made that difficult. More than a few became frustrated. Some ultimately left the company.

Clearly, it is not enough to inject selected people into a specialized environment designed for skunks, platypi, or other risk-taking creatures. They may indeed unleash their creative imaginations, but there must also be a plan for reentry into the organization. Claudia Kotchka understood this need when she created the Clay Street Project for Procter & Gamble—named for a loft in downtown Cincinnati where project teams can get away from the day-to-day distractions and think like designers. The theory of Clay Street is that a division—Hair Care or Pet Care, for example—funds and staffs each project, and teams that create particularly strong ideas are encouraged to shepherd them through execution and launch. This was the hothouse environment in which the dated Herbal Essences brand was transformed into a fresh, successful new range of products. The people who have experienced Clay Street return to their departments with new skills and new ideas that they can apply with the full permission of the company.

how using real space helps the process

Although it can at times seem forbiddingly abstract, design thinking is *embodied* thinking—embodied in teams and projects, to be sure, but embodied in the physical spaces of innovation as well. In a culture of meetings and milestones, it can be difficult to support the exploratory and iterative processes that are at the heart of the creative process. Happily, there are tangible things we can do to ensure that facilities do what they are supposed to do: *facilitate!* IDEO allocates special “project rooms” that are reserved to a team for the duration of its work. In one room a group will be thinking about the future of the credit card; next to it a team is working on a device to prevent deep-vein thrombosis among hospital patients, and another planning a clean water distribution system for rural India for the Bill and Melinda Gates Foundation. The project spaces are large enough that the accumulated research materials, photos, storyboards, concepts, and prototypes can be out and available all of the time. The simultaneous visibility of these project materials helps us identify patterns and encourages creative synthesis to occur much more readily than when these resources are hidden away in file folders, notebooks, or PowerPoint decks. A well-curated project space, augmented by a project Web site or wiki to help keep team members in touch when they are out in the field, can significantly improve the productivity of a team by supporting better collaboration among its members and better communication with outside partners and clients.

So integral are these project spaces to our creative process that we have exported them, whenever possible, to our clients. Procter & Gamble has built the Gym in Cincinnati, an inno-

vation lab that R&D teams use to turbocharge their projects and move more quickly to tangible prototypes. Steelcase has built its Learning Center in Grand Rapids, a corporate education facility that doubles as a design thinking space. On any given day the center's team rooms and project spaces might be claimed by employees taking classes on management techniques, customers learning about how the company's products can enhance collaboration, or senior leaders huddled together to discuss future strategy. These ideas have even made their way into the precincts of higher education. For the Stanford Center for Innovations in Learning, an IDEO team, working with the SCIL's educational research experts, developed several floors of adaptable, reconfigurable spaces. Because of the inherently tentative and experimental nature of design thinking, flexibility is a key element of its success. As Dilbert has shown, regulation-size spaces tend to produce regulation-size ideas.

There is an important lesson here about the challenges of shifting from a culture of hierarchy and efficiency to one of risk taking and exploration. Those who navigate this transition successfully are likely to become more deeply engaged, more highly motivated, and more wildly productive than they have ever been before. They will show up early and stay late because of the enormous satisfaction they get from giving form to new ideas and putting them out into the world. Once they have experienced this feeling, few people will be willing to give it up.

Over the course of their century-long history of creative problem solving, designers have acquired a set of tools to help them

move through what I have called the "three spaces of innovation": inspiration, ideation, and implementation. My argument is that these skills now need to be dispersed throughout organizations. In particular, design thinking needs to move "upstream," closer to the executive suites where strategic decisions are made. Design is now too important to be left to designers.

It may be perplexing for those with hard-won design degrees to imagine a role for themselves beyond the studio, just as managers may find it strange to be asked to think like designers. But this should be seen as the inevitable result of a field that has come of age. The problems that challenged designers in the twentieth century—crafting a new object, creating a new logo, putting a scary bit of technology into a pleasing or at least innocuous box—are simply not the problems that will define the twenty-first. If we are to deal with what Bruce Mau has called the "massive change" that seems to be characteristic of our time, we all need to think like designers.

Just as I am challenging companies to incorporate design into their organizational DNA, however, I want to challenge designers to continue the transformation of design practice itself. There will always be a place in our dizzying world for the artist, the craftsman, and the lone inventor, but the seismic shifts taking place in every industry demand a new design practice: collaborative but in a way that amplifies, rather than subdues, the creative powers of individuals; focused but at the same time flexible and responsive to unexpected opportunities; focused not just on optimizing the social, the technical, and the business components of a product but on bringing them

into a harmonious balance. The next generation of designers will need to be as comfortable in the boardroom as they are in the studio or the shop, and they will need to begin looking at every problem—from adult illiteracy to global warming—as a *design* problem.

converting need into demand, or putting people first

Several years ago, during the research phase for a project on office telephone systems, we interviewed a travel agent who had developed a startlingly effective “workaround” for making conference calls. Rather than contend with her company’s impossibly complicated phone system, she simply dialed each party on a separate telephone and arrayed the receivers around her desk—“Judy” in Minneapolis was on her left; “Marvin” in Tampa was on her right; and together the three of them figured out a complicated travel itinerary. The software engineers who labored over the interface would have probably resorted to the standard lament: “RTFM”—“Read the (ahem) Manual.” For design thinkers, however, behaviors are never right or wrong, but they are always meaningful.

The job of the designer, to borrow a marvelous phrase from Peter Drucker, is “converting need into demand.” On the face of it, this sounds simple: just figure out what people want and then give it to them. But if it’s so easy, why don’t we see more success stories like the iPod? The Prius? MTV and eBay? The answer, I’d suggest, is that we need to return human beings to the center of the story. We need to learn to put people first.

Much has been written about “human-centered design” and its importance to innovation. Since there are so few truly compelling stories, however, it’s time to ask why it is so difficult to spot

a need and design a response. The basic problem is that people are so ingenious at adapting to inconvenient situations that they are often not even aware that they are doing so: they sit on their seat belts, write their PINs on their hands, hang their jackets on doorknobs, and chain their bicycles to park benches. Henry Ford understood this when he remarked, "If I'd asked my customers what they wanted, they'd have said 'a faster horse.'" This is why traditional techniques such as focus groups and surveys, which in most cases simply ask people what they want, rarely yield important insights. The tools of conventional market research can be useful in pointing toward incremental improvements, but they will never lead to those rule-breaking, game-changing, paradigm-shifting breakthroughs that leave us scratching our heads and wondering why nobody ever thought of them before.

Our real goal, then, is not so much fulfilling manifest needs by creating a speedier printer or a more ergonomic keyboard; that's the job of designers. It is helping people to articulate the latent needs they may not even know they have, and this is the challenge of *design thinkers*. How should we approach it? What tools do we have that can lead us from modest incremental changes to the leaps of insight that will redraw the map? In this chapter I'd like to focus upon three mutually reinforcing elements of any successful design program. I'll call them *insight, observation, and empathy*.

insight: learning from the lives of others

Insight is one of the key sources of design thinking, and it does not usually come from reams of quantitative data that measure

exactly what we already have and tell us what we already know. A better starting point is to go out into the world and observe the actual experiences of commuters, skateboarders, and registered nurses as they improvise their way through their daily lives. The psychologist Jane Fulton Suri, one of the pioneers of human factors research, refers to the myriad "thoughtless acts" people perform throughout the day: the shopkeeper who uses a hammer as a doorstop; the office worker who sticks identifying labels onto the jungle of computer cables under his desk. Rarely will the everyday people who are the consumers of our products, the customers for our services, the occupants of our buildings, or the users of our digital interfaces be able to tell us what to do. Their actual behaviors, however, can provide us with invaluable clues about their range of unmet needs.

Design is a fundamentally creative endeavor, but I do not mean this in an arcane or romantic sense. In an analytical paradigm, we simply solve for the missing number (though anyone who struggled, as I did, through high school algebra knows how daunting this can be!). In a *design* paradigm, however, the solution is not locked away somewhere waiting to be discovered but lies in the creative work of the team. The creative process generates ideas and concepts that have not existed before. These are more likely to be triggered by observing the odd practices of an amateur carpenter or the incongruous detail in a mechanic's shop than by hiring expert consultants or asking "statistically average" people to respond to a survey or fill out a questionnaire. The insight phase that helps to launch a project is therefore every bit as critical as the engineering that comes later, and we must take it from wherever we can find it.

