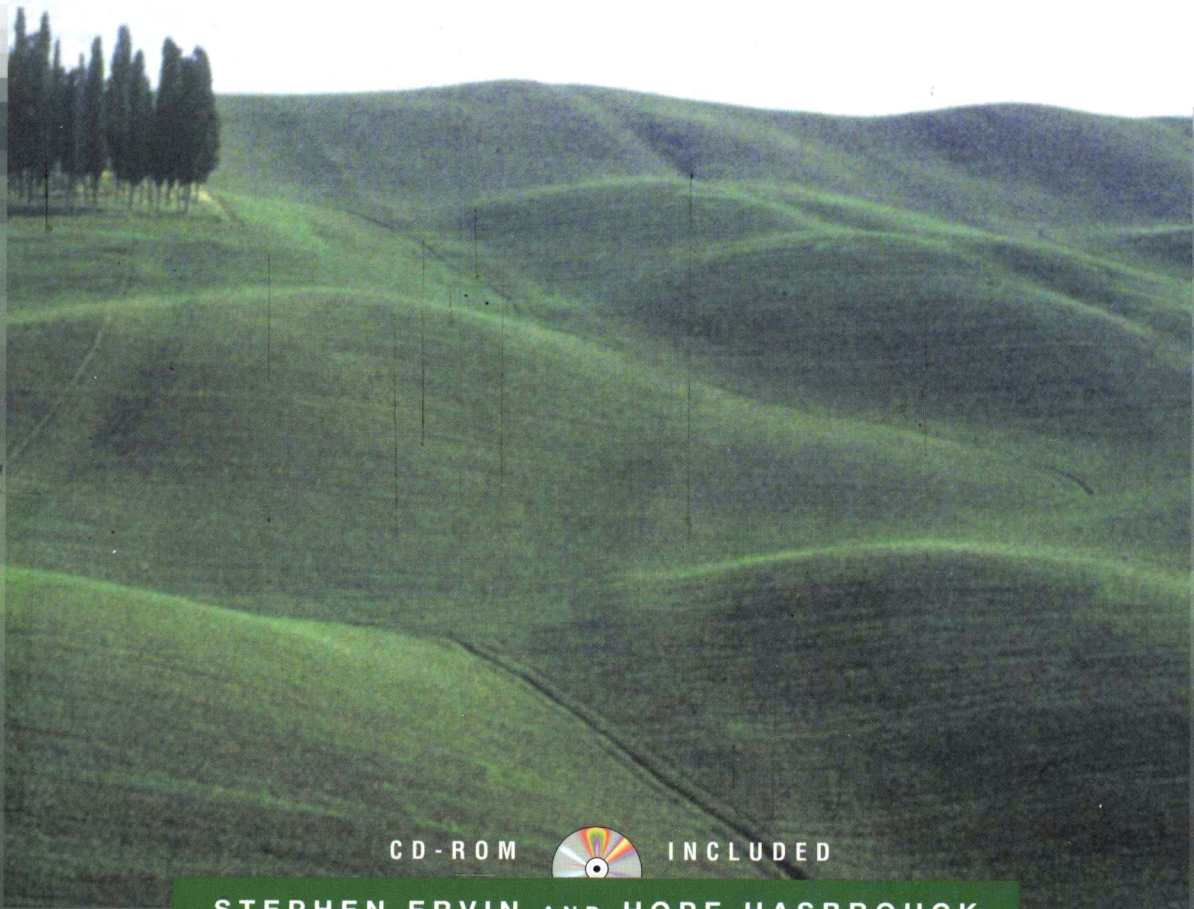


McGRAW-HILL PROFESSIONAL ARCHITECTURE

Landscape Modeling

Digital Techniques for Landscape Visualization



CD-ROM



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STEPHEN ERVIN AND HOPE HASBROUCK

Landscape Modeling

Digital Techniques for Landscape Visualization

Stephen M. Ervin
Hope H. Hasbrouck

McGraw-Hill

New York Chicago San Francisco Lisbon London Madrid Mexico City Milan
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Preface

This book has taken a seemingly long time to come to fruition, but is a chronicle of a discipline still in its infancy. Both the authors have been modeling the landscape for years, it seems, but it has really only been twenty years; Stephen Ervin made his first digital landscape model in 1980, on computer punch-cards; since the 1990s, Hope Hasbrouck has led dozens of graduate students and several professional projects through the process. In those years, the hardware and software we have had to work with have undergone exponential changes. What we can rather easily do now is really quite incredible, technologically, compared to what we both started with.

