DATA-DRIVEN DESIGN AND CONSTRUCTION

25 STRATEGIES FOR CAPTURING, ANALYZING, AND APPLYING BUILDING DATA

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25 Strategies for Capturing, Analyzing, and Applying Building Data

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To my son, Simeon,
who taught me to seek out primary sources
in writing and in life.

If we have data, let’s look at data. If all we have are
opinions, let’s go with mine.

—Jim Barksdale
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In this comprehensive book, Professor Randy Deutsch has unlocked and laid bare the twenty-first-century codice nascosto of architecture. It is data. Big data. Data as driver. The word alone sends shivers down most architects’ spines. It is seen as cold, analytic, devoid of art—a word that suggests formlessness. For some in the design industry, especially those trained before the turn of the millennium, it portends the death of architecture as they were taught it and have come to know it. But data, a building block of information, is an essential strand of architecture’s DNA in the twenty-first century.

Like many who became interested in architecture at a very young age and then were educated and trained in the 1970s using T-squares, triangles, and slide rules, I have seen momentous changes in the profession over the past 40-plus years. There has likely been more transformation (much of it revolutionary) in that time, in terms of how design has been affected, production changed, and outcomes altered, than in the previous five centuries. My generation had to learn architecture, and the making of it, all over again. No longer are we reliant on pens, pencils, and mechanical hardware informed by intuition and limited analysis. Instead, we can rely upon real analysis, real research, real information, broken down and shared into zeros and ones, data bits, and software that alters our understanding exponentially, turning analysis into fact-based performative form.

Zeroes and ones break down words, numbers, and images into a commonly shared language that in turn takes on many forms. The zeroes and ones code data. They are analytic and virtual, replacing the intuitive and virtuous nature of architecture and design that we were taught was timeless. Le Corbusier’s Modulor, his riff on the Golden Section and measurement, can be interpreted as an early zeroes-and-ones analogue, even though most architects choose to see it as solely a yardstick or a cubic and volumetric definer of space and form. This was simple data in the form of a rule-set, or principles, which helped to engender form.

Information is a word that for most architects has real and true meaning—particularly if it ensures for them an exchange of facts and ideas that could potentially lead to realizing design intentions. Information-based design seems harmless enough, but for many architects it has a multiplicity of meanings. Information in the twenty-first century is data-driven and data-based. At its root, in-form-ation is a word that as a basic building block of architecture crosses generation, meaning, and outcome.

Form is a word that most architects embrace. At its root, it means the most to design-oriented architects. Pre-form, per-form, form-ulate—all actively modify the root into more meaning and depth, through prefix or suffix modifications. In this new architecture, zeroes and ones, and therefore data, give form meaning, extend form, and make form performative. Twenty-first-century form, especially as imagined by architects, can only be produced through data, modified by data, realized with data, and measured by data.

Professor Deutsch takes data, information, and form, and explains not only how they are used, but also how they are useful. More important, he discusses
the benefits and positive outcomes of employing big data. Those zeroes and ones become architecture, through data, making up information and helping to form performative form. How novel an idea that is: that architecture can become informed, smart, offer feedback, continuously adjust, and continue to improve—not just because we, as architects, say it can, but because the data either tells us it is working or helps us to adjust and accommodate for that which is not working. Our architecture can be responsive to our environment, and to us, and in turn, it can continuously inform the architecture that follows it.

But here we are, 15 years into the new millennium, and still many architects and constructors do not see it that way. In spite of this, architecture can, and will, be made better through information, realized by gathering, analyzing, and maneuvering data. It will be improved by more of it, in real time, during predesign, design development, and documentation phases, enhancing designs performatively and measurably rather than intuitively. Lastly, data doesn't stop with conception and design. As stated in this tome, it is important not only throughout the design industry among suppliers and constructors alike, but also well beyond the time when clients occupy the buildings they have commissioned. The influence of data is a full cycle, continuously informing and reforming architecture.

This book offers us the chance to become informed and knowledgeable pursuers of data and the opportunities it offers for making architecture a wonderful, useful, and smart art form. Architecture as we were taught, but now architecture that can both fulfill a dream and tell a greater truth.

James Timberlake, FAIA
Partner, KieranTimberlake
Sherlock Holmes was highly intuitive, but only after he had collected sufficient data to eliminate the false positives.

