



[ d i g i t a l ]  
**MODELING**

WILLIAM VAUGHAN

## Praise for *[digital] Modeling*

“This book does a great job of covering the many aspects of digital modeling. William explains everything in detail with full-color references and pictures. What I found most useful was his explanations for why he performed specific modeling tasks. This is the first book that I have read on 3D modeling that isn’t just a rehash of what I can find in a software manual. I’d highly recommend this book to not only modelers, but also anyone looking to improve their understanding of production pipelines.”

—Brian Arndt, BioWare

“William’s skill as a 3d modeler is legendary. His passion for teaching and abilities are just as well known. The combination of his knowledge of the art of modeling, and his clear and patient style of teaching make this book a “must have” for anyone, regardless of their current skill level.”

—Jack “Deuce” Bennett II, owner, Creative Imagineering, Inc.

“William is an amazing teacher and one of the best designer/modelers I have ever met. His digital modeling book is just another in a long list of gifts from the master.”

—Nicholas Boughen, owner, CG-Masters.com

“In his trademark natural writing style, William concisely explains not only how to model but also how to think and solve problems like a professional. This book is an absolute must-have for those who wish to get a solid understanding of the digital modeling process.”

—Alan Chan, Digital Domain

“You’d be hard pressed to find a more talented or prolific artist in the industry today. William is one of a truly rare breed: someone who can both do the work and teach it to others. His methods have shaped my own practices in countless ways. I’ve learned a great deal from William, and so will you!”

—Jarrod Davis, Emmy Award–winning VFX artist

“Think of this book as THE BIBLE—not just for digital modeling but for applying a fun, professional attitude towards a career in the digital arts. I don’t think you can get a clearer picture of what is expected of a digital artist in a production environment than what is shared in this glorious tome. But don’t just take my word for it... really, you should stop reading my quote and get to page one already.”

—David A. Maldonado, Deluxe Digital

“With his industry insights, thorough explanations and relevant examples, William’s new book, *[digital] Modeling*, is required reading not only for those new to the industry but veterans who’ve come to rely on just a small subset of available tools and techniques as well.”

—Chris O’Riley, V|4 Digital

“William Vaughan is not teaching techniques as much as he is teaching the necessary mindset one must have for success as a digital modeler. Having been a student of William’s, in my opinion this book is the best learning experience possible aside from sitting in on one of his classes. From the very first page it is clear that his experience and passion for his craft are the driving forces behind this amazing book.”

—Kurt Smith, Pixomondo

“William Vaughan has the rare ability to share his in-depth knowledge of 3D modeling and the CG industry with others in an easy to digest way. He has trained hundreds of artists working in the industry and has influenced the way I approach modeling. This book is a must-read for anyone interested in creating digital models.”

—Ron Thornton, award-winning VFX/CG Leader and recognized industry pioneer

“I’ve had the privilege of working with William for over a decade at many training events. His ability to explain difficult concepts in a simple, precise manner regarding the concepts of 3D modeling and animation is rare and exceptional. His insight and explanation of methodology to me over the years has been invaluable, and this modeling guide pulls it all into one amazing resource.”

—Graham Toms, 3D educational specialist, NewTek

“Truly William Vaughan has a passion for teaching and shares that passion within the pages of this book. He is one of the best teachers I have had and I’m excited that he’s able to share his modeling knowledge outside the boundaries of a single classroom.”

—April Warren, Digital Domain

[ d i g i t a l ]  
MODELING

The logo for New Riders, featuring the words "New" and "Riders" stacked vertically in a bold, sans-serif font. A curved line arches over the text from the left side.

New  
Riders

**WILLIAM VAUGHAN**

## **[digital] Modeling**

William Vaughan

New Riders  
1249 Eighth Street  
Berkeley, CA 94710  
(510) 524-2178  
Fax: (510) 524-2221

Find us on the Web at [www.newriders.com](http://www.newriders.com)  
To report errors, please send a note to [errata@peachpit.com](mailto:errata@peachpit.com)  
New Riders is an imprint of Peachpit, a division of Pearson Education

Copyright © 2012 Pearson Education, Inc.

Senior Editor: Karyn Johnson  
Developmental Editor: Corbin Collins  
Copy Editor: Anne Marie Walker  
Production Editor: Lisa Brazieal and Katerina Malone  
Composition: WolfsonDesign  
Proofreader: Roxanna Aliaga  
Indexer: Emily Glossbrenner  
Interior Design: Maureen Forsy, Happenstance Type-O-Rama  
Cover design: Aren Straiger  
Cover Image: William Vaughan

### **Notice of Rights**

All rights reserved. No part of this book may be reproduced or transmitted in any form by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher. For information on getting permission for reprints and excerpts, contact [permissions@peachpit.com](mailto:permissions@peachpit.com). See the next page for image credits.

