BIM and Integrated Design

Strategies for Architectural Practice

Randy Deutsch, AIA, LEED-AP

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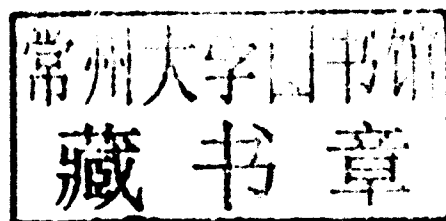## STRATEGIES FOR ARCHITECTURAL PRACTICE

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AIA

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INTRODUCTORY STATEMENT BY THE AMERICAN INSTITUTE OF ARCHITECTS

In this book, Randy Deutsch describes building information modeling (BIM) as a means of coordinating project information. Like the American Institute of Architects (AIA), Deutsch recognizes that while these methods and tools play a vital role in integrated practice, the collaboration essential to integration can be used with any type of project delivery.

As stated in the *Primer on Project Delivery* by the AIA and the Associated General Contractors of America, "At the present, there are no industry-wide accepted definitions of project delivery methods, and many groups, organizations, and individuals have developed their own. In so doing, they have often used different characteristics to define the delivery methods. The result has been a multiplicity of definitions, none of which is either entirely right or entirely wrong." Groups may use the same term to articulate different organizational concepts for project delivery as well as the tools used to bring about a successful project.

Deutsch's text describes the BIM process to be a dynamic, continuously evolving strategy for designing and making buildings. Because it is an emerging form of practice technology, the AIA acknowledges that other definitions of BIM may appear over time. The term *building information modeling* as used within the following pages may also be used to describe other operational arrangements by different groups. This book is an important step forward in the definition and discussion of a BIM-enabled project delivery approach that holds great promise.

PREFACE

Figure A   Building Information Modeling (BIM) platforms can be used to design just about anything. *Zach Kron, www.buildz.info*

This is not another technology book on Building Information Modeling (BIM), the software tool and process for generating and managing building data during its complete lifecycle, from conceptual design through fabrication, construction, maintenance, and operation of the building. While there are several excellent resources at your disposal that can answer many of your most pressing software-related questions concerning BIM, this is not one of them.

Nor is this a business BIM book that measures your return on investment (ROI) or provides business models or value propositions.

While these subjects are discussed in these pages, this is a different sort of BIM book.

That's because his book addresses *you*.

BIM and Integrated Design addresses obstacles faced by design professionals and their organizations in their use of technology, offering strategies—and in doing so—clearing a path toward success, however defined, for yourself, your firm, the profession, or industry.

Until BIM use is ubiquitous, until BIM permanently enters the lexicon and design professionals start thinking in terms of BIM's impact on all trades—until that day comes—you have this book to guide you.

This book originated with something I overheard. Charles Hardy, director of the General Services Administration's (GSA) Office of Project Delivery, put it bluntly when he said that "BIM is about 10 percent technology and 90 percent sociology." And yet to date 90 percent of the focus in training, education, and media has been on the innovative and admittedly visually appealing technology, or equally on the business model and value proposition of BIM. (See Figure B.)

Think about it. If the difference between a successful BIM implementation and a failed or even potentially catastrophic one has as much or even more to do with the mindsets and attitudes of those who use it as it does the technologies and work process the technologies enable and require, how will these necessary practical, attitudinal, and behavioral changes come about? (See Figure C.)

But 90 percent sociology? If that's the case, why are we spending 90 percent of our time attending webinars, seminars, and conferences on the technology? Why are 90 percent of the websites, user groups, and blogs devoted to the software? If true, we're perhaps asking the right questions but focused on the wrong outcomes. That's because it's mastering the process—not the technology—that leads to exceptional results, both aesthetically and financially. (See Figure D.)

There is a gap in our research and in our understanding. This book seeks to fill that gap by asking questions of and gathering insights from those who have worked in the BIM environment, used the software, adopted and implemented the programs and work processes in their organizations, taught the subject in a university setting, and struggled and watched the tools and process evolve over time.

