INTRODUCTION

The Next Environmental Revolution

. . . No world
wears as well as it should but, mortal or not,
a world has still to be built
because of what we can see from our windows . . .
which is there regardless

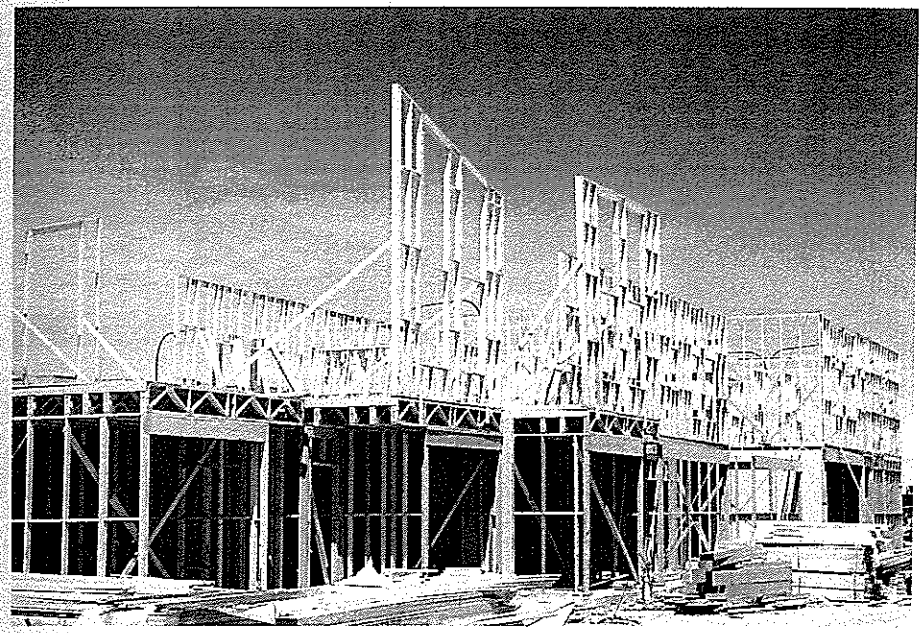
—W. H. AUDEN, "Thanksgiving for a Habitat. I. Prologue: The Birth of Architecture"

Look around you. What do you see from your window? What do you see in the room surrounding you from where you sit? Your answer will be as singular as you are. Whether you live in a city large or small, in a suburb or exurb, or in one of the earth's growing megalopolises—New York, Seoul, São Paulo—you are in, and in all probability look out your window onto, a *built* environment.

In premodern societies, humans by and large constructed their own habitats which were dominated by the natural world. No longer. Around the world in developed and developing countries, people spend most of their time in and around buildings and constructed landscapes. In a hospital or bedroom you were born; in a hospice, bedroom, or hospital you will likely die. In houses and apartments you make your home. On streets and over bridges and underground you travel, going to the office or laboratory or manufacturing facility or the store where you work. In schools and community centers and playgrounds and parks you raise and educate your children, forge and nurture social bonds. In environments constructed for your leisure you go for walks, play ball or run, take in a theatrical performance, attend a sporting event, contemplate a museum exhibition, shop in stores, relax in cafés.

