

ARCHITECTURAL DESIGN WITH SKETCHUP

SECOND EDITION

3D MODELING,
EXTENSIONS,
BIM, RENDERING,
MAKING, AND
SCRIPTING

ALEXANDER C. SCHREYER

WILEY

Architectural Design with SketchUp

**3D Modeling, Extensions, BIM,
Rendering,
Making, and Scripting**

Second Edition

Alexander C. Schreyer

WILEY

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*For my father, Gerhard
(First Edition)
For my mother, Rosemarie
(Second Edition)*

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Preface

What a difference a few years make! In the time since the first edition of this book was conceived, SketchUp and everyone who makes it left Google and joined Trimble, a company until then mostly known for GPS technology for construction (and other related fields), and Tekla, a steel-design software from Finland. In the meantime, Trimble has integrated SketchUp into many of its work areas and is actively pursuing a broadening of its software offerings. Case in point being the acquisition of Gehry Technologies and its software products.

All of this came along with significant performance increases for SketchUp and the integration of substantial BIM-elements into the software. SketchUp also received an online Extension Warehouse as an easy means for users to find and acquire extensions that add capabilities to SketchUp. 3D Warehouse, an online repository for SketchUp models, has also received a major upgrade, and it now features a WebGL online 3D file viewer.

In the same timeframe, the maker-movement has gone into overdrive, leading to many “maker spaces” where people combine advanced yet cost-efficient fabrication techniques with electronics and programming to create fully functional prototypes of technology-based objects in a much shorter time and at a lower cost than was heretofore possible. 3D modeling has become an essential part of this process during digital prototyping and prefabrication steps (e.g., for 3D printing).

This second edition of *Architectural Design with SketchUp* pays heed to these developments. SketchUp’s new capabilities have been highlighted mainly in chapters 2, 3,

and 4. Where applicable, the updated Ruby scripting environment is reflected in chapter 7. While the title of this book retains its architecture focus, much of the content is now also applicable to many of the construction uses that come along with Trimble's application of this software.

An entirely new chapter 6, on making with SketchUp, has also been introduced. It covers the most common fabrication techniques in use with SketchUp (3D printing, laser cutting, CNC routing, and fabrication planning) to give the reader step-by-step instructions on using these in his or her work.

This edition, in other words, incorporates the many "faces" of SketchUp to an even greater degree than the previous edition. It provides an essential desk reference for any SketchUp user and a thorough and well-organized learning sourcebook for those that seek to enhance their knowledge of this software.

Acknowledgments

Having taught SketchUp to varied audiences of eager students, I should start my acknowledgments with exactly those students whose many questions and creative ideas have inspired me not only to look deeper into the software but also to put this text down on paper. To them I say: *Keep pushing the boundaries of the third dimension in your work!*

An amazing product can often be judged by the community that develops around it. SketchUp has always been a small, yet transformative piece of software, whose simplicity and power have enthralled users for many years. This has created a large user community, which in forums, in blogs, at user meetings, and at other venues has—often passionately—taken to using it to design whatever comes to their creative minds and educating others in how to use it to realize their ideas. I would like to acknowledge that community for its devotion, support, and inventiveness, and I am with this book paying forward any support they ever gave me.

Among the makers of SketchUp, I would like to foremost thank SketchUp product manager John Bacus, former product evangelist Aidan Chopra, marketing lead Mark Harrison, and education manager Allyson McDuffie for their feedback whenever I had a request—*and of course for the great time I had at Basecamp.*

This book would not have been possible without the support and feedback from acquisitions editor Paul Drougas and editor Seth Schwartz at John Wiley & Sons. This being my first book endeavor, I am still in awe of the amount of work that the editorial team puts into a

publication like this. In particular, I would like to acknowledge production editor David Sassian's tireless suggestions of edits and revisions as well as copyeditor Kathy Grider-Carlyle's and editorial assistant Mike New's help in this process (as well as Nancy Cintron and Ginny Carroll, for the first edition). Judging by the editing initials in the manuscript, it passed through many more hands whose anonymous work I hereby gratefully acknowledge.