Of the triumvirate of business, technology, and culture, culture is by far the least studied, analyzed, and, frankly, exploited. It is also the least understood. Human habits, social relations, social interaction, and intelligence—these are taken for granted and are the last frontier for garnering the greatest gains from the technology and work processes. The business and technology cases for BIM have already been made and largely accepted. It is about time that somebody made the cultural case for BIM. That is what this book sets out to do. (See Figure E.)

Reality
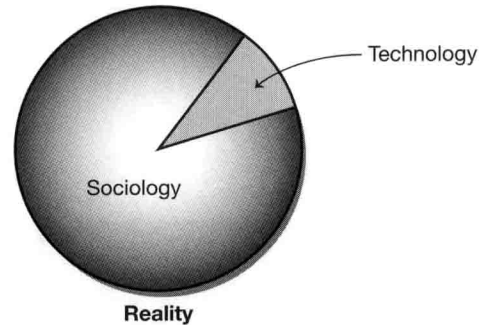
Figure B   "BIM is about 10 percent technology and 90 percent sociology." Charles Hardy, Director, Office of Project Delivery at U.S. General Services Administration (GSA).

Perception

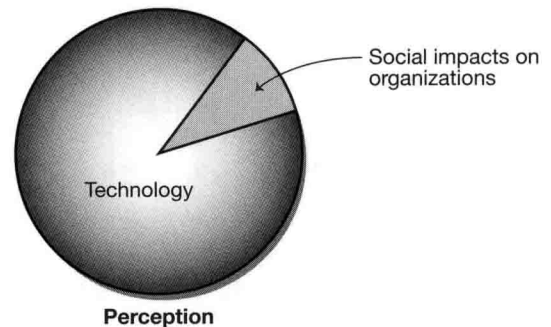Figure C   The misperception is that BIM is about 90 percent technology and 10 percent sociology.
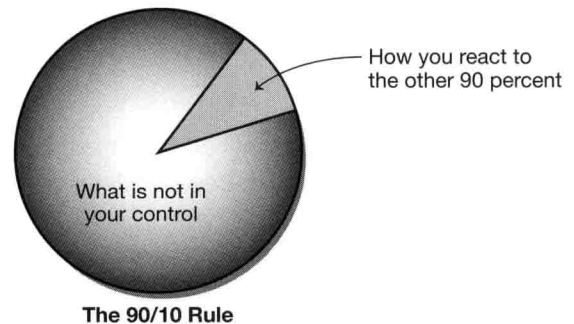

The 90/10 Rule

Figure D   Alternatively, 10 percent is what happens to us as a profession and industry, while 90 percent is decided by how you react to it.

Where were the answers to my questions concerning what it is like to be someone in the design professions or construction industry that works in a BIM environment? How is it different from the way we used to practice? How is the workflow changed—and what exactly is meant by "workflow"? What's with all those large screens and monitors? What exactly is a Big Room or iRoom, and do I need to have one? What's the difference between a BIM manager, an IT manager, and a CAD manager, or between a BIM operator and a BIM coordinator? Whom do I hire, whom do I mentor, and exactly whom do I select to work in BIM? Is it necessarily the employee who excelled at CAD, or is CAD expertise a potential impediment? Is it true that BIM takes as much social intelligence as technical competence? What changes to the workplace should I expect? How will we share data among the parties involved?

Everyone says you need to work collaboratively, but no one tells you how that's supposed to come about. All of a sudden, with a long history of confrontation, we're supposed to hold hands and sing "Kumbaya"? As soon as I started to seek out answers to these questions, other questions arose. (See Figure F.)