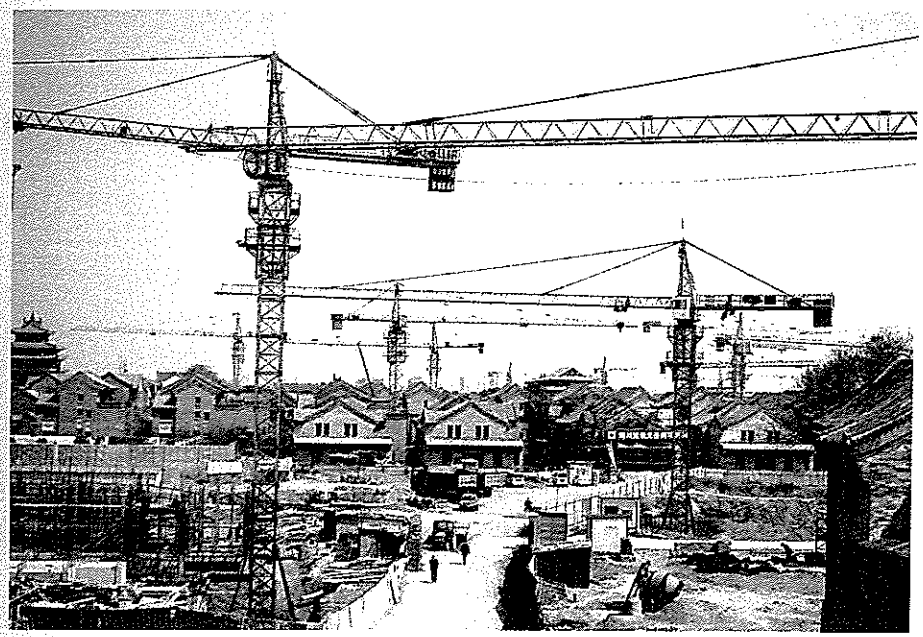
An ever-increasing percentage of humanity spends almost all its time—90 percent or more—inhabiting environments that have been conceived and constructed by human hands, and unlike in the premodern world, by hands that in most cases are not their own. Close to four billion people live in the most built-up portions of the world, known as urban areas. The places we inhabit and use in modern society are not only built in the sense that they are constructed, but are designed in the sense that they are constructed to look and function as they do because people made decisions. Someone *decided* to include one element or another, and someone chose to place these elements into a composition. Not just every building or urban square or park or playground—but every sidewalk is proportioned, every window is sized and positioned, because people made decisions about that sidewalk's dimensions and placement, about what weather that window would be able to withstand, or not, and about how it would look, feel, and function. Somebody decided. Somebody decided, whether that person thought much about the decision or not.

The built environment conveys a deceptive sense of permanence. In truth, statistics of change and growth show that it is constantly under renovation, renewal, and expansion. The numbers are daunting, yet only by confronting them can we comprehend what lies ahead. If we look toward just the next several decades, in the United States alone by 2050 the population is projected to increase another 68 million people, 21 percent, reaching almost 400 million. This will necessitate massive new construction in cities and the areas immediately surrounding them of buildings, landscapes, infrastructure, and urban areas. Think of increasing the built environment of the urban area of New York City by 20 percent—that would house 5 million more people. Then expand the urban area of Los Angeles to accommodate another 4 million people; of Washington, DC, to house an additional 2 million people; of Austin, another 400,000 on top of its 2 million people today, and so on, for every city in the United States. Consider all the construction needed



Construction site, United States

Construction site, China



in each of these cities to provide homes, office buildings, commercial areas, parks, and squares for that many more people. Housing them alone will require in aggregate perhaps a billion square feet of new construction. This, combined with an ever-changing economic landscape that draws people toward some cities and away from others, and which renders some kinds of buildings defunct and necessitates the reinvention of others, means that the United States will need many more, and many different kinds of, buildings and landscapes than the ones built by our parents and grandparents and forefathers and mothers. By 2030, as many as half the buildings that Americans will inhabit will have been built since 2006: every third, perhaps every second building you encounter will be new.

The construction campaign of the coming decades will be even more extensive outside the United States, so much so that it will make Americans' upcoming building needs look like a rounding error. Around the globe, a little more than half the world's population today resides in urban areas. Within less than two generations, urban growth in Asia, Africa, and Latin America will be so explosive that, by 2050, two out of every three people on the planet will be living in an urban area. That means 2.4 billion *more* people will need buildings in which to live, work, and be educated, as well as infrastructure through which to move, and landscapes in which to find refuge.

All this is beyond staggering.

Today 428 cities around the globe each house populations of between one and five million people. In the next fifteen years, that figure will increase to about 550 cities. There are currently 44 cities with a population of between five and ten million people; in fifteen years there will be 63. And the number of megalopolises, the gargantuan cities of more than ten million people, are expected to increase from 29 today to 41, also more than a 40 percent hike. Not only will urban populations grow at an unprecedented and breathtaking pace, the most complex

Site of new Ordos City, China, before (with artist Ai Weiwei)

Ordos, China

urban areas, the large cities and the megacities, will be at the forefront of the growth.