—Jonathon Broughton, Data Wrangler

The impetus for this book goes back to my time as a university student. Upon graduation from architecture graduate school, as a graduation gift, my mentor—a professor—gave me a draft outline of a book he never got around to writing. “Here, you write this,” he said, as though he was giving me a book to read. The book—had it been written—was on the topic of architectural justification, a subject that had at the time and long since interested me. I found the opportunity for design professionals to provide ultimate justifications for their architectural acts compelling. While that book so far has not been written (and this is not that book), a focus on process, decision making, and professional judgment prevail in my thinking, in my public speaking, and—informing my research on data in the AECO industry—in the pages that follow.

More recently, I served as the lead design architect on a team of talented designers and researchers on a prototype apartment building. Only this wasn’t your typical housing project: This building would inconspicuously tap residents for their data. Data, in other words, would be extracted from the building’s inhabitants in exchange for subsidizing their rent. My task, as the sole architect on the team, was partly to design attractive, functioning, buildable housing; but, as I soon discovered (and more importantly to the team in the success of the outcome), the charge was to assure that the 24/7 collecting of valuable data from the residents didn’t feel like eavesdrop- ping, wiretapping, or the intervention of Big Brother. In other words, the data gathering had to feel seamless and invisible. Most importantly, it couldn’t feel creepy. It wasn’t the first time an architect has been called upon to design something that needed to disappear, but it proved to be the most important. And the client’s fascination with data goes a long way toward explaining why, as an architect, I am drawn to the topic of data-driven design. For the first time in my career, design and data met head to head. It wouldn’t be the last.

The real revelation for me as a licensed architect, building designer, and professor was that the housing project—the building—was treated by all on the team as something almost incidental. Sure, it needed to be there: The residents needed to live somewhere. Something needed to keep rain and snow out of their bedrooms. But, to be sure, the focus of every meeting was on the data: how it would be gathered in such a way that people didn’t feel like someone was watching their every move, however private. No one in the building, for example, could be aware of conspicuous data-gathering devices. How one went about tapping the building inhabitants for their data was the real design assignment. The goal was to make the data capturing innocuous, undetectable, and appear to be humane.

In my career as a building designer, I am continuously challenged by the need to persuade clients to go with—or as often dissuade them from going in—a particular design direction. There is only so much arm-waving an architect can do to recommend a preferred design direction. Early on, I realized that this process was a whole lot more successful—
faster and less painful—when the decisions (our so-called preferences) were backed with reliable data.

To take one example, when approached by a client to expand their headquarters due to projected growth, there was some guesswork as to whether the completed project would accommodate the owner’s needs at time of move-in and beyond. I watched as the addition, nearing completion, accommodated the company’s anticipated expansion needs, but not their severely underestimated future needs. Data, and data analytics’ ability to predict outcomes—as several individuals and cases in this book attest—would have prevented these stressful and unhappy outcomes.

In my parallel career as a university professor—whether teaching a comprehensive- or integrated-design studio, sequence of building construction courses, professional practice or mixed-reality construction management (virtual and real)—I have come to realize that the subject of data permeates the heart of the curriculum. Yet, just try getting a course approved on the topic of “buildings as data” over the long-used standbys: buildings as buildings, or buildings as documents. It is disheartening to recognize that what students need to know in order to thrive in the new work environment isn’t always, if ever, taught. Something needs to change.

While writing my last book, *BIM and Integrated Design: Strategies for Architectural Practice* (John Wiley & Sons, 2011), I started paying more and more attention to the often cited “I” in BIM, which stands for “information.” I noticed that, for most users, the BIM model was treated as a receptacle or place for safekeeping. People would say the model “holds” objects, the building code, specifications, and other types of information the way a shelf holds books. As analogies go, this wasn’t a very sophisticated one.

While recognizing the value of BIM, most individuals and firms use BIM today as a document creation tool, when instead design and construction professionals need to recognize BIM’s real value as a database, and start treating it like one. Additionally, it has become increasingly clear—through the ongoing research of Paul Teicholz and others at CIFE—that BIM alone won’t improve labor productivity in the AEC industry, which, after more than 50 years of tracking, still lags other nonfarm industries. To improve productivity we will need something more. In *BIM and Integrated Design*, I suggested that we needed to collaborate and integrate while using BIM to see steeper and swifter gains. As of the writing of this book, those gains have yet to be realized. Something else—in combination with working on integrated teams—will need to do the heavy lifting if we are to see progress in our lifetimes. (See Figure 1.1)

Here, in this book, I am proposing that leveraging, capturing, analyzing, and applying of building data is the answer to our industry’s collective productivity woes.