The book you hold in your hands is the result of having asked these questions. Like integrated design itself, there may be one author listed, but, as in the best of collaborative efforts, the book is informed by many. In this sense, the book less expounds the theory of one than shares the collective, unified wisdom of multitudes. I hope you find the responses I received and the answers I've uncovered insightful, informative, and ultimately invaluable.
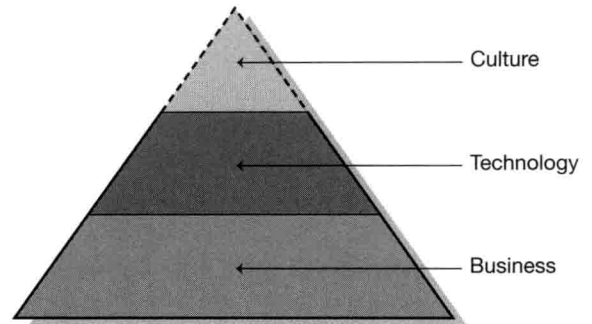
Figure E   The business and technology cases for BIM and integrated design have already been made. It is time to make the social case for firm culture, including working relationships, interactions, and intelligence.
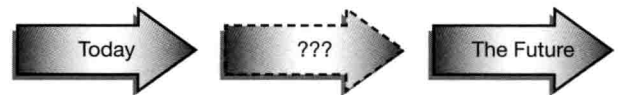
Figure F   The one element propelling you and your organization today toward achieving your goals in the future is people—people with the right attitudes and mindset to benefit the most from using the new tools and collaborative work processes.

ACKNOWLEDGMENTS

INTRODUCTION:
Rethinking Our Work Processes, Roles, and Identities
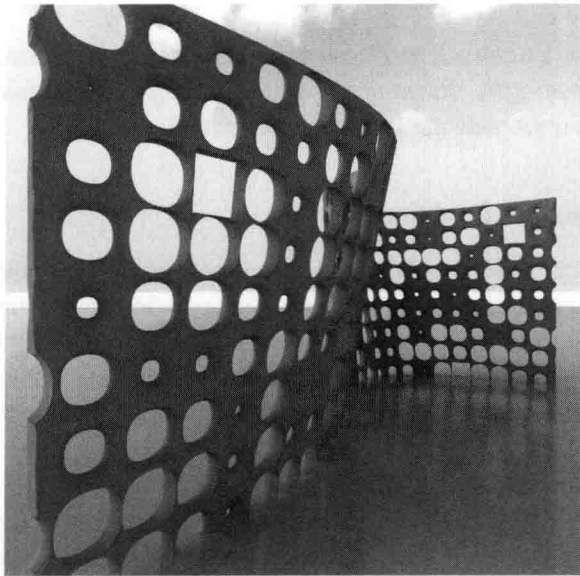
Figure G   Collaboration: one person writes the plug-in, another compiles the source code, and a third writes the installer, resulting in a generative design curtain panel with a divided surface. *Zach Kron, www.buildz.info*

This book addresses something that most firms don't even consider when implementing and working in BIM—and such firms are at risk for not giving this factor their full consideration.

What is the one element that stands between where you and your organization are today and achieving increased success, leadership opportunities, and increased commissions?

Looking Ahead

Business issues such as value proposition and ROI will work themselves out, as will legal issues, ownership issues, issues of responsibility, standards of care, and insurance.

Technology will become easier to use, software will become more or less interoperable, and file sizes will become easier to manage.

The fact is that none of these things are up to you. There is, however, one seminal element that will determine your success—and your organization's—while working in a BIM and integrated design environment.

And that element is *people* (see Figure H).
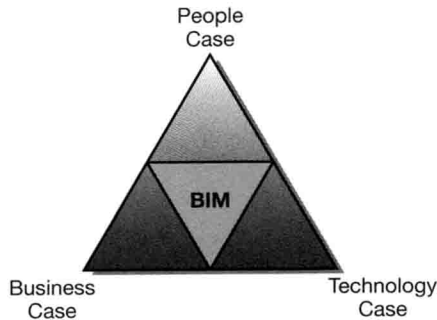
Figure H   The case for BIM is incomplete without the people case.

A Focus on People

This book addresses the number one problem of BIM implementation in the workplace: not technology or business value propositions, or even ROI, but rather *people*.

