



a basic guide

modelmaking

Martha Sutherland

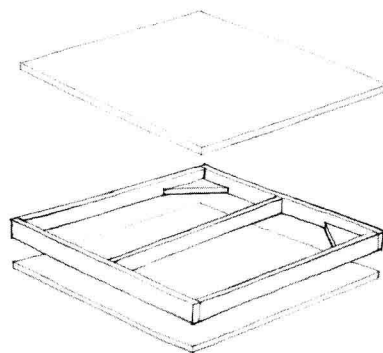
MODELMAKING

A BASIC GUIDE

W · W · N O R T O N & C O M P A N Y · N E W Y O R K · L O N D O N

MODELMAKING

A BASIC GUIDE



MARTHA SUTHERLAND

Copyright © 1999 by Martha Sutherland

All rights reserved

Printed in the United States of America

First edition

For information about permission to reproduce
selections from this book, write to
Permissions, W. W. Norton & Company, Inc.,
500 Fifth Avenue, New York, NY 10110

The text of this book is composed in Monotype
Walbaum with the display set in Graphite.

Composition by Ken Gross
Manufacturing by Courier Westford
Book design by Antonina Krass

Library of Congress

Cataloging-in-Publication Data

Sutherland, Martha, date.

Modelmaking : a basic guide / Martha Sutherland.

p. cm.

Includes index.

ISBN 0-393-73042-5

1. Architectural models—Design and construction. I. Title.

NA2790.S87 1999

720'.22'8—dc21

99-25280

CIP

W. W. Norton & Company, Inc., 500 Fifth Avenue,
New York, NY 10110

www.wwnorton.com

W. W. Norton & Company Ltd., 10 Coptic Street,
London WC1A 1PU

0 9 8 7 6 5 4 3 2

CONTENTS

Credits 8

Introduction 9

1. Getting Started 12

Important Equipment 12

Materials 15

Guidelines and Tips 16

Simple Bases 16

2. Chipboard and Cardboard Models 19

Chipboard Models 19

Cardboard Models 20

3. Paper Models 22

Boxes 23

Pitched Roofs 25

Hip Roofs 26

Chimneys 30

Gables 31

Dormer Windows 32

Geometric and Nontraditional Shapes 34

Façades 52

4. Illustration Board Models 53

Straight Cuts 53

Corners 54

Walls 56

Windows and Doors 57

Cylinders 58

Domes 62

Vaults 65

Stairways 66

Classic Details	68		
Other Details	73		
5. Contour Bases	74		

Level Sites	74		
Simple Contours	75		
Complex Contours	76		
Adding the Model to the Base	82		
6. Foamcore Models	83		

		7. Balsa and Basswood Models	86

		Trusses	88
		Space Frames	89
		8. Tents	92

		Materials	94
		Center-Supported Tents	94
		Saddle-Shaped Tents	96
		Arch-Supported Tents	96
		Additional Shapes	97
		External-Skeleton Tents	99
		9. Entourage	100

		Trees	101
		Shrubbery	107
		Texture	108
		Figures	108
		Conclusion	111
		Index	112

I . . . like models because they are so realistic. You can light them and photograph them and take them to bed and pretend that they are built. —Emilio Ambasz

Credits

With the exception of several grids, all of the illustrations have been drawn freehand. The following list credits the sources for drawings labeled “in the spirit of” or identified in the text as based on an actual project.