And even what our predecessors and colleagues were doing thirty and forty years ago, in the 1960s and 1970s, on far more rudimentary equipment, had very similar goals: to produce images (usually, but more generally, models and representations), in the process of design inquiry and communication, as part of teaching and doing landscape architecture and landscape planning. We have never been involved in this endeavor purely for art's sake, though we have seen and made some beautiful things, in their own right, along the way. Modeling, as we have learned, and tried to teach, and emphasize in this book, is a value-laden, technically dependent but ultimately concept-motivated activity. There are no perfect or best models; rather there are nearly infinitely many different ways of representing almost anything. Choosing between the options, and combining and using them in different ways, is a design act of the highest order.

Both the authors were trained as “traditional” architects and landscape architects, versed in pen and pencil representational techniques. We have both evolved along with computing and information technology, to a position of not replacing, but augmenting and building upon, our original drawing and communications skills. In creating this book, we have used dozens of different computer programs on several different computers and operating systems – any we could get our hands on – to see what we could learn from, or do with, them.

This book has been a joint venture, from its conception to production. As with any combined effort, some division of labor has been obvious and essential. Most of the text was written by Ervin; Hasbrouck provided the graphic narrative, layout, tutorials, and most of the modeling and illustrations, especially of the “University Commons” project used throughout the book. But we remain jointly, and solely, responsible for any errors or omissions.

We hope the book serves both as a reference into an already large, but largely uncollected, body of work, and also a stimulus for new inventions and applications in landscape modeling – for which there is still a lot of room.

Cambridge, Massachusetts 2001

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- Those who have blazed parts of the path before us, including but not limited to Ivan Sutherland, Alvy Ray Smith, Loren Carpenter, Premeslaw Prusinkiewicz, F. Kenton Musgrave, Benoit Mandelbrot, Jack Dangermond, and others
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- Our parents, families, and friends, who also encouraged, supported, and tolerated a project that took far longer and far more out of us than any of us ever guessed it would

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Landscape Modeling

1

1.1 Introduction to Landscape Modeling

This book is about modeling the landscape, and so it has both an action-oriented purpose – *modeling* – and an object-oriented one – *landscape*. Modeling simply means making representations, such as drawings, paintings, and cardboard mock-ups; or, more specifically, using digital computers and computer software to organize information in the form of numbers or bits, then creating images on a computer screen or printed on paper; or creating a series of images to form an animation; or even producing a three-dimensional artifact, such as a physical model created by a numerically controlled machine. Modeling by computer is similar in some ways to drawing or painting with pencil or brush, but is quite radically different in other ways – the differences are mostly what this book is about.

Landscape means the natural world, in which we live, garden, work, and build, including both natural systems such as plants and weather, and also built systems, such as roads and cities. Though we may sometimes speak of “the landscape,” that is misleading, as there are many different landscapes in this world, and many different perceptions of them. In this text, “the landscape” is used in the same spirit as when we speak of “the human race,” meaning to focus on the commonalities and shared attributes, but without ignoring or demeaning the variety and individuality to be found within it.

Four essential elements of the landscape – *landform*, *plants*, *water*, and the *atmosphere* – are the focus of this book. The first three are the traditional palette

of landscape architects, and are the essential components of the natural world, without people or buildings. Of course, in the real world that we live in, the landscape includes structures of all kinds, including buildings and bridges and cars, and a wide variety of animals whose activities are vital to the function and look of the landscape. There is a vast literature on using computers to model buildings and structures, using Computer Aided Design (CAD) software, and while this book assumes some familiarity with those ideas, it does not focus on making models of buildings.

Landscape elements are different enough from most buildings and machines – rarely square or flat or simple or small, often curved and fuzzy and complex and large – that while many of the same basic digital tools are used in modeling the landscape, their application requires different techniques, and often a different frame of mind, as well. Landscapes usually combine the four major elements in a myriad of ways, both in nature and when designed and built by humans in many forms including gardens, parks, building sites and urban plazas. This book is motivated by a desire to share techniques for using CAD modeling and rendering tools, combining them with Geographic Information Systems (GIS), and tapping the power of computing to help landscape planners, designers and modelers expand their representational repertoire, as well as start to grapple with the complexity and dynamics inherent in the landscape.

Figure 1.1

The landscape of the Fens, in Boston, by landscape architect Frederick Law Olmsted, bridge by H.H. Richardson. Most landscapes are made up of varying proportions of landform, including rocks, vegetation, structures, water, atmosphere, and animals, including people.