### Asking the Right Questions

*Starting with data, without first doing a lot of thinking, without having any structure, is a short road to simple questions and unsurprising results. Picking the right techniques has to be secondary to asking the right questions.*

—Max Shron

As conferences are where the questions of what matter most to a field are asked, as a member of Notre Dame University’s Sustainable Data Community, I spoke recently at their Forum where I posed the following 12 questions:

- The AEC industry is the last to use data—why?
- What’s driving data use in other industries?
• Why is this happening now?
• What forces are conspiring to come together to make the time ripe to leverage data in our practices and organizations, in our businesses, job-sites, habitations, and offices?
• What’s the business case for incorporating data into our industry?
• How exactly will design professionals have a competitive advantage when working with data?
• Will architects have to adapt to working with quants? How will they do so?
• Will we need to modify the architectural curriculum to incorporate learning of the gathering, analysis, and use of data in design projects?
• Can data be crunched into a form that can be analyzed and communicated by nonexperts?
• Where do knowledge and judgment come in? And how, using data, does one arrive at insights?
• How can we ensure that our data is of high quality?
• Can we legally allow others to rely on the data in our models? Can we guarantee that data? Who is liable?

After conducting 40 in-depth interviews with design, construction, and operations professionals and educators around the globe for this book, I feel that all of these questions—except one—remain warranted. That would be the first: The AEC industry is the last to use data—why? It turns out that design professionals,
at firms large and small, using sophisticated digital tools and hand tools, intelligence and intuition, have been using data to great effect and equally impressive results in their work. It is just that we, as a profession and industry, have not given voice to it—until now. In this book, I have sought to respond to each and every one of these questions, and many more.

The other week I found myself on a long road trip with a university facilities and operations director. The conversation got around to the topic of my research. I mentioned my book—the one that you are now holding, Data-Driven Design and Construction. He looked at me as though to ask, How will that help me? This book shows him—and now you—how. Using practice-based research and in-depth interviews with industry and academic leaders, this book seeks to answer these and other urgent questions and propose actionable strategies that design and construction professionals can begin to put to use to help convince clients concerning design direction, move projects forward, grow their organizations, remain competitive, and innovate.

Depending on what are you trying to accomplish, data plays a role now in every facet of practice. Data of course can be used in design and planning to generate form and create interesting geometry. But that’s only the beginning of what data can do:

• Data can ensure that your designs remain innovative and relevant.
• Data helps increase building performance and improve productivity, as well as enhance human and operational performance, as it predicts a facility’s future performance.
• Data helps teams, firms, and owners achieve business results, by winning projects or by convincing a client that a particular design option is superior, and can be used to reduce risk for the owner, contractor, and architect.
• Data helps eliminate emotion from the decision-making process and allows teams to make decisions with more confidence by proving that their initial concepts were right. It helps designers to get answers out of the information they are already dealing with that will ultimately validate their outcomes.
• Data provides objective evaluations of all aspects of our built environment and helps us to justify design decisions and anticipate consequences for proposed courses of action.

Additional benefits and challenges of working with data in design and construction—for architects, engineers, building owners, and facility managers—can be found in the Introduction, and for owners in Chapter 8. This book introduces professionals and their organizations that are enabled, informed, or driven by data, and shares their recommendations, insights, and strategies for doing so. It also seeks to address and rectify a gap in our learning, by explaining to architects, engineers, contractors, and owners—and students of these fields—how to acquire and use data to make more informed decisions. Further, it raises—and attempts to answer—important questions that design and construction professionals, owners, and their teams need to clarify in order to grow their practices and proceed with their design agendas.