- 2.3 Anthony J. Lumsden & Associates, Yong Dong Area International Airport, South Korea
- 3.2 Richard Meier, Getty Center, Los Angeles
- 3.19 Mario Botta, San Francisco Museum of Modern Art
- 3.32 Joern Utzon, Sydney Opera House, Australia
- 3.42 Skidmore, Owings & Merrill, Air Force Academy Chapel, Boulder, Colorado
- 3.44 Frank Gehry, Guggenheim Museum, Bilbao, Spain
- 3.53 ROTO Architects, Warehouse C, Nagasaki, Japan
- 3.54 Philip Johnson, Chapel at University of St. Thomas, Houston
- 3.55 Antoine Predock, Rosenthal House, California
- 3.56 SITE, Inc. Architects, Peeling Showroom, Richmond, Virginia
- 3.57 Le Corbusier, Chapel at Ronchamps, France
- 4.13 Kohn Pederson Fox Associates, Wave Tower, Bangkok, Thailand
- 4.43 Frank Lloyd Wright, C.V. Morris Store, San Francisco
- 4.49 Hans Hollein, Kohlmarkt, Vienna, Austria
- 4.50 Issiki Architects & Partners, Marvel Star Iohno Golf Club, Nasu, Japan
- 4.51 Steven Holl, Kaisma Museum of Contemporary Art, Helsinki, Finland
- 6.1 Pei Cobb Freed & Partners, Rock and Roll Hall of Fame, Cleveland
- 7.1 Hammel Green & Abrahamson, Women of the West Museum, Boulder, Colorado
- 7.2 Cyrus A. Sutherland, historic restoration, Boxley Valley, Arkansas
- 7.10 Pierre Thibault, Queen of Hearts Theater, Upton, Quebec
- 8.1 C. W. Fentress, J. H. Bradburn and Associates, Denver International Airport
- 8.2 Samyn & Partners, M & G Research Laboratory Venafro, Pozzilli, Italy
- 8.3 Studio Tensoforma, Camp de Mart, Tarragona, Spain
- 8.6 Matthew Nowicki, Dorton Arena, North Carolina
- 9.1 Hardy Holzman Pfeiffer Associates, San Angelo Museum of Fine Arts
- 9.7 Pei Cobb Freed & Partners, U. S. Air Force Memorial, Arlington, Virginia

INTRODUCTION

Architectural models may be small, large, simple, fancy, professional, or nonprofessional, but all fit into one of two genres: the study model or the presentation model. The study model's job is to clarify spaces. Made more quickly and with inexpensive materials, it is the architect and landscape architect's best tool for working out spatial problems, visualizing the interaction of volumes, and considering a building in relation to its site. It is a creative tool for the designer—a leap toward reality and away from the orthographic flatness of plan and elevation. Working out the geometries of space in three dimensions rather than in two can save you from serious misjudgments.

Creating viable spaces is the most cogent reason for building a study model, but such a model is also a place to play with modifications—the shape of a roof, for example. Half a dozen mock-ups could be popped into place for study and approval. Or, study models can be assembled in modules so that switching whole wings around is a simple matter.

Models are typically seen below eye level. Unfortunately, it is an artificial viewpoint, one from which a building is almost never seen. The designer must remember, particularly in the study-model stage, to hold up the model frequently, rotating it and observing it on a more

normal level. In the studio a cardboard carton can be used to prop up the model for consideration. If there is tack-board space, a piece of foamcore supported by a couple of triangular brackets will make a lightweight shelf.

The presentation model is the one shown to a jury or client. It may be simple or elaborate but is always meticulously constructed. Adopted for the pragmatic reason that all the world loves a miniature, the presentation model is a psychological ploy. Any skillfully crafted object inspires delight, but when the object is also small in scale it has the universal appeal of a puppy, a bird's egg, a dollhouse, or a jewel. Models sell ideas because

they romanticize the object. The large made small endears itself effortlessly to the observer.

Many models are demountable. The roof and each floor can be removed to show the space within. Sections must be made to fit properly and be sturdy enough to stand up to the inevitable handling that will result when the word gets around that hey look, it comes apart!

Models obviously cannot be real buildings made small. They are symbols of real buildings and real sites, and they utilize a symbol vocabulary in which varying degrees of realism relate to varying scale. If the scale is small enough, say in a landscape architect's model of a large park, the buildings might simply be small, rectangular blocks of wood. More detail must be incorporated with larger models. At $\frac{1}{8}$ " (1:100) scale window frames may not be necessary. At $\frac{1}{2}$ " (1:20) scale they are probably essential. Color may or may not indicate a material: a white or gray model may represent painted wood or red brick. Your model should radiate the message you wish to convey. Banks, for example, usually project an aura of solidity, conservatism, and opulence. Quite cer-

tainly you would not create the same building for a summer house as for a city hall.

Choose your materials with your audience in mind. For classroom study, most models are made from plain illustration board. But a presentation to a city council, a hospital building committee, or a business magnate might be an opportunity to use materials in inventive ways—to delight or dazzle. A cautionary note: it is easy to be carried away with the fun of making an exciting model, but the material must not be allowed to outshine the design concept.

The classroom is not the model's only destination or reason for being. Private residence designs should be accompanied by a model, since few lay people are comfortable with architectural drawings. Commercial buildings need models, as do additions to existing buildings, restorations, and historic reconstructions. Models are made for commercial interiors—showcases, display walls, and stairways. And let's not forget the amateurs out there who just like to build miniatures of favorite places—cabins, treehouses, Indian kivas, dollhouses.