1.1.1 Reasons for Modeling

There are many reasons why people need or want to make models of landscapes and landscape elements, and there are many ways of doing so. Modelers include landscape architects, garden designers, architects, planners, engineers, illustrators, scene designers, and others who are engaged in synthetic design processes. Some modelers make models so as to portray landscapes as “scenery” like classical landscape paintings do, or to be used as backgrounds, much like stage sets, or environments for computer games. In quite another vein, scientists and planners may seek to model landscapes and landscape processes so as to be able to simulate or understand them, exploring scientific hypotheses, or measuring aspects of quantitative simulations, such as soil erosion, hydrologic process, or vegetative succession.

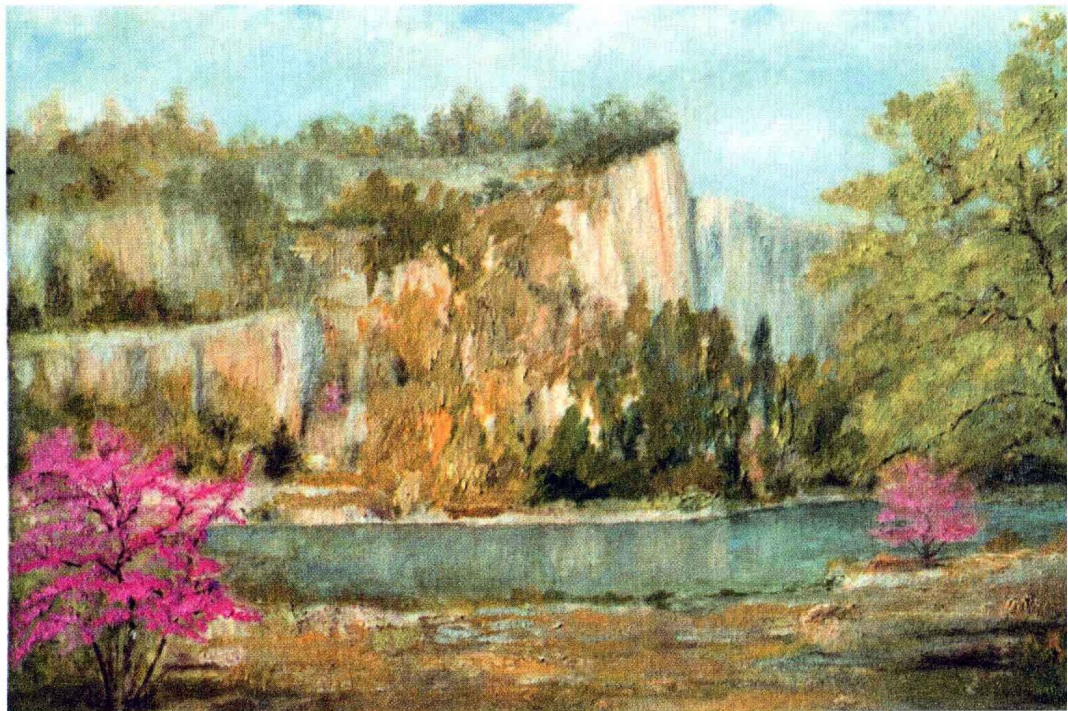
In between, combining art and science, landscape architects and other environmental designers make models of landscapes for the same reasons models are made in all design disciplines: it is easier, faster, often safer, and more responsible, to experiment and try out alternatives with “stand-in” representations, rather than with the “real thing.” A landscape architect comparing alternative planting plans – one-, two-, or three-abreast rows of shade trees, for example – can look to the real world for some examples of each, and so good designers do keep libraries of examples and references garnered from their own and others experiences and observations. To actually try out several different schemes, *in situ*,

Figure 1.2

“Texas Redbuds”
Landscape painting by A.R. McTee
c.1950

Here as in all landscapes, landform, vegetation, and water combine to create a sense of place.

The landscape painter’s eye is focused on composition, texture, color, and light.



though, is complicated almost to the point of impossibility. Comparing growth patterns over time, or visual effects in different light conditions, could take literally years.

Sketches, models, computer renderings, and other representations, however, can be made relatively quickly, and with infinite subtle variations. How good these representations are in helping designers choose between alternatives becomes a question of the detailed characteristics of the representation used – the media, the techniques, the levels of abstraction and realism, and so on. There are no “perfect” or neutral representations; rather, there are a number of important decisions to be made in choosing and making a representation for a specific purpose, and a set of conventions on the one hand, which have become established as appropriate and recognizable (the “artists rendering” of proposed buildings, for example, or the diagrammatic cross-section), and on the other hand, an expansive realm for invention and variety in representations. All models are imperfect, containing simplifications and abstractions, even perhaps distortions. Choosing and using modeling techniques appropriate to the task, is an essential part of using modeling in design.