The evolution from *design* to *design thinking* is the story of

the evolution from the creation of products to the analysis of the relationship between people and products, and from there to the relationship between people and people. Indeed, a striking development of recent years has been the migration of designers toward social and behavioral problems, such as adhering to a drug regimen or shifting from junk food to healthy snacking. When the Centers for Disease Control and Prevention approached IDEO with the challenge of addressing the epidemic of obesity among children and teens, we seized the opportunity to apply these qualitative research practices to a problem where we might have real social impact. In search of insight, a team of human factors experts called Jennifer Portnick at Feeling Good Fitness in San Francisco.

Jennifer had nurtured the dream of becoming a Jazzercise dance instructor but at a full-figured size 18 she ran up against the company's requirement that franchisees project "a fit appearance." She countered that "fit" and "large" are not incompatible and persisted through a legal challenge that won international attention and led Jazzercise to drop its weight-discriminatory policy. Portnick's story has been inspiring to countless people—of all sizes and both sexes—who have faced discrimination on account of acquired or inherited characteristics. It was inspiring to design thinkers, however, on different grounds. Because she flourished on the margins of the bell curve, she was in a position to help the design team frame the problem in a new and insightful way. To begin with the assumption that all fat people want to be thin, that weight is inversely proportional to happiness, or that large size implies lack of discipline is to prejudge the problem.

The single example of Jennifer Portnick gave the project team more insight into the problem of youth obesity than reams of statistics. And the easiest thing about the search for insight—in contrast to the search for hard data—is that it's everywhere and it's free.

observation: watching what people don't do, listening to what they don't say

Walk into the offices of any of the world's leading design consultancies, and the first question is likely to be "Where is everybody?" Of course, many hours are spent in the model shop, in project rooms, and peering into computer monitors, but many more hours are spent out in the field with the people who will ultimately benefit from our work. Although grocery store shoppers, office workers, and schoolchildren are not the ones who will write us a check at the end of a project, they are our ultimate clients. The only way we can get to know them is to seek them out where they live, work, and play. Accordingly, almost every project we undertake involves an intensive period of observation. We watch what people do (and do not do) and listen to what they say (and do not say). This takes some practice.

There is nothing simple about determining whom to observe, what research techniques to employ, how to draw useful inferences from the information gathered, or when to begin the process of synthesis that begins to point us toward a solution. As any anthropologist will attest, observation relies on quality, not quantity. The decisions one makes can dramatically affect

the results one gets. It makes sense for a company to familiarize itself with the buying habits of people who inhabit the center of its current market, for they are the ones who will verify that an idea is valid on a large scale—a fall outfit for Barbie, for instance, or next year's feature on last year's car. By concentrating solely on the bulge at the center of the bell curve, however, we are more likely to confirm what we already know than learn something new and surprising. For insights at that level we need to head for the edges, the places where we expect to find "extreme" users who live differently, think differently, and consume differently—a collector who owns 1,400 Barbies, for instance, or a professional car thief.

Hanging out with obsessives, compulsives, and other deviants can be unnerving, though it certainly makes life interesting. Fortunately, it's not always necessary to go quite to these extremes. A few years ago, when the Swiss company Zyliss engaged IDEO to design a new line of kitchen tools, the team started out by studying children and professional chefs—neither of whom were the intended market for these mainstream products. For that very reason, however, both groups yielded valuable insights. A seven-year-old girl struggling with a can opener highlighted issues of physical control that adults have learned to disguise. The shortcuts used by a restaurant chef yielded unexpected insights into cleaning because of the exceptional demands he placed on his kitchen tools. The exaggerated concerns of people at the margins led the team to abandon the orthodoxy of the "matched set" and to create a line of products united by a common design language but with the right handle for each tool. As a result, Zyliss whisks, spatulas, and pizza cutters continue to fly off the shelves.

the behavioral turn

Although most people can train themselves to become sensitive, skilled observers, some firms have come to rely upon seasoned professionals who guide every stage of this process; indeed, a striking feature of design practice today is the number of highly trained social scientists who have opted for careers outside academia. A few economists entered the government after World War I and a trickle of sociologists ventured into the private sector in the wake of World War II, but they were always regarded by their former academic colleagues with misgivings. Today, however, some of the most imaginative research in the behavioral sciences is being sponsored by companies that take design thinking seriously.

At Intel's campus in Beaverton, Oregon, a high-powered team of researchers led by Maria Bezaitis uses observational tools refined in academic social science to study a range of issues that will affect the company's business not at the end of the current quarter but in ten years: the future of digital money; how teenage girls use technology to protect their privacy; patterns of street life in the emerging multinational metropolis; the burgeoning community of people who live in "extreme homes" such as RVs. The psychologists, anthropologists, and sociologists in Bezaitis's People and Practices Research Group have fanned out around the globe in search of insights into cultural transformations that may or may not remain local phenomena. Why is a Silicon Valley chip maker interested in sponsoring a bunch of renegade social scientists to study people and practices in eastern Europe or western Africa? Because today only about 10 percent of the world's

population has access to networked communications technology. Intel knows that it will have to be ready when “the next 10 percent” comes online.

Other industry leaders are no less committed to the principle of extracting insights from observations and using them to inspire future product offerings. Nokia’s worldwide research is supported by the innovative ethnographic techniques developed by Jan Chipchase, an anthropologist who conducts “exploratory human behavioral field research” from his home base in Tokyo. Chipchase and his group believe that they have glimpsed the future in phenomena ranging from the morning bicycle commute across Ho Chi Minh City to the items people carry in Helsinki, Seoul, and Rio de Janeiro to the sharing of cell phones in Kampala, Uganda. The vast range of observations Chipchase and his colleagues have collected, together with the insights culled from them, will inform Nokia’s future product offerings over the next three to fifteen years. Such work is fundamentally different from trendspotting, coolhunting, and seasonal market research.

There are professional affinities between academic social scientists and those who work in industry—they hold the same degrees, read the same journals, and attend the same conferences—but there are also differences. Academics are typically motivated by a scientific objective, whereas researchers such as Bezaitis and Chipchase are more attuned to the long-term practical implications of their findings. The next stage along this continuum is represented by a new breed of ethnographer who works within the compressed time frame of a project. In contrast to the isolated theorizing of individual academics or the clustering of social scientists in the research units of Intel

or Nokia, these people work best when they are integrated into cross-disciplinary project teams that may include designers, engineers, and marketers. Their shared experiences will become essential sources of idea generation throughout the life of the project.

I have had many opportunities to observe this model of ethnographic practice among my colleagues at IDEO. In a project for an NGO called The Community Builders, the largest nonprofit developer of low- and mixed-income public housing in the United States, we assembled a team consisting of an anthropologist, an architect, and a human factors specialist. Together they interviewed builders, planners, and municipal authorities, and local entrepreneurs and service providers, but did not stop there. The real insights happened when the team arranged to stay overnight with three families at different income levels and with different life trajectories who lived in Park Duvalle, a mixed-income community in Kentucky.

This approach became even more salient on a subsequent project in which the team was trying to develop a tool kit to help NGOs implement human-centered design to meet the needs of subsistence farmers in Africa and Asia. This time, together with their partners from International Development Enterprises, they arranged overnight stays in farming villages in Ethiopia and Vietnam. Over time they were able to build a level of trust among people who might have been justifiably wary of visiting anthropologists or aid officials arriving in shiny SUVs, and this led in turn to a climate of honesty, empathy, and mutual respect.

Although the behavioral science researchers at places such

as Intel, Nokia, and IDEO are trained professionals, there are times when it makes sense to “deputize” our clients and enlist them in the hard work of conducting observations themselves. We thought nothing of putting a pocket-size notebook into the hands of Alan G. Lafley, the CEO of Procter & Gamble, and sending him out shopping for records on Berkeley’s colorful Telegraph Avenue. Lafley is famous for his impatience with CEOs who are content to peer down upon the world from the executive suite or from the smoked-glass windows of a corporate limousine and for his willingness to venture out into the places where his customers live, work, and shop. This perspective is surely the basis of his widely reported pronouncement that “mass marketing is dead.”