Modelmaking is intended as a primer for students in architecture, landscape architecture, interior design, and related fields. Others who want to make models—theater students, historians, and archeologists, for example—will also find it useful. The book considers the study model, but it is primarily intended to help a neophyte produce a creditable presentation model. Professional models, which employ the latest advances in high technology, computer imaging, and expensive equipment, are not discussed. Students will discover that in most moderate-sized offices, models are built in-house, and that being a good modelmaker is an advantage in the job market.



MODELMAKING

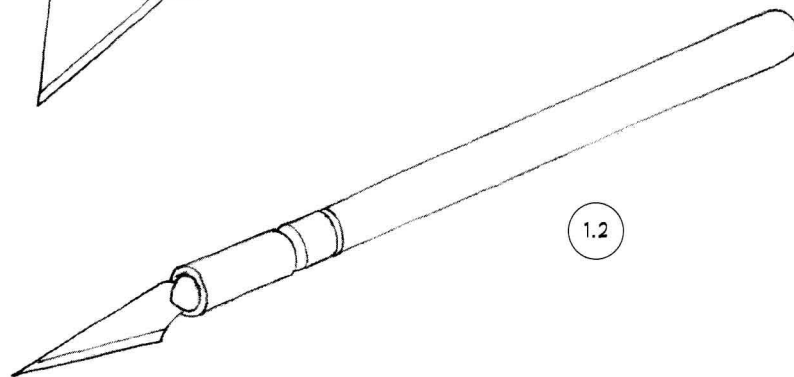
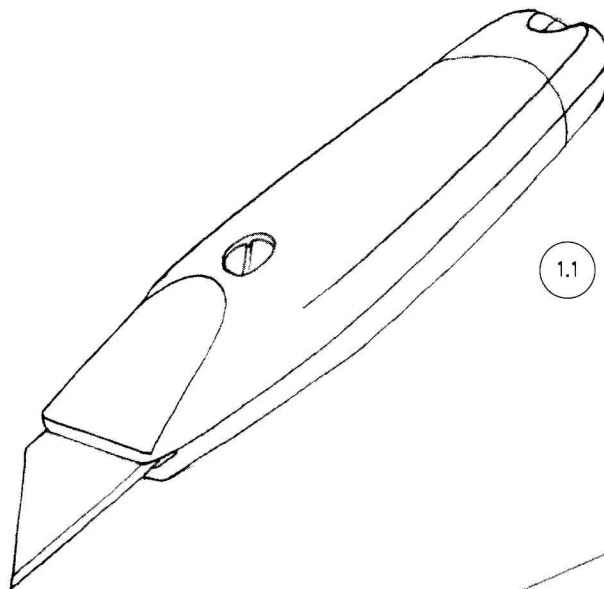
A BASIC GUIDE

Getting Started

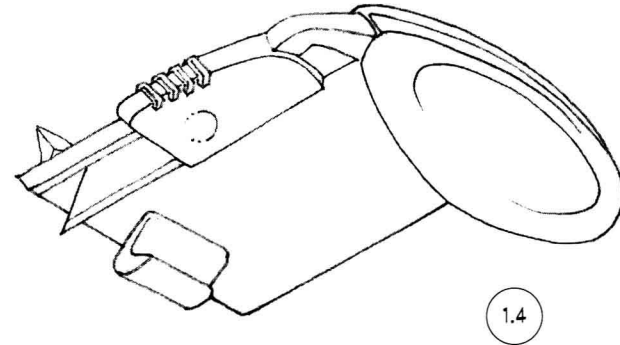
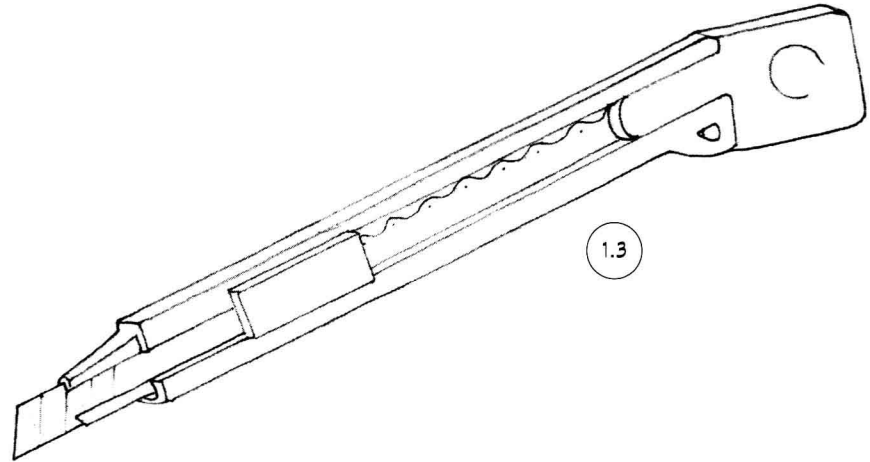
The construction methods described in this book are basic. These methods are not only essential to getting started, but also vital as the complexity of your models increases. Beginning students need to learn the techniques shown, but it is patience, desire for excellence, and attention to detail that are the criteria for success. The modelmaker's skill determines the quality of the model—your second model will be demonstrably better than your first.