Finally—and most importantly—I would like to thank the love of my life, my wonderful wife Peggi, for her tremendous encouragement and constant support, and our two girls, Sophia and Mackenzie, for their patience with me while I was preparing the manuscript. I couldn't have done it without them! They are, together with my mother and my brother, the source of all my strength and joy.

Chapter 1

Introduction

During my years of teaching SketchUp, as well as other Computer-Aided Design (CAD) and Building Information Modeling (BIM) software, I have seen many very proficient users of this software. Students and professionals take easily to SketchUp, and, before long, most of them produce very detailed building models and professional-grade renderings. But I have also found that too many people don't go beyond the basics and believe that some of the advanced modeling (or good-quality photorealistic rendering) needs to be done using other software. Very often, they painstakingly pick up that other software only to find that it is too complex, which likewise leaves them unable to do what they wanted.



Sometimes even advanced users of SketchUp master one aspect of the software (photorealistic rendering, for example) but are completely unaware of the power that SketchUp holds in other areas—Dynamic Components and Ruby scripting are good examples. As you will find out in

this book, SketchUp is a very powerful design and 3D modeling tool. Some of its core features—for example, its extendibility with *extensions* (these are sometimes also called *plugins*)—make it flexible enough to be useful for a variety of disciplines. The large number of high-quality extensions that are currently available for SketchUp bears powerful witness to this.

This book attempts to help the basic to intermediate user make the leap from simply creating “something” in SketchUp to using it as a powerful design tool. It also contains some more advanced topics (such as photorealistic rendering, Dynamic Components, BIM, and Ruby scripting) and provides a clear learning path that takes the reader through easy-to-follow examples to a thorough understanding of the core topics. [Figure 1.1](#) shows an example of how you could use Ruby scripting to create geometry, then render the scene using photorealistic rendering software, and finally “dress up” the image as a watercolor painting.