People are the crux—the key—to advancing BIM and integrated design. You—your organization's people— are the one remaining question mark that needs addressing. Your firm culture will not work itself out. Issues of playing well with others cannot continue to be addressed on a piecemeal basis. Human factors such as personal initiative, mutual respect and trust, human nature, ownership and authorship, comfort with work processes, workflow, impact of technology on design, work habits, preferences, identity and role, personality, legacy, collaboration and communication—all of these impact the efficiency and effectiveness of your BIM efforts. Moving ahead, it will be increasingly necessary to align people's attitudes, mindsets, and work habits in order to continue to not only survive but excel in this new BIM environment. Helping you and your firm to do so is the purpose for, and focus of, this book.

How, you ask, can something as obvious as *people* be overlooked and underrepresented in the vast literature on BIM and integrated design?

Severely underaddressed and currently seemingly unresolved people issues brought about by the introduction and adoption of BIM represent a crisis in the implementation of this exciting and potentially revolutionary technology and integrated design process.

The focus needs to be on people and the strategies they use to manage and cope with the transition to the new digital technology and the collaborative work processes it enables, as they adopt, implement, and then take the technology and process to a higher plane.

Where can you find these firm culture issues addressed thoroughly, convincingly, and effectively in a way that is universally applicable?

Human-Centered BIM

This is where *BIM and Integrated Design* can help to address these pertinent questions and rectify this situation, putting implementation of the new technologies back on track by making them manageable, understandable, and approachable in people terms.

Up until now the focus has been on the business case for BIM, on ROI, on software and technology—but not on the one factor we can do something about. For an organization built on human values—client service, trust, and relations—suddenly introducing a project on a 54-inch flat screen TV monitor, holding or "attending" meetings via satellite, challenges and changes that situation and relationship. Too often, people are left out of the equation. This is such an important theme throughout this book that the book's first part is entitled "BIM as though People Mattered."

If you and your organization haven't yet benefitted from all of the promises of working with BIM, it's the contention of this book that *when people issues*

are addressed, all of the other issues will work them-selves out.

Despite articles and books having been written on the subject of BIM, the problem—the *people* problem—persists. Very little has been written specifically on which elements from the traditional design process change with BIM and which stay the same, or on what knowledge, methods, and strategies must be let go of with BIM and what is critical to keep. What, in the learning process, needs to be *unlearned*?

Unlike other BIM guides, *BIM and Integrated Design* is less focused on the mechanics of the implementation than the "sociology" that makes a smooth adoption and implementation possible—the difference between an aborted or abandoned effort and one that sticks.

The vast majority of BIM-related literature has been focused on the technology, not on the people who use it. This is a problem, given that people issues and people's thought processes, mindsets, and attitudes are the main impediment to widespread adoption and implementation of the technology and, as importantly, of the integrated design work processes enabled by the technology (see Figure I).

People problems, human issues, issues of communication and collaboration, firm-culture issues, issues of motivation and workflow: all brought about or exacerbated by the advent of BIM into the workplace, profession, and industry, these people-oriented factors are a greater challenge than solving the considerable software, business, and technical problems this approach requires. This is the subject addressed in this book.

Social Implications of BIM for Firm Culture

For years the software resellers and for-profit educators, beating the *technical/business* drum, have been
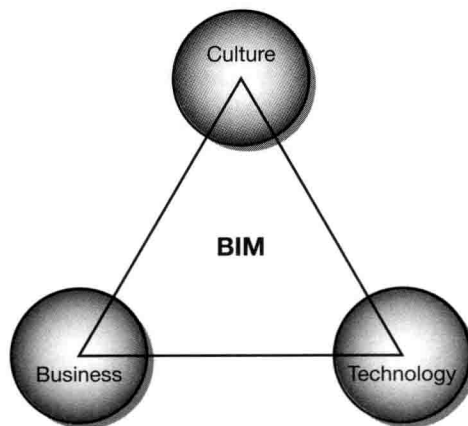
Figure I   Three drivers of change factor into the industry's implementation of BIM.

pushing BIM as a way to increase the output of junior staff, improve document accuracy, and reduce the number of change orders. All well and good. Senior management would listen to the sales pitch and consider the cost of implementation in terms of dollar value, learning curve, and perceptions of the track record of these tools and software programs.

This book looks at these benefits and results as well, but it considers the costs and gains in terms of the social and firm-culture factors of implementing and working in BIM.