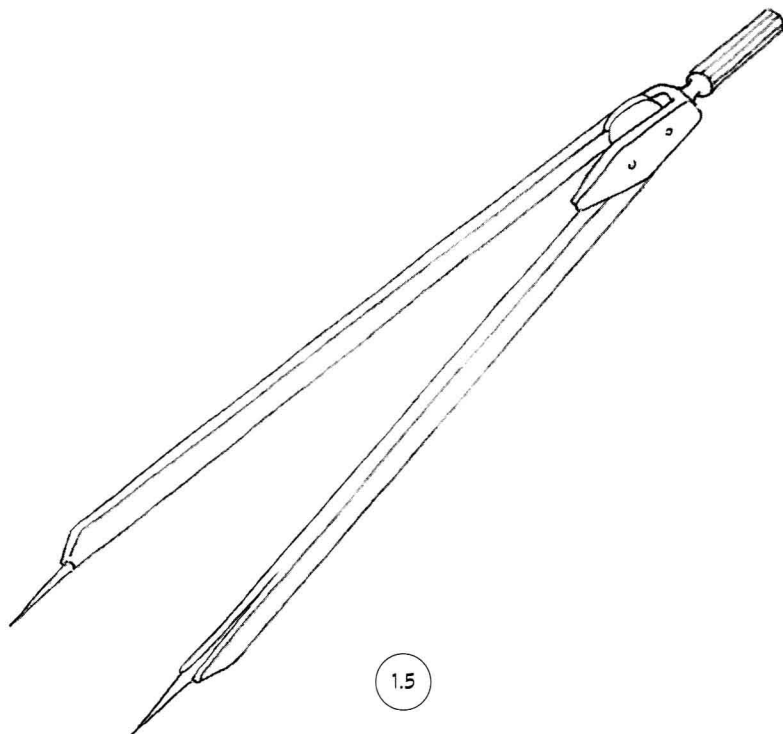
IMPORTANT EQUIPMENT

It is assumed that you have a drawing board with a T square or parallel bar. Don't forget to keep a paper towel or something nearby on which to wipe your hands. A clean model is a must. Your tools and materials may change depending upon the type of model you are making, but the following equipment is almost always necessary.



- Utility knife (figure 1.1). A heavy-duty knife with a comfortable, sturdy holder. Metal holders are better than plastic because they will last forever. This kind of knife has blades with two usable ends. Extra blades are stored in the handle.
- Craft knife (figure 1.2). A lightweight knife for cutting paper or lightweight materials. Ideal for cutting curves and small details. Caution: Throw away knife blades carefully—it's not nice to injure janitors. Stick the blade into a scrap of foamcore or fold drafting tape over the edge.
- Retractable blade knife (figure 1.3). These knives have scored blades that can be snapped off when they become dull. Be sure to find the kind that locks the blade in place. This knife has a heft and feel similar to the craft knife but is not as sturdy. Its advantage is its easily replaced blade.
- Hand-held board cutter and beveler (figure 1.4). A small, efficient mat cutter that can make clean, 45-degree-angle cuts. Using two blades at once, it can also cut strips or make





scores. (A score is a cut made partway through the material, allowing it to fold easily without breaking apart.)

- Dividers (figure 1.5). For hard-to-make measurements and units that are out of true.
- Metal ruler.
- Triangle. Both 30°-by-60° and 45°-by-45° triangles are used.

Other handy but not necessarily essential tools include: an architect's scale, engineer's scale, heavy needle (a candlewicking needle, number 20 tapestry needle, or cotton darning needle will do), circle template, protractor, and self-healing cutting board (this is expensive, but it saves surfaces, knife blades, and tempers). Also helpful (though costly) is a device called a model-scope. It is a pencil-sized, inverted periscope that can be inserted into the model and swiveled in any direction, providing a "walk through" view that is great fun as well as being informative. It is even possible to attach a camera to the model-scope and take photos of the model's interior.