Making digital models, as with any representation-making, will always have to be informed by professional judgment and possibly social context, and will always be an act of “abstraction” and simplification. There are many ways of model-making and many kinds of models. Choosing the right model(s) for a given purpose, whether political and public, or personal and private, is an important part of the overall modeling process. This book is most concerned with model making as part of a design conception and communication process, with a heavy emphasis on the visual, and to a lesser extent, the analytical properties of landscape models.

An important note: sometimes, models are made as part of a larger decision-making process, in which the models are used to further analysis and discussion, leading to a decision which may have far-reaching and real-world consequences, such as costs, visual impacts, environmental impacts, or even health and safety implications. In such cases, naturally, the validity of any model used – how well it actually represents the qualities of the real thing or event it is standing in for – is critical. Models of environmental impacts, and systems that have health or safety implications, need to be fully informed by scientific and engineering knowledge, and probably developed slowly, incrementally, and with full processes of open review and validation. Models used to determine visual impacts may seem less severe in their requirements, but not to the one person or community whose view is changed forever, and for the worse, by some action or design. There is a growing literature on the art and science of visual simulation, taking into account important considerations of human perception, psychology, and culture, as well as statistically valid techniques for performing and interpreting visual preference surveys. The scope of these important matters is well beyond the present book. Similarly, the complexities of scientific landscape modeling –