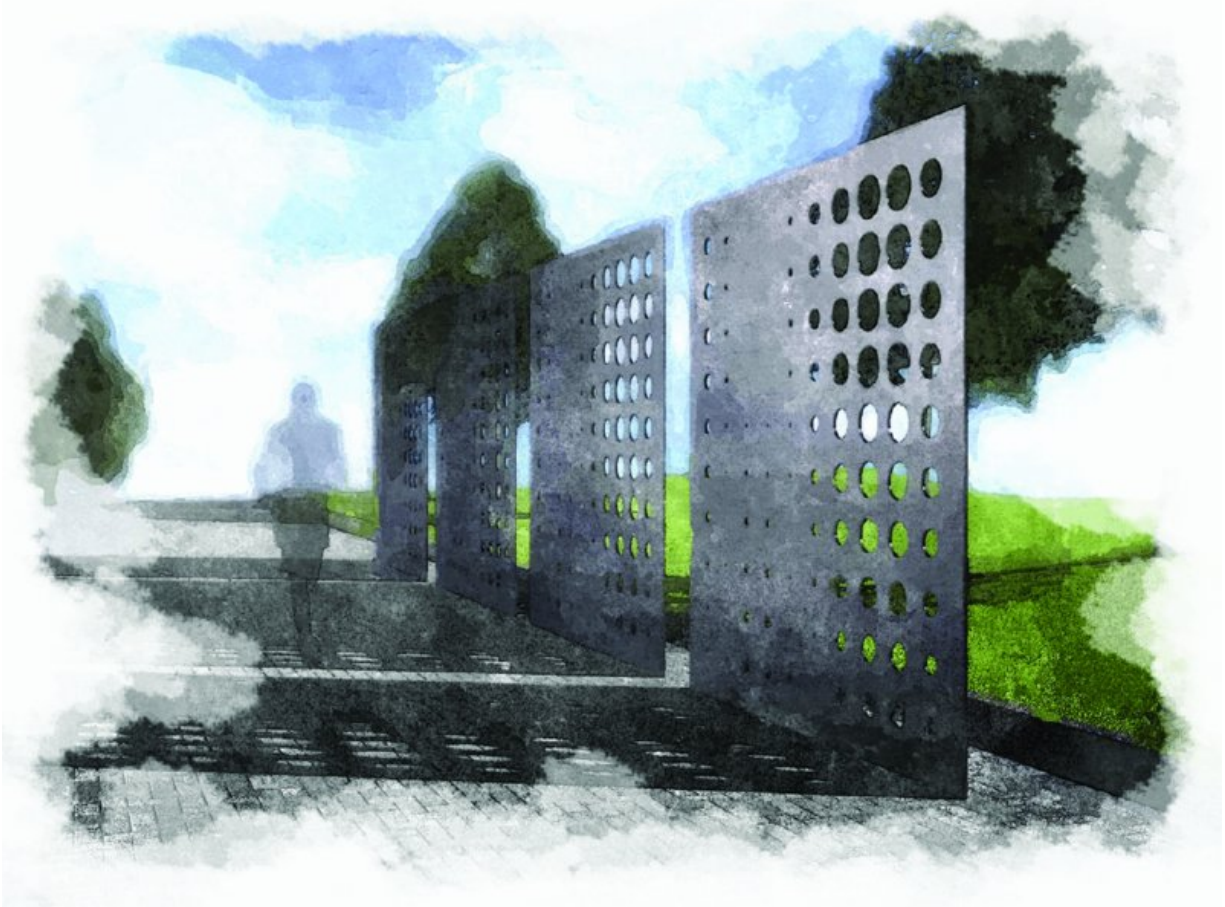


Figure 1.1 Digital watercolor of a rendering of script-generated panels

About This Book

Each chapter in this book presents a different SketchUp use in sufficient detail to get you started and working quickly. Interspersed with the text are many step-by-step examples, tips, and in-depth articles. At the end of each chapter, you will also find a collection of activities that you can undertake to try out new skills that you just learned.

Chapter 2, which follows this introductory chapter, brings every reader up to speed. Its purpose as a “SketchUp Refresher” is to review most of the basic modeling techniques and teach good practices for 3D modeling and

software use. While many readers will already have some knowledge of SketchUp through introductory books or video tutorials, this chapter encompasses enough variety to be useful for everyone, independent of their skill level. In addition to modeling, this chapter covers materials, program setup and user interface, custom templates, geo-based modeling, and plan-based modeling.

Chapter 3 uses SketchUp not only as a modeling tool but also as a tool to inform your designs. In this chapter, you will learn more ways to efficiently work with SketchUp and add data and design intelligence to your models. Examples of this are creating hierarchical, component-based models (e.g., for virtual construction), using Dynamic Components and parametric design, and working with SketchUp's Classifier system. This chapter also lays out how SketchUp can fit into a BIM-based architectural design process.

Chapter 4 leads you into the wide field of SketchUp extensions and their uses. After an introductory section on finding and installing extensions, many individual extensions are discussed. Those small software add-ons to SketchUp provide tools for general modeling, such as drawing splines and lofting curves; tools for architectural design, such as stair making and wood framing; and tools for digital fabrication that will help you prepare your model for 2D and 3D digital printing and assembly. (See [Figure 1.2](#) for an example of a fabricated SketchUp model.) Furthermore, there are extensions for data integration that can import or export data such as Laser Imaging, Detection and Ranging (LIDAR) laser-scan points; extensions for animation and presentation that add object animation or serve as helpers for creating animations and walk-throughs using SketchUp; and, finally, extensions for analysis, which provide analytical tools—mainly from the field of building energy analysis and green building.