The human migrations to metropolitan regions and the construction campaigns that accompany all this are especially fervid in developing countries, notably in India and China, where by 2050 the number of urban dwellers is expected to increase by three hundred million to total more than one billion people. If China were building one entirely new city each year to house this population growth, it would construct a city the size of New York City every single year, for thirty-five years. In fact, in anticipation of this growth, China already has started and finished totally new, enormous cities in places where none had been before. To accommodate the vast migration of rural residents who will relocate to urban areas between now and 2030, China will eventually have 125 cities with a population of more than one million people. Its number of metropolises of five to ten million people will number sixteen, and it will have seven gargantuan cities of more than ten million people, with several of them greater than twenty million. This will require the construction of *four trillion* square meters of floor space in approximately five million buildings. In the next two decades, China will continue to expand its infrastructure—residential housing, roads, bridges, airports, power plants, water purification and distribution systems—on a phenomenal scale and pace that dwarfs anything humanity has ever seen. It will be equivalent in size to the existing urban infrastructure of the entire United States. Although China's rapid development seems to be in a class by itself, it really isn't. India's urban population is projected to increase during this period at an even more rapid rate, *doubling* in size, with an increase of four hundred million people. And other parts of Asia, and various countries in Latin America, are all growing and urbanizing at a fantastic rate, mostly in the form of slums and poor construction. Barring economic meltdown, this global construction tsunami will continue for decades to come.

Figuratively speaking, and almost literally speaking, all the world's a construction site. The decisions people make about the environments currently under construction, what and how we build and where, will affect the lives of billions of people for generations. If you consider all this a bit astonishing, look around you the next time you are out for a walk or a drive, and consider what it means that close to 80 percent of the places that Americans currently call home did not exist sixty years ago. Ask yourself what your life would be like, or your mother's or your brother's or your child's, if 80 percent of the buildings and streets and parks you see looked and were organized and functioned differently and better? What if all neighborhoods were vibrant and socially inviting? What if they all had convenient access to reliable, affordable, comfortable public transportation? What if everyone's house or apartment looked onto or was within walking distance of a well-designed and well-maintained park? If natural light streamed in through large, operable windows in every home, workplace, and classroom? Your life, and the lives of those you love, would be different—just as it would be different if you lived in a dark, characterless, cramped, windowless box, located somewhere in an undifferentiated thicket of high-rise towers.

Most of what we see from our windows or in our surroundings has been constructed, but it was not really *designed* in any but a rudimentary sense of the word. In the United States, 85 percent of new construction—whether it is a new bridge, an urban park, a housing development, or a school addition—is realized at the hands of construction firms collaborating with real estate developers or other private clients. Many of these builders bypass designers (a catchall term for professionals involved in designing the built environment, including architects, landscape architects, interior architects, urban designers, city planners, civil engineers, and other sorts of civil servants) completely, or employ them only cursorily, to review and stamp their approval on drawings—

drawings that have been prepared by people who all too often lack even basic professional training in design.

In the United States and in most other parts of the world today, many people believe that engaging a highly trained design professional is an unnecessary expense. True, wealthy individuals and corporations with plenty of assets do buy design to add beauty or prestige, and public and private institutions aspiring to serve as cultural stewards hire trained, informed professionals for complex structures such as skyscrapers. But this is not the norm.

The reason aside from financial considerations is that most projects in the built environment are commissioned on the basis of and judged by two complementary standards. Safety first: building codes and legislation and inspectors enforce standards that ensure that our bridges and buildings and parks and cityscapes will withstand gravity and wind, will weather the vicissitudes of climate and the ravages of time, and that their smaller features, such as electrical systems and stairways, will not shock or trip people up. Function next: people expect projects to serve an institution's or private individual's daily needs both effectively and efficiently, which often means with as little expenditure of resources—space, time, money—as possible.