This book isn’t about yet another new movement or trend in architecture. In fact, there is nothing new about data use in architecture (the use of data in architecture goes back at least to the Renaissance, if not earlier). “Data,” according to one practitioner, “is something that has been shaping architecture, planning, and design for generations knowingly or not. It is being collected in so many ways it’s scary to fathom.”
What is the start of a trend in architecture that is just beginning to gain notice (one that hasn’t been formally documented until now) is how data-driven design is the new frontier of the convergence between BIM and architectural computational analyses and its associated tools. We are seeing computational design tools develop in parallel with BIM as a game-changer for winning projects and changing owners’ perspectives on the value of model-based studies. A small number of current practitioners are utilizing it today, so the value of making the ROI and methodology available to students to train for as they enter the profession will enable practice to prosper as they enter the workforce.

The current professional discourse has been focused more on BIM than on the equally game-changing computational analytics. Aimed at all members of the project team, this book seeks to rectify this situation by reaching across the boundaries of design, construction, ownership, and operations of buildings. It’s unique in its approach to looking at BIM as the source of data in data-driven design (D³). Having a book that brings attention to the topic will, I hope, incentivize schools and universities to begin to tackle the subject of data-driven design in their curricula, which does not happen often enough today. Students are surprisingly unaware of this issue within architecture and construction management schools. It is time for that to change.

Because data-driven design affects so many facets of the building lifecycle, this book attempts to be as inclusive as possible. The title is Data-Driven Design and Construction, but would include planning, educators, owners, operators, facility managers, energy consultants, strategy, R&D, and real estate if there were available real estate on the book’s front cover. For my research I rely on many sources, including my own experience, among more traditional sources, but especially on first-hand interviews with thought leaders in the AECO industry who work day-to-day with data.

Innovators and Thought Leaders Leveraging Data throughout the Building Lifecycle

The material in this book grew from the author’s recent conversations with firm leaders and other industry executives at companies ranging in size from sole proprietorships to large multinational organizations. The interviewees’ responses were recorded, transcribed by the author, and condensed for publication. Their job titles reflect their status at the time they were interviewed. The conversations occurred between February and July of 2014. Those interviewed for the book (40 of them) include people who are driving this transformation of the industry. In many cases, the interviewees used the occasion of the interview to clarify their own thinking about data in their work and practices. Together, these views and my attendant commentary paint a cohesive (if not entirely comprehensive) picture of where things in the AECO industry are headed.

The practitioners and academics who appear in the book represent a cross-section of the profession and industry; they are predisposed to think in terms of data: architects, engineers, contractors, building owner/operators, energy consultants, predictive analytic and digital consultants. Some are in management and leadership positions. Some have a design role, whereas others work in construction or operations. Some work on the front lines and some in trenches, from firms both large and small. Some hail from academia, some from marketing
and strategy. Some are immersed in software, consulting on digital technology or climate engineering, with some inventing tools as the need arises. Some will be familiar names, some will be new to you—but in a short time all will become familiar presences in your work, career, and thinking.

What the practitioners and academics you’ll meet in this book all have in common is that they each have a strong interest and opinions on the topic of data; they all have a proven track record for utilizing data in their work to achieve outstanding results; and, together, they represent how data is currently leveraged in the AECO industry. Practitioners in architecture, engineering, computer science, informatics, and those affiliated with this research are currently studying methods to create new ways for gathering and broadly disseminating data—including sustainability data—to help improve our habitable built environment. This book identifies individuals and firms who are using the software effectively, creatively, and for higher purposes and uses; taps into their knowledge base and shares their latest findings, best practices, and insights; and presents factual information on how data is being used by those who are leading the way. It presents people with interesting applications of data in the AECO industry, and for the first time, looks inside practices to take a closer look at how those in the AECO are working with data and what lessons they’ve learned.

Throughout the first half of 2014, I spoke with people around the globe who are working with data in design and construction, in planning and research, in fabrication and strategy, in real estate and academia, and have collected their experiences, words of advice, hard-earned insights, and strategies, and made them available to you in this book. So many books show you how the 1 percent does it. Then when it comes time for you to try to do it at home or the office, you are unable to repeat the results. So I also sought out people who are struggling to include data in their design and construction process and practices.

The research for this book has been based on today’s technology and practices. Since leveraging data in architectural practice, construction, and operations is at a point of inception and rapid evolution, updates will be posted to the author’s blog (http://datadrivendesignblog.com) as well as the publisher’s book page as they occur. Book writing itself could be thought of as an exercise in data mining, where the first-hand expert testimony is the raw data leveraged—through queries and data dives—to test working hypotheses and evidence to support the author’s claims. In the writing of this book I often found myself data mining for insights from the interview database. The book you hold in your hands is the result.