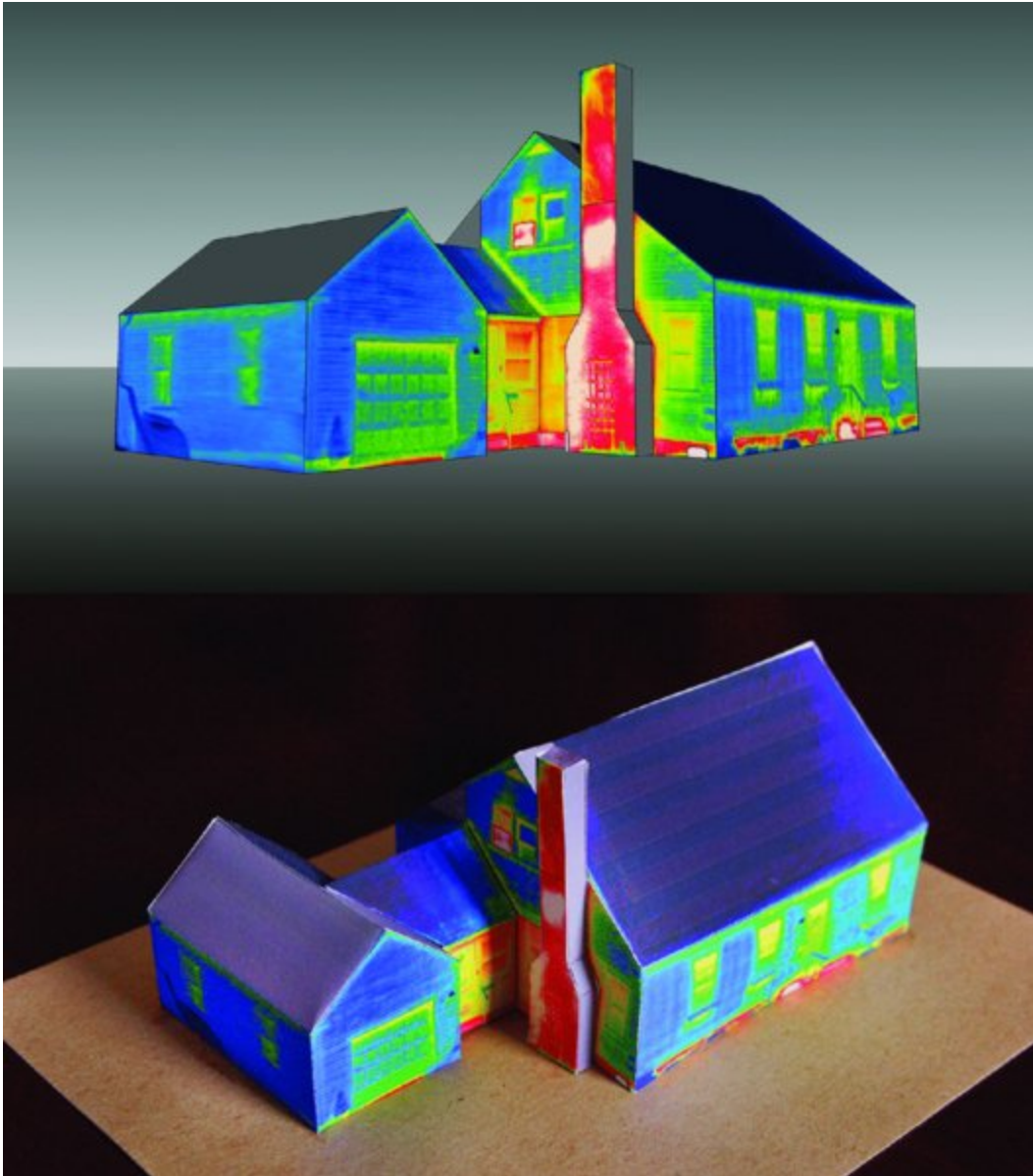


Figure 1.2 Infrared photography house model made in SketchUp and physically built using extensions

Chapter 5 introduces photorealistic rendering and covers all aspects of rendering in detail (see **Figure 1.3** and **Figure 1.4**). This chapter was written to be as independent of your actual choice of rendering software as possible, thereby providing a useful resource no matter which software you end up getting. As part of this chapter, you will learn about modeling for rendering, lighting, sky

environment, materials, and objects, as well as how to edit and modify renderings for final presentation using image-editing software.



Figure 1.3 A night rendering of the cover scene