Fair enough. People consider safety and functionality nonnegotiable. But the aesthetics of a new project, how it is composed, how the people who use it will experience it—how it is *designed*—is too often dismissed as unknowable or irrelevant. The question of how its design *affects* human beings is rarely asked, certainly not systematically, or centrally. People think that design makes something highfalutin, called architecture, and that architecture differs from building, just as surely as the Washington National Cathedral differs from the local community church.

This distinction between architecture and building—or more generally, between design and utility—couldn't be more wrong. More and

more we are learning that the design of all our built environments matters so profoundly that safety and functionality must not be our only urgent priorities. All kinds of design elements influence people's experiences, not only of the environment but also of themselves. Good design—thoughtfully composed ordering systems and patterns, sensuously active materials and textures, deliberately constructed sequences of spaces—create coherent places that have a powerfully positive effect on people. Urban spaces, landscapes, and buildings—even small and modest ones—profoundly influence human lives. They shape our cognitions, emotions, and actions, and even powerfully influence our well-being. They actually help constitute our very sense of ourselves, our sense of identity.

We know that positive emotions prolong life and improve its quality. Yet too few people realize how extensive are the effects of design on human well-being and society's welfare. Rarely is design accorded the high priority that it deserves in our public policy and market calculations; rarely is it accounted for as we forever make and remake our worlds. Given the ongoing, literally world-shaping explosion in building across the globe, the time has come to confront a discomfiting truth. Our disregard for our built environments is bankrupting our lives. What's more, it threatens to bankrupt the lives of people for generations.

"Environment" is a word that sends most people's thoughts toward nature, and "environmental revolution" will elicit in most people's minds thoughts about overpopulation and pollution, particularly from carbon emissions, which has so degraded the protective ozone layer that encircles our planet that we face potentially catastrophic climate change. But the word "environment" refers simply to the places, circumstances, objects, or conditions that surround us. An environment can be ecological, social, virtual, or constructed. Its elements can be grass and trees, flesh and blood, words and images, paint and bytes, or it can be bricks, asphalt, and steel. And as we overwhelmingly live in

environments given shape and dominated by brick, stone, wood and processed wood, glass, steel, and Sheetrock, it makes sense to deploy the word to describe the revolution we need to properly reconfigure our constructed world.

The environments we inhabit and build can make us and our children healthy or sick. They can make us and the people we love smart or dumb. Serene or despondent. Motivated or apathetic. What's more, it's their *design* that is in large measure responsible for these effects. A well-designed, properly constructed environment affects and supports our health, cognitions, and social relations. It meaningfully conveys to each of us that our human presence, not just our productive labor, credit card, or mortgage check, is valued. So how our buildings and landscapes and urban spaces are configured is not and cannot be only a matter of personal taste.

This book is a call to action, imploring all of us to do whatever it takes to develop a policy agenda and practical initiatives to better human welfare by improving the built environment. It is a call to all of us to develop, fund, and implement research programs that will expand our knowledge base about the ways we live and can live in buildings, landscapes, and cities. It is an exhortation to decision-makers in the private and public sectors to make a commitment to good design. And it is an exhortation to designers to devote their resources and attention to learning what is already known in other fields about the architecture of human experience.

Like a herald standing in the public square, I am trumpeting the day's news, and here is my plea. Listen. The shape of our built environments is largely driven by interests, including but not confined to the marketplace, in which many people make decisions that are not necessarily in society's or the planet's best interests. If we've learned anything in the past twenty years, it's that people are not rational actors—at least not most of the time. People think about and experience their built environments in ways that

comport with what we know and are learning about human cognition, social behavior, and experience more generally. And the places in which most of us live are in one way or another, in many ways or just a few ways, not the places we need. This holds true for our internal, individual experience and for the way we conduct ourselves as members of groups in society.