**What This Book Will Do for You**

_Data-Driven Design and Construction: 25 Strategies for Capturing, Applying, and Analyzing Building Data_ addresses how innovative individuals and firms are using data to remain competitive while advancing their practices, and how firms can benefit from creating a data plan and putting data to use in their projects. There’s a need for a book that shows not only why design, construction, and operations professionals need to understand where data and analysis fit into their work and practices, but also how they can go about using data and analysis to meet and exceed expectations.

This book will help you recognize the data you already have: data that you are sitting on, data that is available to you today in abundance, data that you may not have realized was there. It will prepare you—ready you—for the necessity of making the capture, analysis, and application of data a central part of your practice, culture, and—importantly—
mindset. This book will help you to see data as central to your firm’s arsenal of tools and resources; and help you understand data’s impact on learning, recruitment and training, human resources, finance and accounting, branding, strategy, design, innovation, project management, and leadership.

This book explores the most commonly encountered obstacles to a firm’s successful application of data on projects and teams, as well as the challenges the data creates for individuals as they strive to establish a data strategy for their organization. These challenges include interoperability, workflow, impacts on firm culture, training, technological challenges, data’s influence on who works on teams, communication, cost, data sharing, and privacy and security. Design decisions, when challenged, have to be justified, and there is no better way to defend these courses of action than to provide data to back up these decisions.

Show Me the Data

The secret to success in business—and no less in design and construction—is to speak your client’s language, and more and more of that language is spoken in terms of data. Owners no longer accept designers’ and contractors’ reasons at face value. They ask for evidence, and data, to back up those claims and reasons, and then base their decisions to move forward with their projects on that data. If you want to see your preferred design scheme selected, and buildings built, and want others to continue to come to you for the services you provide, you will need to add new tools to your toolkit. This book will help you identify and use them effectively, and introduce you to people who can help you along the way.

This book won’t quote trends and statistics. Ninety percent of the world’s data has been produced in the last two years. How does knowing that help you? You won’t find many factoids like that in this book. As interesting as they are in and of themselves, you don’t want factoids. What you want is information that enables you to do your job better. All this data-related trivia tells you is that there’s a lot of data. We get that. What these statistics don’t do is help you do your job better. And that is the purpose of this book.

There are two types of people who will react differently to the title of this book: those who count themselves amongst the analog (some might call themselves Luddites or close to retirement and thus immune to change), and those who want to prepare for the future, because they recognize that the future is already here. To this second group, using data is common sense. They don’t need convincing: they just want to be shown the way. That is what this book is for and sets out to accomplish.

This book is about saving the architecture profession from extinction and construction from languishing in 100-year-old habits. This book is about making the AEC industry more productive, about helping firms become more competitive and giving architects a purpose again. This book is about rebuilding credibility in the eyes of building owners, and adding substance to spurious arguments about beauty and design. This book is about creating better buildings with better information, and it is about all of the things that can’t be captured in a book title (Data-Driven Everything?) This book is about building a bridge between design intent and the outside world; it’s about the “I” in BIM, and it’s about how big data can be leveraged in our industry, long after we stop calling it big data. This book is about making firms perform more efficiently and effectively; about optimizing energy use in buildings; and about making smarter decisions. This book is about the future, and it’s about what is happening right now. I hope you enjoy reading it as much as I enjoyed writing it.

Please go to www.wiley.com/go/datadrivendesign for instructor materials.
Notes

Unless otherwise indicated, quoted text throughout the book is from interviews with the author that took place between February and July of 2014.


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INTRODUCTION: MEASURING THE IMMEASURABLE, VALIDATING THE INEFFABLE

Buildings are decisions.  
—Markku Allison

Being a design and construction professional today is a balancing act. Many are overwhelmed: at capacity in terms of time, resources, and mind-space; struggling to keep up with the latest technologies and work processes, let alone considering getting ahead. Meanwhile, they know—despite dwindling margins—that they need to remain competitive in order to compete for work, move projects forward, and get work done in an efficient manner.