Dealing with Change in an Environment of Change

What design professionals do—what they produce—is neither just facilities nor documents but *change*. Yet, ironically, when it comes time for them to confront it they seem to have such a hard time swallowing change themselves.

It is the difference between technical and systematic companywide change, as indicated in this report: "In its haste to introduce a BIM capability Company X

Within the context of this book, BIM refers to **Building Information Modeling** *as a process—as opposed to software, technology, or tool—of generating and managing building data during its complete lifecycle, from conceptual design though maintenance and operation of the building.*

*   **Integrated design** *here is a collaborative approach—inclusive of delivery methods such as integrated project delivery (IPD)—to building design marked by the qualities of early participation by all team members, sharing risk and reward, among other benefits that attempt to resolve efficiency and waste concerns and overcome historically adverse relations while creating the most value for the owner in the resulting completed project. Integrated design also implies "integration," connoting a sense of acceptance, even transparency, within the user environment. Together, BIM and integrated design support and reinforce each other to mutually beneficial results.*

Figure J   Your success and progress with BIM occurs where the three drivers of change overlap.

purchased software, but did not factor in the process changes/training required to implement new workflow and design processes that would optimise the way the BIM system fitted with current and future business needs."[1]

What is that factor and how does it work? This book seeks to explain just what that missing factor is—and how best to utilize it for you and your organization to work more fluidly and effectively. With the social impacts of BIM addressed and mastered, ROI should come more naturally, and more effective use of the tools come more easily (see Figure J).

The Situation Today

BIM adoption and implementation are no longer the main challenge most firms are currently grappling with, as they were a few years back. Today, the challenge is the social implications of the technology and associated work processes on firm culture and workflow brought about by implementing BIM. Firms want to know how best to optimize their work processes to become more efficient at what they do best, to remain competitive by utilizing the competitive advantage of BIM and integrated design.

Today, most organizations face economic uncertainty, greater competition for projects, and clients demanding less waste, more efficient use of labor and resources, shorter schedules, projects on budget, fewer unpleasant surprises, and less finger-pointing and litigation—the very issues that have brought BIM and integrated design to the fore.

The movement to BIM and integrated design, though largely driven by owners and government, can take place only when design professionals and others in the construction industry have a compelling reason to change. Together, the technology and work

processes enabled by new technology are seen as one of the drivers of change in the industry to help keep construction lean and achieve these goals.

About the Book

BIM and Integrated Design is an implementation book from a firm-culture standpoint, addressing Building Information Modeling as a cultural process with a focus on the technology's impact and transformative effect—both potentially disruptive and liberating—on the social, psychological, and practical aspects of the workplace.

Neither a technology nor software book per se, *BIM and Integrated Design* addresses the questions that implementing BIM poses to the firm that adopts it. Through thorough research and a series of case study interviews with industry leaders—and leaders in the making, out from behind the monitor—and with a focus on real-world practice, process, and people, *BIM and Integrated Design* is the first book devoted to the subject of the social impact BIM has had on individuals and organizations within the ever-changing construction industry.

This book presents multiple snapshots from varied viewpoints of the state of BIM implementation and of what's holding back design professionals and keeping them from reaching a widespread leadership role in the AECO industry, as well as offering recommendations and strategies for regaining a leadership position.

Who ought to read this book? *BIM and Integrated Design* is for those who want to be prepared with the right attitudes, mindsets, skill sets, and aptitudes for when they adopt BIM and the collaborative work process of integrated design throughout their organization, as well as for who seek to attain a solution that leverages the skills, experience, and insights—as well as prevailing attitudes and mindsets—already present in your organization.

BIM and Integrated Design is for you if you

- Are curious about BIM but would like the facts and know what impacts are involved—the full picture.

- Have the software but feel that you are not completely utilizing it—or are utilizing it less satisfactorily than you had hoped.

- Find yourself in transition between the old way of doing things and things to come.

- Are already running with the technology, but have run into roadblocks—unexpected issues that you would like to resolve effectively, once and for all.

- Have mastered BIM but would like to learn more about how others use this knowledge to leverage integrated design in practice.