In chapter 1 we assess the actually existing contemporary built environment, taking stock of how it does and mostly does not accommodate humans as we know them to think, feel, and act. Chapter 2 lays out the foundation of how people experience their built environments by looking at ordinary cityscapes and civic landmarks, explaining the nonconscious cognitive mechanisms underlying our human experience of the constructed world, which powerfully shape our thoughts as well as our individual and social lives. The next three chapters examine a wide range of buildings, landscapes, and urban environments to excavate the specific dimensions of how our experience of the built world is determined, shaped, and inflected by the fact that we are situated: in the body (chapter 3), in the natural world (chapter 4), and in the social world (chapter 5). Chapter 6 puts all that we've learned together to advance some basic principles for how built environments can be designed for the humans that people are. In the final chapter, we discuss the larger implications of our findings, how all this establishes the absolute centrality of built environmental design to human well-being, now and for the future.

What kind of worlds and societies do we want to shape for the generations to come? This remains as pressing a question today as it was in 1943, when Winston Churchill, following the Germans' destruction of the chamber of the House of Commons in London's Houses of Parliament, urged Britain's parliamentarians to vote to rebuild the chamber in its original rectangular form, with two long rows of benches facing one another, accommodating and at the same time symbolizing

The House of Commons after the London Blitz

the two opposing parties. The two-party system that this arrangement represented, Churchill maintained, constituted the backbone of British parliamentary democracy. Emphasizing how design shapes everyday experience, Churchill declared that "we shape our buildings, thereafter they shape us."

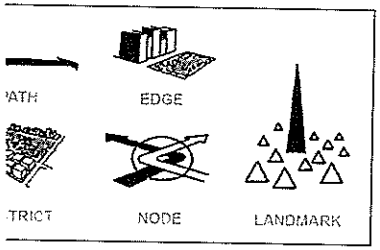
The importance of Churchill's pronouncement basically has been overlooked. The built environment per se remains, for the most part, little discussed. The media cover some aspects of it, but mainly in the context of "starchitecture," travel destinations, or home decor. In the meantime, the amazing breakthroughs in cognitive neuroscience and perception are establishing precisely why our relationship to the built environment is so essential to the human experience, and describing how.

Certainly, some writers have led the way in considering how the built environment's design overtly and subtly shapes the type and character of people's social interactions. Jane Jacobs's *The Death and Life of Great American Cities*, published in 1961, launched a broad attack on early postwar American city planning's slum-clearance and development policies, suggesting that even well-intentioned interventions could profoundly compromise people's lives. Jacobs argued that the forms of our cities and urban places must be based on empirical knowledge about how urban dwellers actually conduct their social and individual lives, a position she learned from urbanist William H. Whyte, who spent decades studying people in public spaces, examining the design elements that attract or repel passersby. A decade after the publication of Jacobs's book, Oscar Newman, in *Defensible Space*, substantiated Jacobs's assertions by linking the incidence of crime to the design of just the sort of social housing projects Jacobs had criticized. Newman identified design elements, such as homogeneity, repetition, and the absence of sight lines, that prevented residents from surveying and developing a sense of emotional connection to the places they inhabited, thereby eroding their ability to develop a robust feeling of responsibility for their community. Recently, the influential Dutch urbanist Jan Gehl extended the work of Jacobs, Whyte, and Newman, specifying the design elements that contribute to vibrant urban settings, such as "soft" edges, walkability, active ground-floor spaces, and variability.

Jacobs, Whyte, Newman, and Gehl's works demonstrate the thoroughgoing effects of design on people's social lives. By contrast, analyzing how the built environment shapes and impacts people's *individual* experience has been mostly relegated to the province of theoretical and philosophical speculation, in works such as Gaston Bachelard's *The Poetics of Space* and Edward Casey's *Getting Back into Place*. The most notable exception, an empirical study by Kevin Lynch (*The Image of the City*, 1960), is more than fifty years old. Lynch conducted interviews

with urban dwellers and drew on principles from Gestalt psychology to construct an intuitive framework of how urban dwellers make sense of a city and where they find themselves in it. He discovered that people, to navigate complex environments and develop an internal cognitive map of a city's organization, rely on very specific design elements, a combination of *landmarks* (the Eiffel Tower); *edges*, which must be clearly defined by visible boundaries (the facade lines of Parisian boulevards); and demarcated *paths* that link to focal points, or *nodes*, such as plazas, squares, and major intersections.