You might think that design and construction professionals have already dealt with successive disruptive technologies—CAD, BIM, digital-, parametric-, and computational-design tools, to name a few—and aren’t sure if they’re ready for another. Aren’t architecture, engineering, and construction already complex and complicated enough?

Not One More Thing

Some will balk: We’re not ready—we’re unprepared—to deal with data on top of everything else we have going on. Or, we’re just trying to make ends meet—trying to compete for projects on threadbare budgets and miserly fees. Do we really need another thing on top of everything else we have to contend with? These are all ways of saying the same thing: that data is one more thing.

But capturing, engaging with, analyzing, and applying data is not one more thing. As this book will try to make clear, data is not something added on to all you are currently doing. It is integral to what you do and have been doing for some time. All activities that we undertake today can be transformed into data. Data always informs our designs. The data is already there; you just need to know where to look to find it. It already exists—in abundance—and represents an opportunity too big to pass up. You cannot afford to ignore it. This book will help you to see the data you have available to you more clearly and readily.

Something Old, Something New

Architects, engineers, and even contractors have been working with data for ages. What is new are the myriad ways we have to capture, analyze, and apply the data that is available to us. Likewise, many data sources are new, and many industry players—and their titles and backgrounds—may be unfamiliar, even to those in the industry.

Data is recognized by many in the architecture, engineering, construction, and operations (AECO) industry as the elephant in the room. Data and especially the catchall term big data is an important topic and, specific labels aside, is poised to remain so. To their credit, many design and AECO industry professionals already realize that data is the answer to their most perplexing professional and business problems—but they are unfamiliar with the steps necessary to
acquire and use the data that will enable them to do their jobs better, remain competitive, and achieve a higher return on their technology and training investment. Even more than the acquisition of new skill sets and technological capabilities, to reclaim their roles as leaders, architects in particular need to simultaneously account for data and information derived from their digital models, and also be able to gather, navigate, and communicate this information while working collaboratively throughout the complete design and construction cycle.

**Strategies for Practice**

In this book you will find step-by-step instructions for working with data, but, because no two firms are alike, only a scant few one-size-fits-all solutions. That’s because this is a book of adaptable strategies you and your organization can apply today to make the most of the data you have at your fingertips—much of which you may not be aware of. This book also reflects the trend toward a real-time convergence of technologies and processes that aren’t reflected in linear first-this-now-this checklists. This book looks inside practices to observe how people in the AECO industry are leveraging data in their day-to-day work—today.

We need to get better at leveraging data to remain competitive, to satisfy our clients’ need for evidence, and to help make our claims credible. We need to learn how to work with data to verify our intuition and instinctive hunches, to bridge the gut/data divide, and to remain relevant in a business-oriented, STEM-centric world. (See Figure I.1.)

**Why Start Now?**

You’ve gone this long without consciously using data, so why start now? In fact, you have been using—gathering, analyzing, and applying—building data all along and likely didn’t realize it. This book shows you how to do so more intentionally, purposefully, and effectively, and helps you see the opportunity that has been there all along.

Data is changing the way we work in the AECO industry. Design and construction professionals need to increase productivity. Building owners have charged us with the task of verifiably increasing value while simultaneously decreasing waste, realizing the promise of our digital tools, integrated processes, and workflows. This book covers the role that data plays in our profession’s and industry’s continued relevance, improved prospects, and brighter future—because an industry is a terrible thing to waste.

Learning to work more effectively with data will require the acquisition of some new skills. But even more important, especially at the beginning, is the development of effective mindsets. BIM (building information modeling) is a case in point. While recognizing the value of BIM, most still use BIM tools today for document creation, at a time when design and construction professionals need to recognize BIM’s real value—as a database—and start treating it like one. How we use and interact with the data generated in BIM-enabled projects is the next step in BIM adoption. Learning to capture, analyze, and apply data is how many of us will take BIM beyond visualization, clash detection, and coordination to

![Figure I.1: A spectrum of decision-making criteria: Data increases credibility. © R Deutsch](image)
the next level. In fact, *Data-Driven Design and Construction: 25 Strategies for Capturing, Applying, and Analyzing Building Data* was written, in part, to help design practitioners and their project teams to make better use of BIM. Many firms are already doing this—you will meet them in the chapters that follow—but up until now, there has been little to guide those who would like to explore a similar path.