MATERIALS

Beyond the basics—paper, illustration board, or some heavy card—the range of materials used in modelmaking is almost endless. Do not be afraid to experiment with different materials or to use them in inventive new ways. You will learn their properties and may make interesting discoveries. Take no chances with your model, though. If paint is involved, try it out first to check the color and to ensure that it doesn't adversely affect your material. Some sprays have been known to eat Styrofoam, for instance. If you are covering the board with paper, your glue job needs to be wrinkle-free, so experiment first. Below is a list of materials that you will need sooner or later if you continue modelmaking.

- Illustration board. A heavy cardboard with one side having a smooth, evenly textured surface suitable for drawing on. Available in hot or cold press, hot press being the smoothest.

- Poster (bristol) board. Thinner and cheaper than illustration board. Its surface is smooth and shiny on both sides.
- Chipboard (pulpboard). Inexpensive, usually gray, cardboard-type material with uniform sides. Available in several weights.
- Museum board. A heavy paper with a very soft surface.
- Foamcore (foamboard). A foam plastic filling sandwiched between two sheets of slick paper. Very lightweight.
- Canson paper. A toothy drawing paper available in a wide variety of colors.
- Balsa wood and basswood. Soft, lightweight woods good for modelmaking.

Respect the physical properties of the materials you use. Paper shouldn't be asked to support weight; illustration board doesn't like to bend; foamcore will warp; museum board fights erasure. When you pick the right material for the job it will oblige you by behaving well.

Adhesives are essential to modelmaking. These are the basic types:

- White glue (PVA). Sobo and Elmer's are the most common. White glues are water soluble until they dry. Tacky Glue is a white glue that is already partially set up.
- Rubber cement (latex-based glue). Use for paper. Rubber cement is not archival quality; it will discolor paper over a period of years.
- Spray adhesive. Suitable for paper and card. Spray both sides. There is no room for error—once the two sides meet, the join is irrevocable. In a studio environment the drift from spraying may pervade the entire air space. It also enters the ventilation system and is conducted to other areas of the building. The fallout leaves a perceptible residue on surfaces and breathing fumes is bad for your health. Moral: Do all spraying out of doors or in a spray booth.
- Balsa wood cement, Duco, or "magic" glues. These dry quickly and are good for wood and plastic.
- Sticky tape

Other materials mentioned in this book are useful but less frequently used. They include: dry mount (tissue adhesive applied with heat), corrugated cardboard, plywood, particle board (wood shavings pressed into a thick board), wire (steel and copper), electrical wire, monofilament (clear plastic string), clear plastic sheets, plastic screen, steel straight pins, corsage pins, nylon stocking material, cotton knit fabric, wooden dowels, wooden skewers, round toothpicks, plastic straws, Styrofoam balls, wooden beads, loofah sponge, natural sponge, steel wool, cotton wool, dried sedum (a plant with an umbrella-like seed head), sandpaper, spray paint.

GUIDELINES AND TIPS

From the scale drawings to the last tree, take pains to be precise, neat, and careful. To make the modelmaking process smoother:

- Begin your model by making careful orthographic drawings—that is, plans and elevations. Measurements are taken from the plans and elevations, and meticulous attention to both the drawings and the measurements taken from them is essential.
- Use new knife blades and change them often. As blades get dull they tear the material instead of cutting it. Dull blades also cause wear and tear on arms and hands. Wear and tear should not be in the form of blood and tears, either—new blades are extremely sharp, so be careful.
- Always place cardboard or some sort of cutting board underneath what you are cutting. This not only saves the surface of the table but also preserves your knife blades.
- Use the least amount of glue possible.
- White glue can be spread evenly on a surface by using a piece of illustration board as a squeegee.
- Make a habit of using the heavy-duty utility knife for straight cuts. It gives straighter, surer cuts than the skinny craft knife, which is prone to veer. Craft knives are good for details, curves, and very small cuts.
- Always cut against a metal straight edge, because cutting against plastic (T square, parallel bar, or triangle) is guaranteed to ruin your equipment.
- Stand when you cut to exert maximum pressure on the straight edge and the knife.

SIMPLE BASES

Study models do not necessarily require bases on which to sit, but a presentation model needs to have a base in order to be portable. Bases are