Of all these studies on how we as individuals experience built environments, only the findings of Kevin Lynch have been substantively confirmed: landmarks, edges, paths, and nodes are indeed the critical tools our brains use in human spatial navigation and cognitive mapping. Recently, a group of cognitive neuroscientists—Edvard Moser, May-Britt Moser, and John O'Keefe—reinterpreted and further specified Lynch's paths and nodes. In discoveries that collectively earned them a Nobel Prize in Physiology and Medicine, they identified specific place recognition and building recognition cells, which work together with grid cells in an integrated system. An inner GPS in our brains enables us to orient ourselves in space. Now we know the answers to questions such as "How do we know where we are? How can we find the way from one place to another? And how can we store that information so that we can retrace the same path another time?"



edges, nodes, landmarks: the central of wayfinding, from Kevin Lynch's *Image City*.

Lynch's work highlighted the need for more information on the ways that humans experience and are impacted by their built environments. And in small, relatively confined corners of the academy, research did continue. But few findings reached the eyes, ears, and minds of the

people who buy and live in buildings—clients—or even designers. More and more, such questions are being taken up in various research initiatives and collaborations among urban, architectural, and interior designers and researchers in the academy and the health-care industry, as well as being championed by the small but growing Academy of Neuroscience for Architecture.

To investigate how our built environments shape both our internal and our external worlds—in common parlance, how we *experience* them—we must first articulate what we mean by an "experience." An experience differs from the unselfconscious fact of mere existence; it is distinguished by its unifying quality, which pervades all its constituent features and gives them meaning. This persuasive unity is the product of the human mind, through which everything we encounter is filtered and interpreted.

In the past two decades, a vast amount of knowledge about the operations of the mind—much of which is not focused on architecture and the built environment per se—has emerged from the sciences and social sciences. Synthesizing this knowledge produces a surprising yet unavoidable insight: our built environments will not accommodate people's needs until we integrate what we know and are learning about human experience into their design and composition. This is true at every level, from families inhabiting their homes, to schoolchildren on playgrounds, to workers toiling in the offices or distribution centers of corporations.

This steady stream of new research on how humans perceive and think collectively demonstrates that humans are pervasively integrated into their environments. Whether it's the way we see, without really knowing that we see, how lines arrange into patterns on a wall, or nonconsciously register the height or shape of a ceiling, or respond without realizing it to the quality and intensity of light in a room; whether our intuitive sense of gravity has been tamed or tempted, how we imagine

feeling the coldness of a stone floor—a person's sense of emotional well-being, her social interactions, and even her physical health are all affected by the places she inhabits, in ways large and small. This fast-growing body of knowledge originated in the "cognitive" turn in psychology in the 1960s, when ever more scientists began to argue that people's thought processes—their cognitions—could be scientifically studied and were as important a dimension of human experience as human behavior. The cognitive revolution continued to gain speed, then accelerated rapidly in the 1990s, when a number of new imaging and computation technologies permitted the scientific study of the human brain in action.

We know much, much more—a hundred times more—than we did a few decades ago about how cognitions directly or indirectly affect, or are precipitated by, our experience of the built environment. And we now know that, even if some of what passed for conventional and scientific wisdom for centuries about what makes good architecture, landscapes, or urban design was right, much more of it was and remains just plain wrong. What we know about the structure of human memory, learning, and the relation of emotions to cognitions has been utterly transformed. Not only do we understand the mechanisms of spatial navigation, thanks to Lynch and his successors, but we are finding also that those mechanisms play important roles in other cognitive processes that are essential to our daily lives. We know that our perceptions and determinations to act do not happen entirely sequentially but instead are more intermeshed. And most important, we know that the bulk of our cognitions are nonconscious and associative in nature.