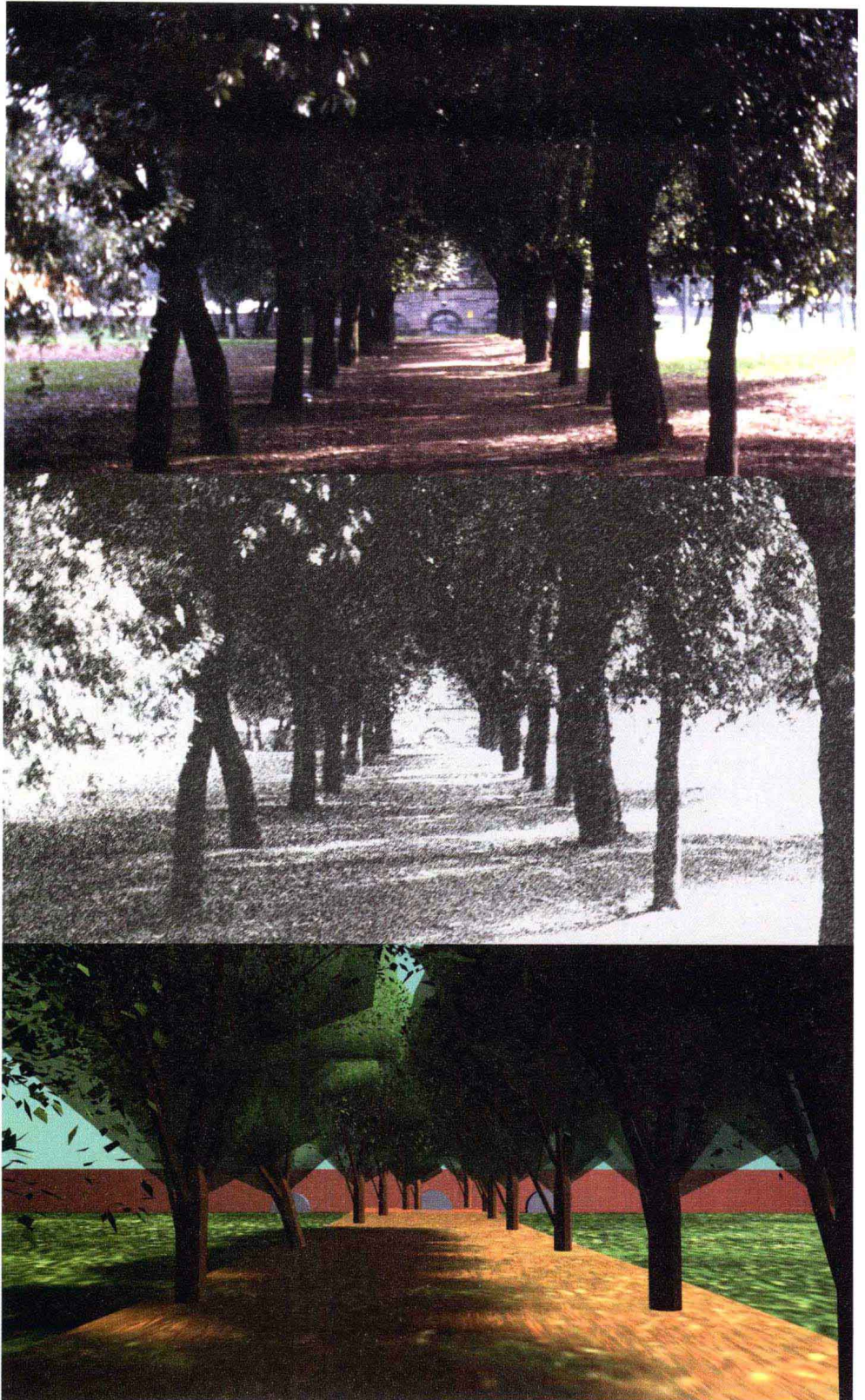
Figure 1.3

Multiple representations:

a. Photograph of a view down an alley of trees in a garden outside of Rome, Italy.

b. A black-and-white "sketch" made by image processing filter operations.

c. A computer-generated view of a 3-D model.



ecological, hydrological, air-pollution modeling, and others – are not covered, except in passing reference, in this book.

The emphasis throughout this book is on digital methods of visualization, and the necessary abstraction they entail. Some of the techniques presented are based on physics and natural properties; some are based purely on human perception. Most of the examples come from the domain of landscape architecture, which is equally concerned with the ecological and functional aspects of landscape, and with the visual, aesthetic, and formal.

Throughout the second and third chapters, many of the techniques for modeling will be presented with reference to a specific landscape project: the design by Hargreaves and Associates for a campus plaza, called University Commons, at the University of Cincinnati. This project was chosen because of its formal elegance and because it is typical of many designed landscapes in its artful combinations of landform, vegetation, water, and human circulation systems (paths and paving). The project demonstrates very well a variety of techniques for forming terrain into beautiful and functional sculptural landforms, and for integrating those with tree plantings and groundcovers, as well as path systems, drainage, and lighting. The project has the advantage of having been designed at least in part with digital tools, and built (in 1998 and 1999) so that photographs and construction details are available.

Other real and built projects, as well as imaginary landscapes, are also used as examples in subsequent chapters. In all cases, the goal is to use these examples to highlight the essential characteristics of landscape, to show exemplary landscape design and planning, and to demonstrate useful and appropriate techniques for digital modeling and visualization.

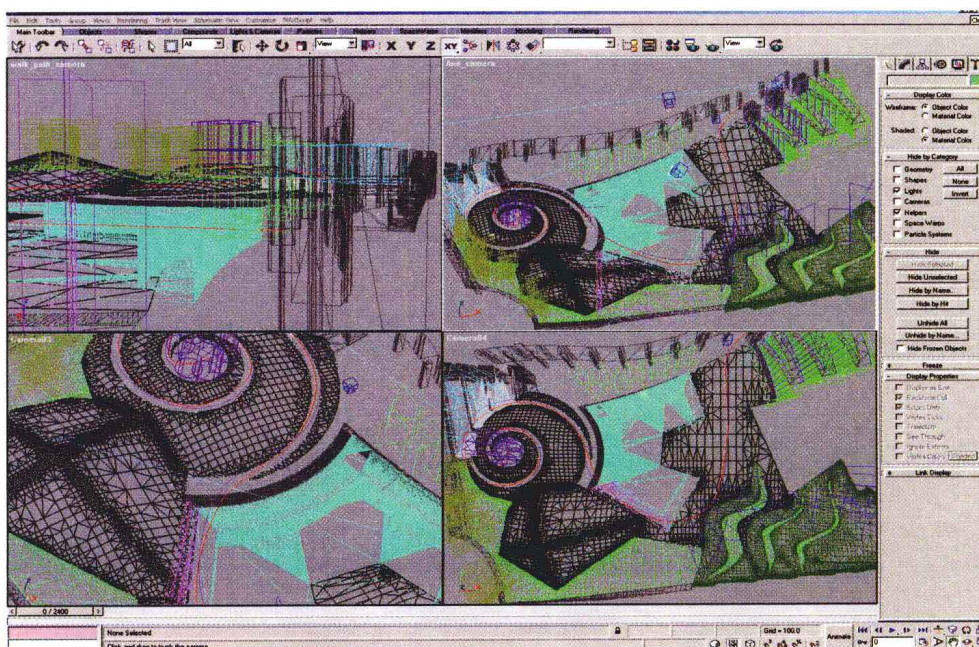


Figure 1.4
Wireframe representation of the University Commons Model in 3D Studio Max. The abstract colored lines on a computer screen are indicators of landscape elements.