While the book assumes vendor software neutrality—I was trained and work in Revit but have also worked in ArchiCAD and am familiar with other programs—"BIM" is used generically throughout. And while the book does not promote any one proprietary BIM program, the interviewees frequently mention design data created in an authoring application such as Revit or ArchiCAD.

Research Methodology

Because the focus of this book is on the sociological impacts of the various new technologies and work processes, besides the stated and cited data a good amount of the information is empirical, garnered from a variety of reliable sources including in-depth

interviews with individuals immersed in the technology and the industry, including industry leaders and technology experts revealing actionable strategies through their insights and experiences. These interviews provide a balance of qualitative as well as quantitative research and evidence.

As important, in this book I write from the perspective of having served for twenty-five years as a lead design architect working on the design of large, complex projects; on the front lines in BIM and IPD environments where BIM was used both alone and collaboratively; having run my own design practice and served in senior management in organizations both large and small; having helped inaugurate and teach an integrated building science/design studio for a number of years in one of the finest graduate architecture programs in the country; and having served on the board of AIA–Chicago chapter for many years. In other words, I write as one of you—immersed in a profession and industry that I want to see not only survive but flourish in the years to come.

How To Use This Book

BIM and Integrated Design is organized into three parts: "BIM as though People Mattered," "Leading Integrated Design," and "Leading and Learning."

Chapter 1—What You Adopt When Adopting BIM

Chapter 1 introduces the human factors in BIM and integrated design; discusses owning the process and managing change and transition; covers the biggest myths and misconceptions regarding BIM and introduces the many co-benefits of working in BIM. Questions this chapter will attempt to answer include: Firms intend to start every new project in BIM, but do so in actuality only a fraction of the time. Why is this?

Why does BIM take so long to implement? And why it's not BIM that you implement, but rather your decision, your choice, to adopt BIM?

Chapter 2—The Social Implications of Implementing BIM

Chapter 2 addresses social implications of working in a BIM environment, including work processes and workflow; makes suggestions for how to overcome barriers to successful BIM implementation and how to conduct a BIM self-assessment for individuals as well as for your organization. It concludes with two interviews. The first is a case study interview with leaders of a successful design firm that, through the creative and bold use of BIM, has not only been able to hold its own but grew during the recent economic downturn. They share what worked, what didn't, and what they believe is necessary to accomplish similar results for yourself and your organization. The second, a conversation with a BIM and integrated design consultant who has extensive experience working in BIM with designers, a design/build firm, and constructors, explains how his peers and clients went about successfully implementing BIM.

Interview with Paul Durand and Allison Scott, Winter Street Architects

Interview with Aaron Greven, BIM Consultant

Chapter 3—Working with Others in BIM

Chapter 3 describes the ten most commonly encountered obstacles to successful collaboration; suggests strategies to overcome these obstacles and for making collaboration work; and follows with an in-depth interview with a clinical and organizational psychologist, executive coach, and organizational consultant working with architectural firms—and in the construction industry himself—for over thirty-five years.

The chapter concludes with a conversation with a pioneer in applying information technology to architecture, engineering, and facility management in the design and construction industry and in helping AEC firms and government and corporate facilities groups evaluate and implement technology systems.

Interview with Jack Hungerford, PhD

Interview with Kristine K. Fallon, FAIA, Kristine Fallon Associates

Chapter 4—Who Works in BIM and Who Doesn't

Chapter 4 describes the new roles design professionals play on teams, in organizations, and in the profession and industry, as well as what happens to former roles (such as project designer, project architect, and project manager) in the transition to BIM. The chapter culminates in a conversation with one of the industry's most well-informed and strategic CIOs, a registered architect and LEED AP who is responsible for the strategy, supervision, coordination, and delivery of all information systems and services for his top-tier firm.

Interview with Rich Nitzsche, CIO, Perkins+Will

Chapter 5—BIM and Integrated Design

Professionals in the building and construction industry have been slow to jump on the integrated design bandwagon. One goal of this book is to rectify this situation.

