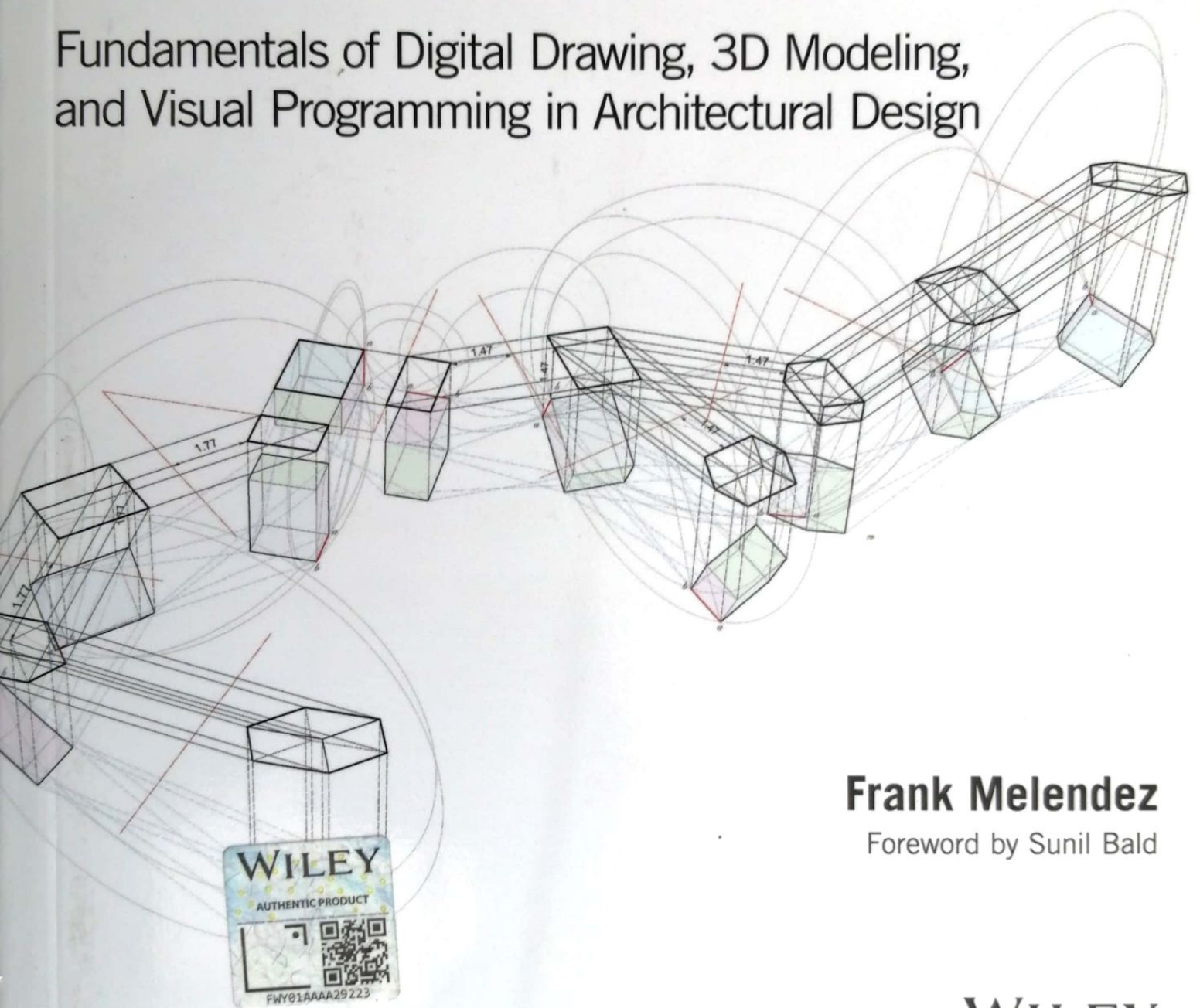


DRAWING FROM THE MODEL

Fundamentals of Digital Drawing, 3D Modeling,
and Visual Programming in Architectural Design



Frank Melendez

Foreword by Sunil Bald

WILEY

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Published by John Wiley & Sons, Inc., Hoboken, New Jersey

Published simultaneously in Canada

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Cover image: Courtesy of PATH

Cover design: Wiley

Library of Congress Cataloging-in-Publication Data is available upon request

ISBN: 978-1-119-11562-5

ISBN: 978-1-119-11564-9 (ebk.)

ISBN: 978-1-119-11563-2 (ebk.)

Printed in the United States of America

V1008599_030919

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Introduction

Architectural drawing is a communicative medium that is based on our ability to translate ideas pertaining to three-dimensional geometry into two-dimensional representations. Since the Italian Renaissance, the primary mode of representing architecture through drawing has been based on parallel and perspective projection techniques. Although other mediums of architectural representation have developed from technological advances such as photography and film, drawing remained the primary communicative medium of architecture. With advances in computing and the invention of computer-aided design (CAD) tools in the 1960s, the production of architectural drawing shifted from hand drafting to computer-aided drafting. Computer-aided design drawings proved to be more accurate, faster to produce, and easier to correct and copy. While this had a big impact on the production of drawings in both academia and practice, the technique of creating drawings by two-dimensional drafting methods remained the same. It wasn't until advances in 3D modeling, beginning in the 1990s, that the role of drawing in architecture was called into question. 3D models provided opportunities to generate and visualize new geometries and forms based on topology. This visual imagery relished the appearance of rendered, seamless surfaces, often output as matrices from animation sequences. Digital models demonstrated the potential for iterative designs based on variable parameters. Animation software introduced temporality to the virtual environment, and the impact of forces and behaviors on geometry and form. As computational technologies continued to evolve, so did the digital tools, techniques, and workflows used to design, model, and draw architecture. Today, 3D models, in tandem with visual-programming tools, offer architects and designers new methods for generating geometry, forms, and systems through the use of scripting and algorithmic processes that continue to impact architectural design and representation.