On other occasions, it is our clients themselves who take the lead and provide cues as to where we might look for insight. In the course of a project on emergency room care, undertaken with the Institute for Healthcare Improvement and the Robert Wood Johnson Foundation, a member of the IHI group reported on his experience at the Indianapolis 500. A smoking racecar pulled into a pit stop where a precision team of trained professionals, with state-of-the-art tools at the ready, assessed the situation and performed all the necessary repairs within seconds. Change a few words around, and you have an accurate description of a hospital trauma center. Of course, we also looked at real emergency room environments and observed physicians and nurses at work, but observing “analogous” situations—a pit stop at the Indy 500, a neighborhood fire station, an elementary school playground during recess—will often jolt us out of the frame of reference that makes it so difficult to see the larger picture.

empathy: standing in the shoes (or lying on the gurneys) of others

It’s possible to spend days, weeks, or months conducting research of this sort, but at the end of it all we will have little more than stacks of field notes, videotapes, and photographs unless we can connect with the people we are observing at a fundamental level. We call this “empathy,” and it is perhaps the most important distinction between academic thinking and design thinking. We are not trying to generate new knowledge, test a theory, or validate a scientific hypothesis—that’s the work of our university colleagues and an indispensable part of our shared intellectual landscape. The mission of design thinking is to translate observations into insights and insights into products and services that will improve lives.

Empathy is the mental habit that moves us beyond thinking of people as laboratory rats or standard deviations. If we are to “borrow” the lives of other people to inspire new ideas, we need to begin by recognizing that their seemingly inexplicable behaviors represent different strategies for coping with the confusing, complex, and contradictory world in which they live. The computer mouse developed at Xerox PARC in the 1970s was an intricate technical apparatus invented by engineers and intended for engineers. To them it made perfect sense that it should be taken apart and cleaned at the end of the day. But when the fledgling Apple Computer asked us to help it create a computer “for the rest of us,” we gained our first lesson in the value of empathy.

A designer, no less than an engineer or marketing executive, who simply generalizes from his own standards and ex-

pectations will limit the field of opportunity. A thirty-year-old man does not have the same life experiences as a sixty-year-old woman. An affluent Californian has little in common with a tenant farmer living on the outskirts of Nairobi. A talented, conscientious industrial designer, settling down at her desk after an invigorating ride on her mountain bike, may be ill prepared to design a simple kitchen gadget for her grandmother who is suffering from rheumatoid arthritis.

We build these bridges of insight through *empathy*, the effort to see the world through the eyes of others, understand the world through their experiences, and feel the world through their emotions. In 2000, Robert Porter, the president and CEO of the SSM DePaul Health Center in Saint Louis, approached IDEO with a vision. Porter had seen the episode of ABC's *Nightline* in which Ted Koppel had challenged us to redesign the American shopping cart *in one week* and wanted to discuss the implications of our process for a new wing of the hospital. But we had a vision too, and we saw an opportunity for a new and radical "codesign" process that would join designers and health care professionals in a common effort. We challenged ourselves by starting with what is perhaps the most demanding of all hospital environments: the emergency room.

Drawing upon his highly specialized expertise in the ethnographic study of technology and complex systems, Kristian Simsarian, one of the core team members, set out to capture the patient experience. What better way to do so than to check into the hospital and go through the emergency room experience, from admission to examination, as if he were a patient? Feigning a foot injury, Kristian placed himself into the shoes—and in fact, onto the gurney—of the average emergency room pa-

tient. He saw firsthand how disorienting the check-in process could be. He experienced the frustration of being asked to wait, without ever being told what he was waiting for or why. He endured the anxiety of being wheeled by an unidentified staffer down an anonymous corridor through a pair of intimidating double doors and into the glare and the din of the emergency room.

We have all had those kinds of first-person, first-time experiences—buying our first car, stepping out of the airport in a city we have never visited, evaluating assisted living facilities for an aging parent. In these situations we look at everything with a much higher level of acuity because nothing is familiar and we have not fallen into the routines that make daily life manageable. With a video camera tucked discreetly beneath his hospital gown, Kristian captured a patient's experience in a way that no surgeon, nurse, or ambulance driver could possibly have done.

When Kristian returned from his undercover mission, the team reviewed the unedited video and spotted numerous opportunities for improving the patient experience. But there was a larger discovery. As they sat through minute after tedious minute of acoustic ceiling tiles, look-alike hallways, and featureless waiting areas, it became increasingly evident that these details, not the efficiency of the staff or the quality of the facilities, were key to the new story they wanted to tell. The crushing tedium of the video thrust the design team into Kristian's—and, by extension, the patient's—experience of the opacity of the hospital process. It triggered in each of them the mix of boredom and anxiety that comes with being in a situation in which one feels lost, uninformed, and not in control.

The team realized that two competing narratives were in play: The hospital saw the “patient journey” in terms of insurance verification, medical prioritization, and bed allocation. The patient experienced it as a stressful situation made worse. From this set of observations the team concluded that the hospital needed to balance its legitimate concerns with medical and administrative tasks with an empathic concern for the human side of the equation. This insight became the basis of a far-reaching program of “codesign” in which IDEO’s designers worked with DePaul’s hospital staff to explore hundreds of opportunities to improve the patient experience.

Kristian’s visit to the emergency room exposed a layered picture of a patient’s experience. At the most obvious level, we learned about his physical environment: we can see what he sees and touch what he touches; we observe the emergency room as an intense, crowded place that provides patients with few cues as to what is going on; we feel the cramped spaces and the narrow hallways and note both the structured and improvised interactions that take place within them. We may infer that the emergency room facilities—not unreasonably, perhaps—are designed around the requirements of the professional staff rather than the comfort of the patient. Insights lead to new insights as seemingly insignificant physical details accumulate.

A second layer of understanding is less physical than cognitive. By experiencing the patient journey firsthand, the team gained important clues that might help it to translate insight into opportunity. How does a patient make sense out of the situation? How do new arrivals navigate the physical and social space? What are they likely to find confusing? These questions are essential to identifying what we call *latent* needs, needs

that may be acute but that people may not be able to articulate. By achieving a state of empathy with anxious patients checking into an emergency room (or weary travelers checking into a Marriott hotel or frustrated passengers checking in at an Amtrak ticket counter), we can better imagine how the experience might be improved. Sometimes we use these insights to emphasize the new. At other times it makes sense to do just the opposite, to reference the ordinary and the familiar.

Cognitive understanding of the ordinary and the familiar was at work when Tim Mott and Larry Tesler, working on the original graphical user interface at Xerox PARC in the 1970s, proposed the metaphor of the desktop. This concept helped move the computer from a forbidding new technology of value only to scientists to a tool that could be applied to office and even household tasks. It was still in evidence three decades later, when the start-up Juniper Financial asked IDEO to help it think about whether banks still needed buildings, vaults, and tellers.

In approaching the uncharted territory of online banking, we began by trying to get a better understanding of how people thought about their money. This exercise proved to be challenging in the extreme since we can’t watch the *cognitive* process of someone thinking about money in the way we can watch the *behavioral* process of someone paying a bill or withdrawing cash from an ATM. The team settled on the technique of asking selected participants to “draw their money”—not the credit cards in their wallets or the checkbooks in their purses but the way in which money played a part in their lives. One participant—we called her “The Pathfinder”—drew little Monopoly-style houses representing her family, her 401(k) retirement plan, and some rental properties,

since her focus was on long-term security. Another participant—designated “The Onlooker”—drew a picture with a pile of money on one side and a pile of goods on the other. With disarming candor, she explained to the team, “I get money and I buy stuff.” The Onlooker was completely focused on her day-to-day financial situation and did almost no planning for the future. Beginning from cognitive experiments like these, the team of researchers, strategists, and designers developed a subtle market analysis that helped Juniper refine its target market and build an effective service in the emerging world of online banking.

A third layer—beyond the functional and the cognitive—comes into play when we begin working with ideas that matter to people at an emotional level. Emotional understanding becomes essential here. What do the people in your target population feel? What touches them? What motivates them? Political parties and advertising agencies have been exploiting people’s emotional vulnerabilities for ages, but “emotional understanding” can help companies turn their customers not into adversaries but into advocates.

The Palm Pilot was an indisputably clever invention, and it has, deservedly, won widespread acclaim. Jeff Hawkins, its creator, began with the insight that the competition for a small, mobile device was not the omnifunctional laptop computer but the simple paper diary that many of us still slip into and out of our shirt pockets or purses a hundred times a day. When he began to work on the Palm in the mid-1990s, Jeff decided to buck the conventional wisdom and create a product that did *less* than was technically possible. That his software engineers could have stuffed spreadsheet capabilities, colorful graphics, and a garage-door opener into the Palm didn’t matter. Better

to do a few things well, so long as they were the *right* things: a contact list, a calendar, and a to-do list. Period.