Before one can suggest and promote the integrated design process to owners, we need to thoroughly understand what it entails. If the best way to learn is by trial and error, this book aims to keep the mistakes—and associated pain—to a minimum. Chapter 5 serves as a brief but incisive overview of integrated design and closes with two interviews: the first with two construction professionals who are helping lead their organization's efforts in the development of Virtual Design and Construction (VDC) and BIM for the advancement of technology in construction; and closing with a discussion with an architect, development advisor, past-chair of the Integrated Practice Steering Committee of the AIA California Council and author of *Integrated Project Delivery: Six Case Studies,* published by AIA, AGC, and Mc-Graw-Hill.

Interview with Andy Stapleton and Peter Rumpf, Mortenson Construction

Interview with Jonathan Cohen, FAIA

Chapter 6—Leading from the Model

Leading at any time is hard. Leading during turbulent times is even more difficult. Due to disruptive technologies and new ways of working together—the introduction of collaborative work processes—learning how to shift into the mindset essential to leading the BIM and integrated design process has become especially critical. Chapter 6 will help you—working in a BIM and Integrated Design environment—to become more effective leaders no matter where you find yourself in the firm hierarchy or on the project team. The chapter concludes with a conversation with a project architect/BIM manager for the highly ambitious Canadian Museum for Human Rights (CMHR). He was charged with the transforming of 2D Design Development documents into a complete 3D Building Information Model that is currently being utilized as an aid in construction. A second interview is with the director, Office of Project Delivery, at the U.S. General Services Administration (GSA) Public Buildings Service National Capital Region.

Interview with Brad Beck, BIM Manager, Architect

Interview with Charles Hardy, GSA

Chapter 7—Learning BIM and Integrated Design

The introduction of BIM into the workforce has education and training implications as well—factors that impact firms and practices, especially those that hire directly out of school. This impacts HR, hiring practices, recruitment, and ultimately the makeup of the firm—its organization, if not its organizational chart. The ultimate goal for the architect is to lead the process and create the ultimate BIM and Integrated Design experience for all involved. It is not a question of learning software. It is a question of becoming familiar with the process and how this awareness is learned and acquired. Chapter 7 features two interviews with exceptional educators, authors and thinkers: The first with a postdoctoral associate in the Program in Science, Technology, and Society at MIT, where he studies human-machine-environment interaction, having served as visiting lecturer at Cornell University, bringing an interdisciplinary background in architecture, computing, and ethnography to his work.

The second is a candid interview with a vice president at Autodesk who is responsible for the company's future vision and strategy for technology serving the building industry. He is a former principal with Pelli Clarke Pelli Architects; educator of Professional Practice at Yale where he received both his B.A. and his M. Arch.; coeditor of *Building (In) The Future: Recasting Labor in Architecture,* published in 2010 (MIT); a senior fellow of the Design Futures Council; and former chair of the AIA National Contract Documents Committee.

Interview with Yanni Loukassis, PhD, MIT

Interview with Phil Bernstein, FAIA, Autodesk VP, Yale University

Do You Have What It Takes?

Perhaps Phil Bernstein, FAIA, explains it best when describing what he personally went through in his first well-publicized and documented IPD project:

> Our project involved a certain amount of me just going around and saying, "I'm just going to jump off the cliff." I cannot in good conscience be running around the world talking about this process revolution and technology and we're going to run another one of these jobs as a CM at risk. And everyone is saying, "Are you sure this is going to work?" And, "Do you have any way of demonstrating that this is going to work?" And I said, "No, except go read our marketing materials." Since we're talking about this we need to have the intestinal fortitude to actually go and try it. That's not a learned thing. I don't know how to convince people to do that. We just did it ourselves. We just jumped off the edge of the cliff.[2]

Whether or not you have the intestinal fortitude to "jump off the cliff," reading the book is a much safer—and more enjoyable—way to learn.

Notes

Note: Unless otherwise noted, interviews refer to those conducted for this book.

1. "BIM Implementation: Learning from the mistakes of others," *BIM Journal*, August 1, 2009, http://bimjournal.com.
2. Phil Bernstein, interviewed by the author, October 15, 2009.

CONTENTS