**Data’s PR Problem**

Data admittedly has a public relations problem. Why focus on something so seemingly small when there are many large and complex problems demanding our attention? Most people are indifferent when it comes to data. Data is not as interesting or sexy as design. Some are hesitant to talk about data because they see it as a commodity. Some, especially academics, are threatened by data, the study of which culturally and institutionally originates outside of design and architecture proper. Some see it as one more thing threatening to minimize the architect’s strength and core competency—design—or don’t see how these things relate to or support one another. Some fear that data is the antithesis of craft: why crunch numbers when you can use your hands to create something beautiful and of everlasting value? All of this combines to ask: *Do we really need one more intervention, trend, or movement to move architects away from their art, and contractors from their craft?* There’s an attitude that data should be something left to the “quants.” The basic question is: *Why should design professionals and contractors concern themselves with data?*

You work with data not because you like to work with numbers, but so you can design with more confidence. As you’ll learn in the chapters that follow, data isn’t the antithesis of design and craft; rather, data enhances craft and, importantly, ensures that what is designed and crafted gets built. Working with data doesn’t preclude you from using your imagination or from designing innovative buildings. In fact, data makes each more likely to happen. Because it leads to quicker, more assured decisions, working with data frees you up to spend more time in design.

Is data a *nice-to-have*, but not yet a *must-have*, for design and construction firms? The point isn’t for you to become an expert at working with data for its own sake, but to learn how to leverage the data you already have available to you to increase the chances that your design will get approved and built, so you, your clients, and the building users benefit from your built work. By this definition, data is indeed a *must-have*.

There are just too many ways that data can be gathered and utilized for you and your organization to ignore it. As we move forward, *not* recognizing this could be a mortal blow to the sustenance of untold firms. No matter where you find yourself in the building lifecycle, data can help you achieve your goals. This book will explain in clear terms what you need to have in place to make data part of your practice, and will help you determine how prepared you are to use data. You wouldn’t go hiking or camping without the right supplies and tools. This book will let you know what you need to have in place to make this journey.

We need to start thinking of buildings, and our work as building professionals, in terms of data, to tell better data stories to our clients and stakeholders. We need educators who recognize the value of data and share this knowledge with their students, who are the future of the profession and industry. We need to continue to identify problems that can be addressed with data, and a way of thinking about those problems to render them amenable to computational analysis. This book will help you ask questions that others don’t ask—or don’t know to ask—that will lead to more assured decisions and insights. (See Figure I.2.)
Benefits of Gathering, Analyzing, and Applying Building Data

The benefits of using data on building projects are many, and some may surprise you. These and other benefits—and challenges involved in working with data—are covered in greater detail in the chapters that follow.

Globally Shared Benefits

In addition to benefits specific to the owner, architect, and contractor, there are several benefits that are equally shared by all involved parties. Global benefits of data include the elimination of emotion from the decision-making process and fostering of behavioral changes, as well as a reduction in risk, management of complexity, and an improved project definition.

Data Brings an Analytical Approach to the Building Process

Many AECO professionals use data to help eliminate emotion from the decision-making process. As Evelyn Lee, strategist at MKThink, noted, “It helps our clients find thought processes that are objective when it comes to the ultimate solutions we help them to create using data that supports how we move forward in the project.”

Data Leads to Behavior Change

Behavior change is one of the more startling results of leveraging data in building projects, especially on the user end. Daniel Davis of CASE lived in an apartment where tenants had to prepay for their power. “Right beside the door was a meter displaying how much credit you had left—how much power was remaining,” explains Davis. “You could turn on the oven and see the remaining power quickly diminish. I became acutely aware of how much power I was using in that apartment.” No longer was a unit’s power usage an abstract number sent as part of a bill every month, says Davis, “it was something I constantly saw, every day. Through this constant exposure I came to better understand my power usage and how to better control it. This was just a single metric, a single data point, and it had a noticeable effect on my behavior. Using data in this way has great potential.”

Data Reduces Risk

Owners are convinced by data. Evelyn Lee points out that data’s ability to convince has the added benefit of reducing an owner’s sense of risk. “The fact that

An Incomplete List of Things That Can Be Made Better with Data

- Answering a factual question
- Telling a story
- Exploring a relationship
- Discovering a pattern
- Making a case for a decision
- Automating a process
- Judging an experiment