The first version of the Palm PDA was a hit among tech-savvy early adopters, but there was nothing about its chunky gray plastic form that fired the imaginations of the larger public. In search of this elusive quality, Jeff teamed up with Dennis Boyle at IDEO, and together they began to work on a redesign that would appeal not just at a *functional* but also at an *emotional* level. The interface was left largely unchanged, but the physical quality of the device—designers call it the “form factor”—was reimagined. First, it was to be thin enough that it would slide smoothly into a pocket or purse—if it didn’t disappear, Dennis sent his team back to the drawing boards. Second, it was to have a feel that was sleek, elegant, and sophisticated. The team sought out an aluminum-stamping technique used by Japanese camera manufacturers and found a rechargeable power supply that even the battery suppliers doubted would work. The added development was worth the effort. The Palm V went on sale in 1999, and sales rocketed to more than 6 million. It opened up the market for the handheld PDA not because of a lower price point, added functionality, or technical innovation. The elegant Palm V did everything it promised to do, but its sophisticated look and professional feel appealed, at an emotional level, to a whole new set of consumers.

beyond the individual

If we were interested only in understanding the individual consumer as a psychological monad, we could probably stop here;

we have learned to observe him in his natural habitat and gain insight from his behaviors; we have learned that we must empathize, not simply scrutinize with the cold detachment of statisticians. But even empathy for the individual, as it turns out, is not sufficient. To the extent that designers have one at all, their prevailing concept of “markets” remains the aggregate of many individuals. It rarely extends to how groups interact with one another. Design thinkers have upped the ante, beginning with the premise that the whole is greater than the sum of its parts.

With the growth of the Internet, it has become clear that we must extend our understanding to the social interactions of people within groups and to the interactions among groups themselves. Almost any Web-based service—from social networking sites to mobile phone offerings to the vast world of online gaming—requires an understanding of the dynamic interactions within and between larger groups. What are people trying to achieve as individuals? What group effects, such as “smart mobs” or “virtual economies,” are taking shape? And how does membership in an online community affect the behavior of individuals once they return to the prosaic world of atoms, proteins, and bricks? It is hard to imagine creating anything today without trying to gain an understanding of group effects. Even a chair.

When Steelcase, the giant office furniture manufacturer, sits down with its customers to help them plan the right workplace environments, the designers use network analysis to understand who in their organization interacts with whom and which departments, functions, or even individuals should be colocated. Only then does it make sense to begin thinking about desks, storage units, and ergonomic chairs. We may use

similar approaches when we are designing systems to facilitate knowledge sharing within and between offices. Simply asking people to recount how they spend their time or with whom they regularly communicate can result in skewed information. Even with the best of intentions, people’s memories are faulty and their answers are likely to reflect what they think should be the unvarnished facts. Tools such as video ethnography (in which cameras record group behavior over time) and computer interaction analysis help gather more accurate data about the dynamic interactions among people and groups.

A second set of considerations is forcing us to rethink our notions of how to connect to consumers, and that is the pervasive fact of cultural differences—a theme that has moved from bad jokes about “political correctness” to the center of our concerns as we confront the realities of a media-saturated, globally interconnected society. Clearly, Kristian Simsarian’s first-person observations of an emergency room would have yielded an entirely different set of insights if they had taken place in sub-Saharan Africa rather than suburban America.

This reality puts yet another dent in the idealized image of the designer as the source of professional expertise that can be taught in school, honed in professional practice, and exported universally to anyone in need of a better desk lamp or digital camera. Spending time to understand a culture can open up new innovation opportunities. This may help us to discover universal solutions that have relevance beyond our own culture, but they will always have their origins in empathy.

The movement from insight to observation to empathy leads us, finally, to the most intriguing question of them all: if cultures are so diverse and if the twentieth-century image of “the

unruly mob” has given way to the twenty-first-century discovery of “the wisdom of crowds,” how can we tap that collective intelligence to unleash the full power of design thinking? The designer must not be imagined as an intrepid anthropologist, venturing into an alien culture to observe the natives with the utmost objectivity. Instead we need to invent a new and radical form of collaboration that blurs the boundaries between creators and consumers. It’s not about “us versus them” or even “us on behalf of them.” For the design thinker, it has to be “us *with* them.”

In the past, the consumer was viewed as the object of analysis or, worse, as the hapless target of predatory marketing strategies. Now we must migrate toward ever-deeper collaboration not just among members of a design team but between the team and the audience it is trying to reach. As Howard Rheingold has shown in his studies of “smart mobs” and Jeff Howe has demonstrated through “crowdsourcing” (more formally known as “distributed participatory design”), new technologies are suggesting promising ways of forging this link.

We are in the midst of a significant change in how we think about the role of consumers in the process of design and development. In the early years, companies would dream up new products and enlist armies of marketing experts and advertising professionals to sell them to people—often by exploiting their fears and vanities. Slowly this began to yield to a more nuanced approach that involved reaching out to people, observing their lives and experiences, and using those insights to inspire new ideas. Today, we are beginning to move beyond even this “ethnographic” model to approaches inspired and underpinned by new concepts and technologies.

My colleague Jane Fulton Suri has even begun to explore the next stage in the evolution of design as it migrates from designers creating *for* people to designers creating *with* people to people creating *by themselves* through the application of user-generated content and open-source innovation. The idea of “Everyman the Designer” is a compelling one, but the ability of consumers to generate breakthrough ideas on their own—as opposed to replicating existing ideas more efficiently and cheaply—is far from proven. Mozilla, with its Firefox Web browser, is one of the few companies to have been able to build a significant brand using an open-source approach.

These limitations do not mean that user-generated content is not interesting or that it may not become the Next Big Thing to roil out of the innovation cauldron. It has been argued that user-generated content is leading to far greater engagement and participation in the world of music than we ever saw during the top-down reign of mass media. Perhaps, but even the most zealous advocates of open-source design will admit that it has not produced its Mozart, John Lennon, or Miles Davis. Not yet, at any rate.

For the moment, the greatest opportunity lies in the middle space between the twentieth-century idea that companies created new products and customers passively consumed them and the futuristic vision in which consumers will design everything they need for themselves. What lies in the middle is an enhanced level of *collaboration* between creators and consumers, a blurring of the boundaries at the level of both companies and individuals. Individuals, rather than allowing themselves to be stereotyped as “consumers,” “customers,” or “users,” can now think of themselves as active participants in the process of

creation; organizations, by the same token, must become more comfortable with the erosion of the boundary between the proprietary and the public, between themselves and the people whose happiness, comfort, and welfare allow them to succeed.

We see evidence of innovative strategies meant to enhance the collaboration between creators and consumers everywhere. In an initiative funded by the European Union to look at ways in which digital technology might strengthen the fabric of society, Tony Dunne and Bill Gaver of the Royal College of Art in London developed a set of “cultural probes”—journal exercises, inexpensive video cameras—that enabled elderly villagers to document the patterns of their everyday lives. In industries more geared to the youth culture—video games, sports apparel—it is now quite common for developers to work with tech-savvy youths at every stage of the development process from concept development to testing. Sweat Equity Enterprises in New York (the term refers to contributing time and effort to a project as opposed to “financial equity,” or money) works with companies as diverse as Nike, Nissan, and Radio Shack to codevelop new products with inner-city high school kids. The sponsoring companies capture cutting-edge insights “from the street” (a somewhat more reliable source of creativity than the executive suite) while at the same time making a lasting investment in education and opportunity for underserved urban youth.

One of the techniques we have developed at IDEO to keep the consumer-designer involved in the creation, evaluation, and development of ideas is the “unfocus group,” where we bring an array of consumers and experts together in a workshop format to explore new concepts around a particular topic. Whereas traditional focus groups assemble a random group of “average”

people who are observed, literally or figuratively, from behind a one-way mirror, the unfocus group identifies unique individuals and invites them to participate in an active, collaborative design exercise.

On one memorable occasion—we were looking at new concepts for women’s shoes—we invited in a color consultant, a spiritual guide who led barefoot initiates across hot coals, a young mother who was curiously passionate about her thigh-high leather boots, and a female limo driver whose full livery was accented by a pair of outrageously sexy stiletto heels. Needless to say, this group proved to be extremely articulate about the emotional connections among shoes, feet, and the human condition. By the time we released them back into the San Francisco demimonde they had inspired an exciting portfolio of ideas. Though drawers in the heels to hide secret items and raised patterns that targeted key acupressure points did not survive, the insights on which they were based prodded us to think about what people *really* desire from shoes.