Drawing from the Model presents design students and professionals with a broad overview of drawing and modeling in architectural representation, beginning with historical analog methods based on descriptive geometry and projection, and transitioning to contemporary digital techniques and workflows based on computational processes and emerging technologies.

Part 1 offers an overview of drawing, modeling, and computing, with descriptions and examples of drawings that range from hand sketching to computational visualizations, and descriptions and examples of models that range from analog material performance studies to digital physics-based simulations. Additional content includes methods that blur the boundaries of physical and digital environments, such as scanning and digital fabrication technologies.

Part 2 provides an overview of digital drawing and 3D modeling tools, techniques, and workflows for creating geometry in Robert McNeel & Associates Rhinoceros® (Rhino 6 for Windows) software. This includes descriptions of vectors, splines, and NURBS (nonuniform rational B-splines) geometry to better understand the mechanics of digital models. Methods for generating various types of surface geometries, such as planes, ruled surfaces, and doubly curved surfaces, are described and depicted through examples of paradigmatic works of architecture.

Part 3 focuses on the use of linework to create architectural drawings. Readers are introduced to conventional architectural drawings, such as plans, sections, elevations, axonometrics, and perspectives, and methods for creating projections within digital modeling environments. This section describes methods for exporting line-work to the vector-based software Adobe Illustrator® CC, to apply line weights, line types, color, text, and other graphic qualities to produce and enhance architectural drawings.

Part 4 provides an overview of computational design processes including an introduction to parametric and algorithmic modeling tools through visual programming processes in Grasshopper®, a node-based algorithmic editor for Rhino. Readers will be introduced to scripting procedures for developing various types of incrementally varying patterns, modular assemblies, and emergent forms. Through visual programming add-ons for Grasshopper, such as Ladybug, Kangaroo, and Firefly, environmental data visualizations, physics-based simulations, and physical computing technologies can be explored as novel tools for architectural design and representation. This section introduces the topics of robotics and physical computing platforms as instruments for creating experimental drawings and visualizations by using Arduino microcontrollers to drive drawing machines.

In summary, *Drawing from the Model* presents a comprehensive overview of digital drawing and modeling skill sets that are required in contemporary architectural education. This opens up new possibilities and approaches to teaching and learning architectural drawing in a manner that builds on the history of drawing, while preparing students and future generations of architects for designing architectures that are based in computation, automation, responsive design, and robotics.

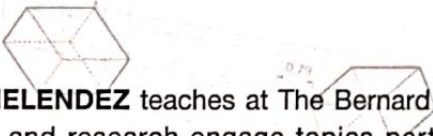


Bridges traditional and contemporary methods of creating architectural design drawings and 3D models through digital tools and computational processes

Drawing from the Model: Fundamentals of Digital Drawing, 3D Modeling, and Visual Programming in Architectural Design presents architectural design students, educators, and professionals with a broad overview of traditional and contemporary architectural representation methods. The book offers insights into developments in computing in relation to architectural drawing and modeling, by addressing historical analog methods of architectural drawing based on descriptive geometry and projection, and transitioning to contemporary digital methods based on computational processes and emerging technologies.

Drawing from the Model offers digital tools, techniques, and workflows for producing architectural design drawings (plans, sections, elevations, axonometrics, and perspectives), using contemporary 2D drawing and 3D modeling design software. Visual programming is introduced to address topics of parametric modeling, algorithmic design, computational simulations, physical computing, and robotics. The book focuses on digital design software used in higher education and industry, including Robert McNeel & Associates Rhinoceros® (Rhino 6 for Windows), Grasshopper®, Adobe Illustrator® CC, and Arduino, and features an appendix filled with 10 design drawing and 3D modeling exercises intended as educational and pedagogical examples for readers to practice and/or teach workflows that are addressed in the book.

- Bridges analog hand-drawing and digital design drawing techniques
- Provides comprehensive coverage of architectural representation, computing, computer-aided drafting, and 3D modeling tools, techniques, and workflows, for contemporary architectural design drawing aesthetics and graphics.
- Introduces topics of parametric modeling, algorithmic design, computational simulation, physical computing, and robotics through visual programming environments and processes.
- Features tutorial-based instruction using the latest versions of Rhinoceros® (Rhino 6 for Windows), Grasshopper®, Adobe Illustrator® CC, and Arduino.

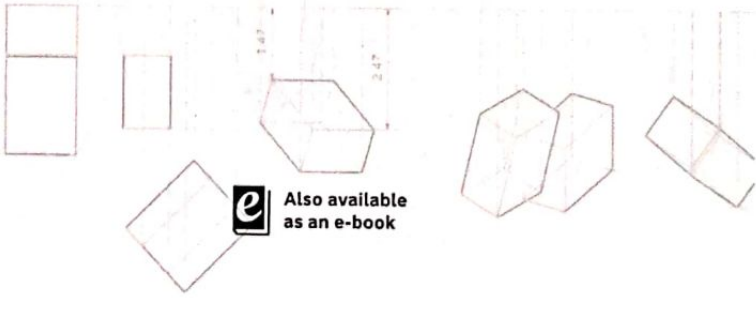



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Cover Design: Wiley
Cover Image: Courtesy of PATH

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 Also available
as an e-book

ISBN 978-1-119-11562-5