We need a new conceptual framework to understand how we think about and experience the built world, because the human brain fundamentally differs from the brain that psychologists, philosophers, and designers until fairly recently thought we had. During my childhood, a cardinal belief among psychologists was that the physiology of the human brain, after a critical period early in a person's development,

was set. No new neurons could be generated, no new connections established or pared away. Then around 2000, a series of studies of London taxi drivers demonstrated clear changes in cabbies' brains (in particular, their hippocampi) after they completed the extensive training required of them to memorize—in Lynch's terms, to build a cognitive map of—the city's geography. Even in fully formed adults, these and other studies revealed, the human brain is dynamic, ever-changing in response to what we experience in our environments—human, social, physical, architectural, landscape, and urban. The fact of our brain's neural plasticity has immense implications for our understanding of human cognition: it reveals that as we learn, our brains are changing shape, rewiring us throughout our lives. And contrary to what had been assumed for centuries, we now know that all our lives, our minds are changing and *quite literally being shaped* by our experiences in the physical environments in which we live.

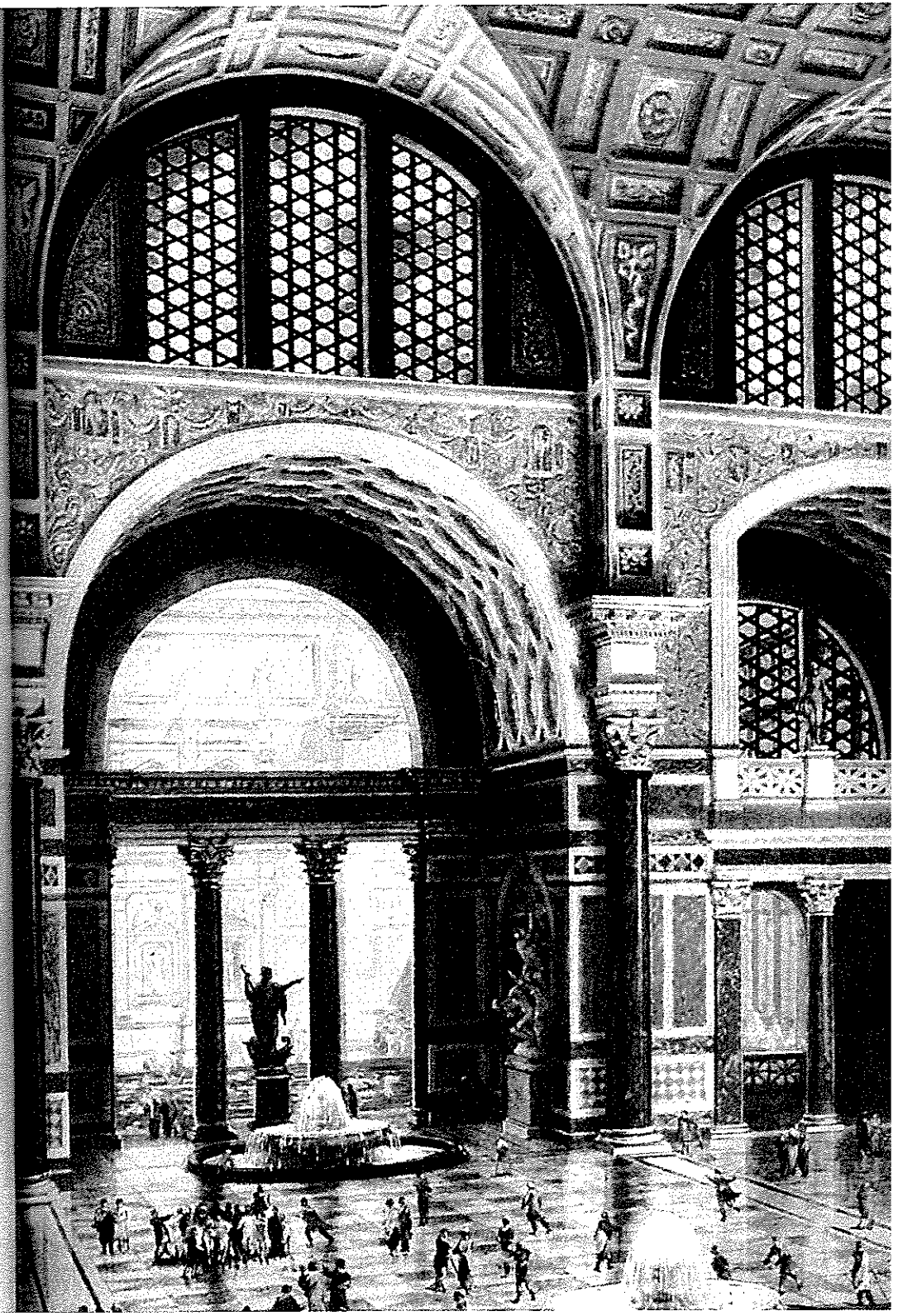
The more we know, the more we can think about, investigate, and assess the fit between what we have built and will build and what it takes to nourish our well-being. The more we know, the more evident it becomes that we must revisit our received wisdom about cities, architecture, landscape architecture, and the built environment's relationship to people. And we should undertake this reinvestigation with optimistic dedication, with hopeful vigor. My decades of studying and writing about the built environment have made it clear that our built environments can be made much, much better. At every level of investment, there is much that all of us can do to improve our buildings, landscapes, and cities. And it turns out that, more often than not, it takes just as many resources to build a bad building—or landscape or townscape—as a good one.