One autumn day in 1940 the industrial designer Raymond Loewy was visited in his office by George Washington Hill, the president of the American Tobacco Company and one of the more colorful personalities in American business history. Hill offered Loewy \$50,000 if he could improve upon the Lucky Strike package—a wager Loewy readily accepted—and, as he was leaving, turned to Loewy and asked when it would be ready. “Oh, I don’t know, some nice spring morning I will feel like designing the Lucky package and you’ll have it in a matter of hours. I’ll call you then.”

Today we no longer feel that we must sit patiently and wait for some outrageous insight to strike us. Inspiration always involves an element of chance, but, as Louis Pasteur observed in a famous lecture of 1854, "Chance only favors the prepared mind." Certain themes and variations—techniques of observation, principles of empathy, and efforts to move beyond the individual—can all be thought of as ways of preparing the mind of the design thinker to find insight: from the seemingly commonplace as well as the bizarre, from the rituals of everyday life but also the exceptional interruptions to those rituals, and from the average to the extreme. That insight cannot yet be codified, quantified, or even defined—not yet, at any rate—makes it the most difficult but also the most exciting part of the design process. There is no algorithm that can tell us where it will come from and when it will hit.

a mental matrix, or "these people have no process!"

One way to help design thinking diffuse throughout an organization is for designers to make their clients part of the experience. We do this not just to give them the thrill of peering behind the wizard's curtain but because we find that we invariably get much better results when the client is on board and actively participating. But be forewarned: it can be messy! Imagine an avid theatergoer who is invited backstage to witness the chaos that lies behind even the most flawless performance—last-minute costume repairs, two-by-fours lying about everywhere, Hamlet standing outside the stage door having a cigarette while Ophelia chatters into her cell phone . . . or, as one client was heard to lament in a frantic call back to her office, "These people have no process!"

A few weeks later she had become a convert, promoting design thinking within her own company—a stolid, respectable organization renowned for its structure, discipline, and *process*. But as with all epiphanies, that's where the hard work begins. It is one thing to witness the power of design and even to participate in it, quite another to absorb it into one's thinking and patiently build it into the structure of an organization. Those of us who have spent long years at design school still find it hard to shake off dearly held assumptions about how to get things done. People from more methodical backgrounds may

fear that the risks are too high and the margin of error is perilously slim.

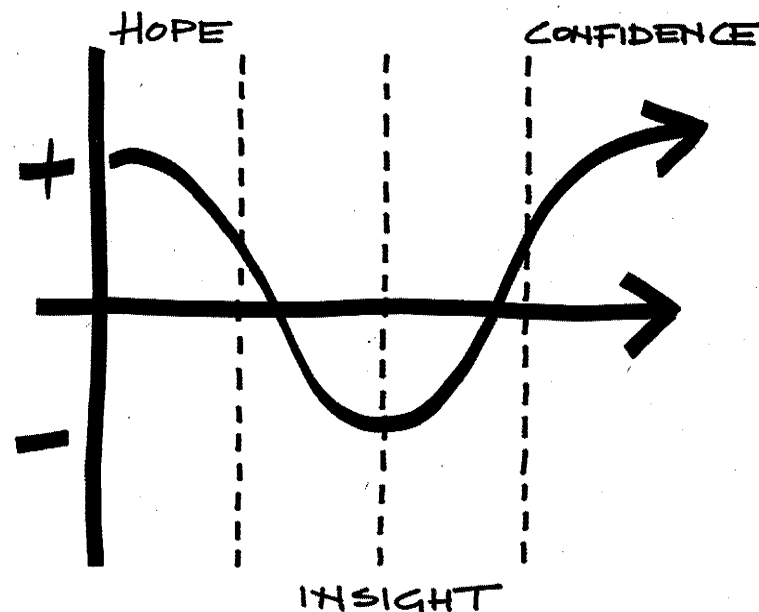
What's the best way to orient first-time visitors to this new and unfamiliar terrain? Though there is no real substitute for actually doing it, I can impart a fair sense of the experience of design thinking—some navigational landmarks, perhaps, if not a complete road map.

In chapter 1, I introduced the idea that a design team should expect to move through three overlapping spaces over the course of a project: an *inspiration* space, in which insights are gathered from every possible source; an *ideation* space, in which those insights are translated into ideas; and an *implementation* space, in which the best ideas are developed into a concrete, fully conceived plan of action. Again, these are overlapping “spaces” rather than sequential stages of a lockstep methodology. Insights rarely arrive on schedule, and opportunities must be seized at whatever inconvenient time they present themselves.

Every design process cycles through foggy periods of seemingly unstructured experimentation and bursts of intense clarity, periods of grappling with the Big Idea and long stretches during which all attention focuses on the details. Each of these phases is different, and it's important—if only for the morale of the team—to recognize that each *feels* different and calls for different strategies.

One of our more jaded designers even devised a project mood chart that pretty accurately predicts how the team will feel at different phases of the project:

When a fresh team ventures out into the field to collect information, it is full of optimism. The process of synthesis—the



ordering of data and the search for patterns—can be frustrating as important decisions seem to ride on the most insubstantial of hunches. But then things begin to pick up. The ideation process becomes more tangible, and new concepts begin to take shape. The process peaks when the team begins to produce prototypes. Even if they don't look so good, don't work properly, or have too many features or too few, they are visible, tangible signs of progress. Eventually, once the right idea has been agreed upon, the project team settles down to a state of pragmatic optimism punctuated by moments of extreme panic. The scary bits never completely go away, but the experienced design thinker knows what to expect and is not undone by the occasional emotional slump. Design thinking is rarely a grace-

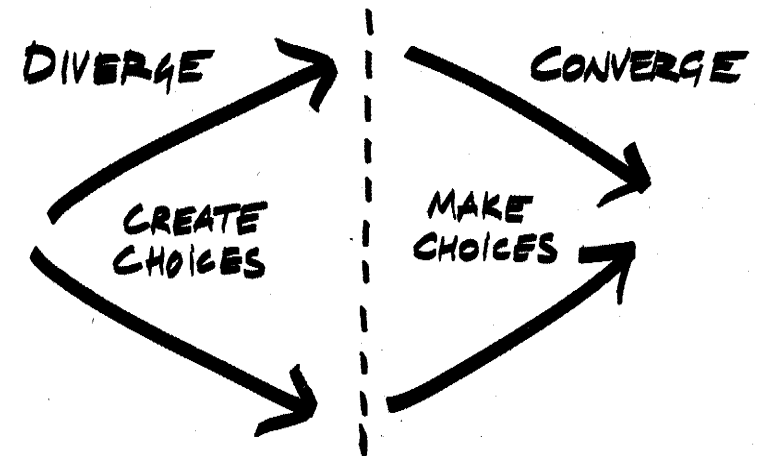
ful leap from height to height; it tests our emotional constitution and challenges our collaborative skills, but it can reward perseverance with spectacular results.

convergent and divergent thinking

To experience design thinking is to engage in a dance among four mental states. Each has its own moods and manners, but when the music suddenly starts it can be difficult to recognize where we are in the process and which is the right foot to put forward. The best guide, in launching a new design project, is sometimes just to choose the right partner, clear the dance floor, and trust our intuition.

Woven into the very fabric of our culture is an emphasis on thinking based upon logic and deduction; the psychologist Richard Nisbett, who has studied approaches to problem solving in Western and Eastern cultures, has gone so far as to suggest that there is a “geography of thought.” Whether the problem lies in the domain of physics, economics, or history, Westerners are taught to take a series of inputs, *analyze* them, and then *converge upon* a single answer. At times we may find that the best—as opposed to the right—answer will have to do or that we may have to choose among equally compelling alternatives. Just think about the last time you and five friends had to agree on where to go out for dinner. Group thinking tends to converge toward a single outcome.

Convergent thinking is a practical way of deciding among existing alternatives. What convergent thinking is *not* so good at, however, is probing the future and creating new possibili-



ties. Think of a funnel, where the flared opening represents a broad set of initial possibilities and the small spout represents the narrowly convergent solution. This is clearly the most efficient way to fill up a test tube or drive toward a set of fine-grained solutions.

If the convergent phase of problem solving is what drives us toward solutions, the objective of divergent thinking is to multiply options to create choices. These might be different insights into consumer behavior, alternative visions of new product offerings, or choices among alternative ways of creating interactive experiences. By testing competing ideas against one another, there is an increased likelihood that the outcome will be bolder, more creatively disruptive, and more compelling. Linus Pauling said it best: “To have a good idea, you must first have lots of ideas”—and he won *two* Nobel Prizes.

But we also need to be realistic. More choices means more complexity, which can make life difficult—especially for those whose job it is to control budgets and monitor timelines. The natural tendency of most companies is to constrain problems and restrict choices in favor of the obvious and the incremental. Though this tendency may be more efficient in the short run, in the long run it tends to make an organization conservative, inflexible, and vulnerable to game-changing ideas from outside. Divergent thinking is the route, not the obstacle, to innovation.

The point, then, is not that we must all become right-brain artists practicing divergent thinking and hoping for the best; there is a good reason why design education draws in equal measure upon art and engineering. The process of the design thinker, rather, looks like a rhythmic exchange between the divergent and convergent phases, with each subsequent iteration less broad and more detailed than the previous ones. In the divergent phase, new options emerge. In the convergent phase it is just the reverse: now it's time to *eliminate options* and *make choices*. It can be painful to let a once-promising idea fall away, and this is where the diplomatic skills of project leaders are often tested. William Faulkner, when asked what he found to be the most difficult part of writing, answered, "Killing off your little darlings."

analysis and synthesis

Designers love to complain about "feature creep," the proliferation of unnecessary functions that add expense and complex-

ity to otherwise straightforward products (RCA's original TV remote control device in 1958 had exactly one button; mine has forty-four). Design thinkers, for their part, need to be wary of what might be called "category creep." Nevertheless, I need to bring two additional terms into the discussion: *analysis* and *synthesis*, which are the natural complements to divergent and convergent thinking.

Without analytical forms of thinking we could not run large corporations or manage household budgets. Designers, too, whether they are looking at signage for a sports stadium or alternatives to carcinogenic PVCs, use analytical tools to break apart complex problems to understand them better. The creative process, however, relies on synthesis, the collective act of putting the pieces together to create whole ideas. Once the data have been gathered, it is necessary to sift through it all and identify meaningful patterns. Analysis and synthesis are equally important, and each plays an essential role in the process of creating options and making choices.

Designers carry out research in many ways: collecting ethnographic data in the field; conducting interviews; reviewing patents, manufacturing processes, vendors, and subcontractors. They can be found jotting notes, taking pictures, shooting videos, recording conversations, and sitting on airplanes. They are, hopefully, looking at the competition. Fact collecting and data gathering lead to an accumulation of information that can be staggering. But then what? At some point the team must settle down and in an intense period of synthesis—sometimes over the course of a few hours, sometimes over a week or more—begin to organize, interpret, and weave these many strands of data into a coherent story.

Synthesis, the act of extracting meaningful patterns from masses of raw information, is a fundamentally creative act; the data are just that—data—and the facts *never* speak for themselves. Sometimes the data are highly technical—if the task is a sophisticated piece of medical equipment, for instance; in other cases they may be purely behavioral, for example, if the problem is to encourage people to switch to energy-saving compact fluorescent bulbs. In every case we may think of the designer as a master storyteller whose skill is measured by his or her ability to craft a compelling, consistent, and believable narrative. It's no accident that writers and journalists now often work alongside mechanical engineers and cultural anthropologists in design teams.

Once the "raw material" has been synthesized into a coherent, inspiring narrative, a higher-level synthesis kicks in. It is far from unusual for a project brief to contain seemingly conflicting goals—low cost and high quality, to use an obvious example, or an accelerated time frame together with an interest in an unproven technology. There may be a tendency, under such circumstances, to simplify the process and reduce it to a set of specifications or a list of features. To do so is almost invariably to compromise the integrity of the product on the altar of convenience.

These are the seeds of design thinking—a continuous movement between divergent and convergent processes, on the one hand, and between the analytical and synthetic, on the other. But that is by no means the end of the story. As any gardener will attest, the hardiest seeds, cast into rocky or barren soil, will wither. The ground needs to be prepared. Attention must be shifted upward, from teams and individuals to companies. We

might think of this as moving from the organization of design to the design of organizations.

an attitude of experimentation

The master choreographers of the dance between divergent and convergent thinking, on the one hand, and detailed analysis and synthetic judgment, on the other, were Charles and Ray Eames, the most creative design partnership that America has produced. From their legendary office at 901 Washington Boulevard in Venice, California, the Eameses and their associates conducted a series of design experiments that stretched across four decades and covered every imaginable medium: the molded plywood chairs that became synonymous with American modernism; their famous Case Study House No. 8 in Pacific Palisades; the museum exhibitions they built, and the educational films they produced. Not always visible in the finished projects, however, is the methodical experimentation that lay behind them. The lesson? A creative team must be given the time, the space, and the budget to make mistakes.

Individuals, teams, and organizations that have mastered the mental matrix of design thinking share a basic attitude of experimentation. They are open to new possibilities, alert to new directions, and always willing to propose new solutions. Back in the 1960s, during the formative years of Silicon Valley, Chuck House, then an ambitious young engineer at Hewlett-Packard, came within a hair's breadth of losing his job. Following a hunch, he ignored an explicit corporate directive and set up an under-the-radar skunkworks to develop a large-screen CRT.

The illicit project went on to become the first commercially successful computer graphics display, used for the space video transmission of Neil Armstrong's foot-on-the-moon broadcast, Dr. Michael DeBakey's first artificial heart transplant monitor, and countless other applications. Chuck ended up as corporate engineering director for HP, with an office next door to David Packard himself, who had personally issued the prohibition against further research, and a "Medal of Defiance" hanging on his wall. Things have changed. He now runs Media X at Stanford University, a collaboration of industry and academia that brings together interactive technology researchers with companies committed to technical advancement and innovation. Today companies like Google and 3M are renowned for encouraging scientists and engineers to spend up to 20 percent of their time on personal experiments.

A tolerance for risk taking has as much to do with the culture of an organization as with its business strategy. Some would argue that a climate of open-ended exploration encourages a profligate waste of resources: Chairman Mao Zedong's policy during the Great Leap Forward, "Let a hundred flowers bloom," ended in complete disaster. But in contrast to the hermetically sealed environment of revolutionary China, the globalized economy today really is experiencing a "great leap forward." In an organization that encourages experimentation, there will be projects destined to go nowhere and still others that the keepers of institutional memory prefer not to talk about (remember the Apple Newton?). But to view such initiatives as "wasteful," "inefficient," or "redundant" may be a symptom of a culture focused on efficiency over innovation and a company at risk of collapsing into a downward spiral of incrementalism.

It's no accident that designers in recent years have been following the emerging science of biomimicry—the idea that nature, with its 4.5 billion-year learning curve, may have something to teach us about things such as nontoxic adhesives, minimal structures, efficient thermal insulation, or aerodynamic streamlining. The bewildering variety at work in a healthy ecosystem is nothing but an exercise in sustained experimentation—try something new, and see what sticks. It may well be that we need to begin mimicking nature not just at the molecular level but at the systemic level of companies and organizations. An excess of experimental zeal would be risky—companies do not enjoy the luxurious time frame of biological systems and their leaders would be remiss if they chose not to exercise what might be called—with apologies to Darwin—"intelligent design." What is called for is a judicious blend of bottom-up experimentation and guidance from above.

The rules for this approach are as simple to state as they are challenging to apply:

1. The best ideas emerge when the whole organizational ecosystem—not just its designers and engineers and certainly not just management—has room to experiment.
2. Those most exposed to changing externalities (new technology, shifting consumer base, strategic threats or opportunities) are the ones best placed to respond and most motivated to do so.
3. Ideas should not be favored based on who creates them. (Repeat aloud.)
4. Ideas that create a buzz should be favored. Indeed,

ideas should gain a vocal following, however small, before being given organizational support.

5. The “gardening” skills of senior leadership should be used to tend, prune, and harvest ideas. MBAs call this “risk tolerance.” I call it the top-down bit.
6. An overarching purpose should be articulated so that the organization has a sense of direction and innovators don’t feel the need for constant supervision.

These rules apply to almost every field of innovation. Together they ensure that the seeds of individual creativity take root—even in the aisles of a grocery store.

John Mackey, the CEO of Whole Foods Market, has applied this idea of bottom-up experimentation to his business since its founding, in 1980. Now the world’s largest retailer of natural and organic foods, Whole Foods organizes each store’s employees into small teams and encourages them to experiment with better ways to serve Whole Foods customers. These might include different display ideas or products selected to meet local customers’ needs. Each store may have its own unique regional and even neighborhood identity. Managers are encouraged to share the best ideas so that they propagate outward across the company rather than remaining localized. None of this may sound all that revolutionary, but what Mackey has done since the earliest days of the company—he started with a single grocery store in Austin, Texas, and a total workforce of nineteen—is to make sure that every employee understands, appreciates, and has the ability to contribute to the overall vision of the company. These ideas act as navigational beacons for the localized innovations taking place throughout the organization.