So consider the shape of the room where you are sitting and the height, shape, and color of its ceiling. The texture and construction of the walls.

The softness or hardness of the floor surfaces. The views to nearby internal spaces and the views (if you have them) through windows to the outdoors. The air quality and temperature. The quality of the sounds that you hear. The selection of the furniture and its arrangement. The types and levels of lighting. The configuration of the passageways leading to nearby rooms and places, and their placement relative to where you are. All of this affects you. It affects your well-being and your health, in ways you may recognize and in other ways you may not even suspect. It affects the ways you interact with—and even conceive of—the other people in that space. It can affect your very sense of who you are, as someone who belongs or does not belong in that type of place.

Why does this matter? Because it can be changed. Everything around you—from the shape of the room in which you currently sit, to the amount of sunshine filling your home, to the character of the house or apartment where you live, to the width and patterns on the sidewalks or roads that brought you there—is as it is because somebody made a *choice*. By commission or by default, the built environment is composed, which means that it could have been composed differently. And much of it can be remade, as so much more of it will be created in the coming decades. We have before us an unprecedented opportunity to reshape the world into a better place.

Louis Kahn, an American architect who built some of the most revered buildings of the late twentieth century, spent his life making the case for the powerful effect of built environmental design on people's lives. Once he put it this way: "If you look at the Baths of Caracalla . . . we all know that we can bathe just as well under an eight-foot ceiling as we can under a 150-foot ceiling." But, he insisted, "there's something about a 150-foot ceiling that makes a man a different kind of man." In



"There's something about a 150-foot ceiling that makes a man a different kind of man," said Louis Kahn about the Baths of Caracalla (reconstruction).

speaking of the ennobling quality of the legendary Roman baths, Kahn expressed an intuition that has been proved correct, albeit for reasons that Kahn himself could not possibly have known. A recent study revealed that people think more creatively and respond better to abstract concepts when seated in rooms with high ceilings. A person who feels quite literally "unconstrained" is more apt to think creatively.

Architecture has always seemed to me to be the most important art—the kind that everyone deserves. Our buildings, landscapes, and cityscapes influence the lives not just of the people who commission or pay for them—and if they are constructed for investment, as most are, not ever inhabited by them. They are foisted upon countless users and passersby. Moreover, most buildings, landscapes, and urban areas outlast people, not only those for whom they were originally constructed but also subsequent generations of people, and sometimes even beyond.

Of course some people, especially in the design professions, know that design matters. But many find themselves stumped when making the case for *why* design matters, and matters crucially to people's lives. One such person I know runs a small, successful nonprofit that advocates for good architecture. She once told me that when a new crisis that affects the design world hits, like the collapsing levees in New Orleans, the prospective demolition of a landmark building, or the permitting of a new real estate development sure to be execrable, she sits around a table with members of her board bemoaning the state of the built environment. These are all like-minded professionals, all passionate about design. We all keep saying to one another, she once complained, that design *matters*. But no one, she continued, can ever say very much about why.

Before, perhaps, no one could. Now we can.

WELCOME TO YOUR WORLD