As with each of the stories I’ve told, there is a moral to be drawn from this one: don’t let the results of bottom-up experimentation dissipate into unstructured ideas and unresolved plans. Some companies provide suggestion boxes intended to harvest the bottom-up creativity of the organization. They tend to fail, leaving management to wonder why ungrateful employees pour coffee into them if they are hanging on the wall or flame them if they are online. At best they tend to yield small and incremental ideas. More often they go nowhere because there is no obvious mechanism for acting upon suggestions. What is needed is a serious commitment from the top of the corporate pyramid, and it will be repaid by better ideas from the base. Any promising experiment should have a chance to gain organizational support in the form of a project sustained by appropriate resources and driven by definable goals.

There is a simple test for this, though I have to admit that it has taken some getting used to: when I receive a cautiously worded memo asking for permission to try something, I find myself becoming equally cautious. But when I am ambushed in the parking lot by a group of hyperactive people falling all over one another to tell me about the unbelievably cool project they are working on, their energy infects me and my antennae go way, way up. Some of these projects will go wrong. Energy will be wasted (whatever that means) and money will be lost (we know exactly what that means). But even in these cases there is an old adage that remains worth pondering: in the words of my countryman Alexander Pope (back in the days when design thinkers did their best thinking in Latin), “*Errare humanum est, perdonare divinum*”—“To err is human, to forgive divine.”

a culture of optimism

The obvious counterpart to an attitude of experimentation is a climate of optimism. Sometimes the state of the world makes this difficult to sustain, but the fact remains that curiosity does not thrive in organizations that have grown cynical. Ideas are smothered before they have a chance to come to life. People willing to take risks are driven out. Up-and-coming leaders steer clear of projects with uncertain outcomes out of fear that participation might damage their chances for advancement. Project teams are nervous, suspicious, and prone to second-guessing what management “really” wants. Even when leadership wants to promote disruptive innovation and open-ended experimentation, it will find that no one is willing to step forward without permission—which usually means defeat before the start.

Without optimism—the unshakable belief that things could be better than they are—the will to experiment will be continually frustrated until it withers. Positive encouragement does not require the pretense that all ideas are created equal. It remains the responsibility of leadership to make discerning judgments, which will inspire confidence if people feel that their ideas have been given a fair hearing.

To harvest the power of design thinking, individuals, teams, and whole organizations have to cultivate optimism. People have to believe that it is within their power (or at least the power of their team) to create new ideas, that will serve unmet needs, and that will have a positive impact. When Steve Jobs returned to Apple in the summer of 1997 after being dismissed by his own board, he found a demoralized company that had spread its resources across no fewer than fifteen product platforms. Those

teams were, in effect, competing with one another for survival. With all the boldness for which he is known, Jobs slashed the company’s offerings from fifteen to four: a desktop and a laptop for professionals and a desktop and a laptop “for the rest of us.” Every employee understood that the project he or she was working on represented fully one-quarter of Apple’s business and there was no possibility that it would be killed by an accountant scrutinizing the balance sheets. Optimism soared, morale turned 180 degrees, and the rest, as the saying goes, is history. Optimism requires confidence, and confidence is built on trust. And trust, as we know, flows in both directions.

To find out whether a company is optimistic, experimental, and attuned to risk, people should simply use their senses: look for a colorful landscape of messy disorder rather than a suburban grid of tidy beige cubicles. Listen for bursts of raucous laughter rather than the constant drone of subdued conversation. Because IDEO does a great deal of work in the food and beverage industry, employs food scientists, and maintains an industrial kitchen, I can often literally *smell* excitement in the air. In general, try to be alert to the nodes where it all comes together, because that is where new ideas originate. I love to slip downstairs and observe members of a team at work building prototypes out of Legos or enacting an improvisational skit to explore a new service interaction. Above all, I love to be allowed to sit in on a brainstorm.

brainstorming

Business school professors are fond of writing learned articles about the value of brainstorming. I encourage them to continue

to do so (after all, some of my best friends are business school professors, and it keeps them busy and out of my way). Some surveys claim that motivated individuals can generate more ideas in the equivalent time working on their own. Other case studies demonstrate that brainstorming is as essential to creativity as exercise is to a healthy heart. As is so often the case, there is truth on both sides.

The skeptics certainly have a case: a well-intentioned manager who assembles a group of individuals who don't know one another, who are skeptical, and who lack confidence and gives them a tough problem to brainstorm is likely to get fewer viable ideas than if each of them had been sent away to think about the problem individually. Brainstorming, ironically, is a structured way of breaking out of structure. It takes practice.

As with cricket or football (or their American equivalents), there are rules for brainstorming. The rules lay out the playing field within which a team of players can perform at high levels. Without rules there is no framework for a group to collaborate within, and a brainstorming session is more likely to degenerate into either an orderly meeting or an unproductive free-for-all with a lot of talking and not much listening. Every organization has its own variations on the rules of brainstorming (just as every family seems to have its own version of Scrabble or Monopoly). At IDEO we have dedicated rooms for our brainstorming sessions, and the rules are literally written on the walls: Defer judgment. Encourage wild ideas. Stay focused on the topic. The most important of them, I would argue, is "Build on the ideas of others." It's right up there with "Thou shalt not kill" and "Honor thy father and thy mother," as it ensures that every participant is invested in the last idea put forward and has the chance to move it along.

Not long ago we were working on a kids' product for Nike. Although we have plenty of skilled toy designers on our staff, sometimes it makes sense to hire expert consultants to help us out. So we waited until their Saturday-morning cartoons were over and invited a group of eight-to-ten-year-olds to come in to our Palo Alto studios. After warming them up with orange juice and French toast, we split the boys and girls into two different rooms, gave them some instructions, and let them have at it for about an hour. When we gathered the results, the difference between the two groups was striking. The girls had come up with more than two hundred ideas whereas the boys had barely managed fifty. Boys, at this age, find it more difficult to focus and to listen—attributes essential to genuine collaboration. The girls were just the opposite. Fortunately, it's not my task to decide whether this disparity is the result of genetic inheritance, cultural norms, or birth order, but I can say that what we saw in these side-by-side brainstorms was real evidence of the power of building on the ideas of others. The boys, so eager to get their own ideas out there, were barely conscious of the ideas coming from their fellow brainstormers; the girls, without prompting, conducted a spirited but nonetheless *serial* conversation in which each idea related to the one that had come before and became a springboard to the one that came next. They were sparking off one another and getting better ideas as a result.

Brainstorming is not necessarily the ultimate technique for idea generation, and it cannot be built into the structure of every organization. But it does prove its worth when the goal is to open up a broad spectrum of ideas. Other approaches are important for *making* choices, but nothing beats a good brainstorming session for *creating* them.

visual thinking

Design professionals spend years learning how to draw. Drawing practice is not so much in order to illustrate ideas, which can now be done with cheap software. Instead, designers learn to draw so that they can *express* their ideas. Words and numbers are fine, but only drawing can simultaneously reveal both the functional characteristics of an idea and its emotional content. To draw an idea accurately, decisions have to be made that can be avoided by even the most precise language; aesthetic issues have to be addressed that cannot be resolved by the most elegant mathematical calculation. Whether the task at hand is a hair dryer, a weekend retreat in the country, or an annual report, drawing forces decisions.

Visual thinking takes many forms. We should not suppose that it is restricted to objective illustration. In fact, it is not even necessary to possess drawing skills. In November 1972, relaxing in a late-night deli in Honolulu at the end of a long day of conference proceedings, a couple of biochemists took out a cocktail napkin and shared some crude drawings of bacteria having sex. A few years later Stanley Cohen was on a plane to Stockholm to collect his Nobel Prize and Herbert Boyer was pulling his red Ferrari into the parking lot of Genentech.

All children draw. Somewhere in the course of becoming logical, verbally oriented adults, they unlearn this elemental skill. Experts in creative problem solving such as Bob McKim, founder of Stanford's product design program, or the United Kingdom's prolific Edward de Bono, devoted much of their creative energy to mind maps, two-by-two matrices, and other visual frameworks that help explore and describe ideas in valuable ways.

When I use drawing to express an idea, I get different results than if I try to express it with words, and I usually get to them more quickly. I have to have a whiteboard or sketch pad nearby whenever I am discussing ideas with colleagues. I get stuck unless I can work it out visually. Leonardo da Vinci's sketchbooks are justly famous (no less a collector than Bill Gates snatched up the Hammer Codex when it came up for auction in 1994), but Leonardo didn't just use them to work out his own ideas. Often he simply stopped in the street to capture something he needed to figure out: a tangle of weeds; the curl of a cat sleeping in the sun; an eddy of water swirling in a gutter. Moreover, scholars poring over his mechanical drawings have punctured the myth that every sketch depicts his own inventions. Like any accomplished design thinker, Leonardo da Vinci used his drawing skills to build on the ideas of others.

to post, or not to Post-it

Most people, by now, know the story of the humble Post-it note: Dr. Spencer Silver, a scientist working at 3M back in the 1960s, happened upon an adhesive with some curious properties. His employer, quite reasonably, did not see the utility of "inherently tacky elastomeric copolymer microspheres," aka glue that does not stick, and gave him little encouragement. It was not until one of his colleagues, Art Fry, began to use the adhesive to keep his bookmarks from falling out of his church hymnal that a plausible use was found for the little yellow notes. It is now a billion-dollar product and one of 3M's most valuable assets.

The Post-it note stands as an object lesson in how organiza-

tional timidity threatens to kill off a great idea. But those ubiquitous little stickies have proven themselves to be an important tool of innovation in and of themselves. Festooned on the walls of project spaces, they have helped untold numbers of design thinkers first to capture their wide-ranging insights and then to order them into meaningful patterns. The Post-it note, in all its pastel glory, embodies the movement from the divergent phase that is the source of our inspiration to the convergent phase that is the road map to our solutions.

The techniques of the design thinker that I have been describing—brainstorming, visual thinking—contribute to the *divergent* process of *creating* choices. But accumulating options is merely an exercise if we do not move on to the *convergent* phase of *making* choices. Doing so is critical if a project is to move from a rousing exercise in creative idea generation toward a resolution. Just for that reason, however, it can be one of the most difficult tasks that a design team faces. Given the opportunity, every design team will diverge endlessly. There is always a more interesting idea just around the corner, and until the budget runs out they will happily turn one corner after another. It is here that one of the simplest tools available for convergence comes into play: the Post-it note.

Once everyone is gathered together for a project review, there needs to be a process for selecting the ideas that are strongest and hold the greatest promise. Storyboards help—panels that illustrate, almost like comic strips, the sequence of events a user might experience in checking into a hotel, opening a bank account, or using a newly purchased electronic device. Sometimes it helps to create alternate scenarios. But sooner or later some level of consensus is called for, and it rarely comes about by

debate or executive fiat. What is needed is some kind of tool to extract the intuition of the group, and this is where a generous supply of Post-it notes cannot be beat. At IDEO we use them to submit ideas to the “butterfly test.”

Invented by Bill Moggridge, design thinker extraordinaire and one of the pioneers of Silicon Valley design, the butterfly test is a thoroughly unscientific but amazingly effective process for extracting a few key insights from a mass of data. Let’s imagine that by the end of a deep research phase, numerous brainstorming sessions, and endless prototypes, an entire wall of the project room has been covered with promising ideas. Each participant is then given a small number of small Post-it “ballots” to attach to the ideas they think should move forward. Members of the team flutter about the room inspecting the tableau of ideas, and before long it is clear which ones have attracted the most “butterflies.” Of course, all kinds of issues come into play, including politics and personalities, but that is what reaching consensus is all about. Give and take. Compromise and creative combination. All these and more play a part in reaching the end result. The process is not about democracy, it is about maximizing the capacities of teams to converge on the best solutions. It’s chaotic, but it works surprisingly well and can be adapted to the peculiarities of many organizations.

I don’t mean this to be an advertisement for 3M. The Post-it note, which encourages people to capture a quick thought, reposition it, or reject it, is just one of many tools available to deal with one insistent fact common to every design project: deadlines. Though we all have deadlines all of the time, in the divergent and exploratory phase of design thinking, deadlines take on an extra level of importance. They refer to the process

and not the people. The deadline is the fixed point on the horizon where everything stops and the final evaluation begins. These points may seem arbitrary and unwelcome, but an experienced project leader knows how to use them to turn options into decisions. It's unwise to have a deadline every day, at least in the earlier phases of a project. Nor does it work to stretch it out for six months. It takes judgment to determine when a team will reach a point where management input, reflection, redirection, and selection are most likely to be valuable.

I have not yet met a client who says, "Take all the time you need." All project work is bound by limits: limits of technology, limits of skill, limits of knowledge. But the calendar is probably the most insistent limit of them all because it brings us back to the bottom line. As Ben Franklin, America's first and most adventurous real design thinker, pointed out in a letter to a young tradesman, "Time is money."

I have saved for last the single most powerful tool of design thinking. This is not CAD, rapid prototyping, or even offshore manufacturing but that empathic, intuitive, pattern-recognizing, parallel-processing, and neural-networking Internet that each of us carries between our ears. For the time being, at any rate, it is our ability to construct complex concepts that are both functionally relevant and emotionally resonant that sets humans apart from the ever more sophisticated machines we use to assist us. As long as there is no algorithm that will tell us how to bring divergent possibilities into a convergent reality or analytical detail into a synthetic whole, this talent will guarantee that accomplished design thinkers have a place in the world.

People may be deterred from venturing into the turbulent world of design thinking for any number of reasons. They may believe that creativity is an inner gift possessed only by celebrity designers, that it is better just to gaze respectfully at their chairs and lamps in modern art museums. Or they may suppose that it is a skill reserved for a priesthood of trained professionals—after all, we hire "designers" to do everything from cutting our hair to decorating our houses. Others, less in awe of the cult of the designer, may confuse the mastery of tools—including the qualitative tools of brainstorming, visual thinking, and storytelling—with the ability to reach a design solution. And there are those who may feel that without a precise framework or methodology, they will be unable to fathom what is going on. They are the ones who are most likely to bail out when the morale of a team dips, as it invariably will over the life of a project. What they may not appreciate is that design thinking is neither art nor science nor religion. It is the capacity, ultimately, for *integrative* thinking.

As dean of the acclaimed Rotman School of Management at the University of Toronto, Roger Martin is well positioned to observe the world's great managerial leaders and in particular the ability shared by many of them to hold multiple ideas in tension to reach new solutions. In *The Opposable Mind*, based on more than fifty in-depth interviews, Martin argues that "thinkers who exploit opposing ideas to construct a new solution enjoy a built-in advantage over thinkers who can consider only one model at a time." Integrative thinkers know how to widen the scope of issues salient to the problem. They resist the "either/or" in favor of the "both/and" and see nonlinear and multidirectional relationships as a source of inspiration,

not contradiction. The most successful leaders, Martin finds, “embrace the mess.” They allow complexity to exist, at least as they search for solutions, because complexity is the most reliable source of creative opportunities. The traits of management leaders, in other words, match the traits I have ascribed to design thinkers. This is no coincidence, and it does not imply that the “opposable mind” is the reward to those who won the genetic lottery. The skills that make for a great design thinker—the ability to spot patterns in the mess of complex inputs; to synthesize new ideas from fragmented parts; to empathize with people different from ourselves—can all be learned.

One day, perhaps, neurobiologists will be able to plug us into an MRI scanner and determine which parts of the brain light up when we apply integrative thinking. That may make it easier to devise new strategies for teaching people how to do it better. For the moment, at least, our task is not to understand what is going on in our brains but to find ways of getting that thinking out into the world, where it can be shared with others and, ultimately, translated into concrete strategies.

building to think, or the power of prototyping

Lego launched me on my career as a design thinker. In the early 1970s, when I was nine or ten, England was going through yet another of its periodic recessions and the coal miners had waited until winter to go out on strike. This meant no coal for the power stations, which meant not enough electricity to meet demand, which meant regular blackouts. Determined to do my bit, I marshaled my entire inventory of Legos and built a great big flashlight using some fancy light bricks that glowed in the dark. I proudly handed the flashlight to my mother so that she had enough light to cook my dinner. I had built my first prototype.

By the age of ten I had learned the power of prototyping based on years of intensive study. As a younger child I had spent hours using Legos and Meccano (known to Americans as Erector Sets) to create a world full of rocket ships, dinosaurs, and robots of every imaginable size and shape. Like every other kid, I was thinking with my hands, using physical props as a springboard for my imagination. This shift from physical to abstract and back again is one of the most fundamental processes by which we explore the universe, unlock our imaginations, and open our minds to new possibilities.

Most companies are full of people who have set aside such childish pursuits and moved on to more important matters such