### **Notice of Liability**

The information in this book is distributed on an “As Is” basis, without warranty. While every precaution has been taken in the preparation of the book, neither the author nor Peachpit shall have any liability to any person or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by the instructions contained in this book or by the computer software and hardware products described in it.

### **Trademarks**

Many of the designations used by manufacturers and sellers to distinguish their products are claimed as trademarks. Where those designations appear in this book, and Peachpit was aware of a trademark claim, the designations appear as requested by the owner of the trademark. All other product names and services identified throughout this book are used in editorial fashion only and for the benefit of such companies with no intention of infringement of the trademark. No such use, or the use of any trade name, is intended to convey endorsement or other affiliation with this book.

ISBN-13: 978-0-321-70089-6

ISBN-10: 0-321-70089-9

9 8 7 6 5 4 3 2 1

Printed and bound in the United States of America

## Image Credits

Figure 1.1a used courtesy of Chris Patchell. All rights reserved.

Figures 1.2a, 9.6, and 15.11 used courtesy of Joe Zeff Design at Splashlight. All rights reserved.

Figures 1.2b, 1.2d, 2.9, and Chapter 5 opening spread image used courtesy of Worldwide Biggies. All rights reserved.

Figures 1.3 and 15.5a–b used courtesy of Bruce Branit. All rights reserved.

Figures 2.1 and 2.21 used courtesy of Inhance Digital. Photo by Johan Lefkowitzz. All rights reserved.

Figure 2.4a used courtesy of Alan Chan. Photo by Dan Katzenberger. All rights reserved.

Figures 2.4b–c used courtesy of Alan Chan. All rights reserved.

Figure 2.6b used courtesy of Rocco Tartamella. All rights reserved.

Figures 2.7 and 2.8 used courtesy of Kory Heinzen. All rights reserved.

Figures 2.13 and 2.23a–c used courtesy of Sound-o-Rama. All rights reserved.

Figure 2.24 used courtesy of Jay Schneider. All rights reserved.

Figures 2.25a–b used courtesy of Rob Powers. All rights reserved.

Figures 3.1, 3.2, 3.3a, 3.5, 3.6, 3.7, 3.10, 3.12, 3.15a–b, Chapter 4 opening spread image, 7.1, and Chapter 11 opening spread image used courtesy of Chris O'Riley. All rights reserved.

Figure 3.11 used courtesy of Graham Toms. All rights reserved.

Figures 4.16, 4.17, 5.15, 5.16, 5.18, 7.31, 15.7 used courtesy of FunGoPlay. All rights reserved.

Figures 5.4 and 5.11 used courtesy of Deuce Bennett. All rights reserved.

Figures 5.5, 10.1a–f, 15.3a–b used courtesy of Pixar. All rights reserved.

Figures 5.7, 5.9, Chapter 12 and 13 images used courtesy of Glen Southern. All rights reserved.

Figure 5.8 used courtesy of Lewis. All rights reserved.

Figure 5.10 used courtesy of Jon-Troy Nickel. All rights reserved.

Figures 5.12a–b used courtesy of Steve Varner. All rights reserved.

Figure 5.13 used courtesy of Elmar Moelzer. All rights reserved.

Figure 9.2 used courtesy of April Warren. All rights reserved.

Figure 15.1 used courtesy of Erik Gamache. All rights reserved.

Figures 15.2a–b used courtesy of Blind Spot Pictures and Energia Productions. All rights reserved.

Figures 15.4a–b used courtesy of The Foundation TV Productions Limited/Decode/Blue Entertainment. All rights reserved.

Figure 15.6 used courtesy of Baj Singh. All rights reserved.

Figures 15.8a–b used courtesy of Marv Riley. All rights reserved.

Figures 15.9a–b used courtesy of Sylvain Saintpère. All rights reserved.

*This page intentionally left blank*

*Many people have come in and out of my life over the years, and have helped to shape me into the artist I am today, but one stands out over the rest. Von Kwallek, one of my high school art instructors, instilled in me the importance of problem solving, which has carried me through my entire career. My teaching style can be directly attributed to Kwallek's passion for education and his unbelievable ability to share his knowledge.*

*Thank you, Thank you, Thank you.*



## Author Acknowledgments

I need to start by thanking my long-time, good friend, Deuce Bennett. Deuce recommended to Peachpit that I write this book and then graciously came on board to handle the technical editing. He also made himself available for countless conversations during the creation of the book, offering his vast knowledge of 3D. Deuce has always been quick to offer assistance in anything I've reached out to him for and has been a great friend for many years. I can't think of a better person to have had on board for the production of this book.

Along with Deuce's help, many other industry professionals and friends played a role in the development of this book, offering insights and sharing their expertise in the field. I'd like to thank all of them for their contributions. Some of the artists that played a role include:

Saham Ali, Nick Boughen, Alan Chan, Jarrod Davis, Joe DiDomenico, Aaron Juntunen, Jonny Gorden, Matt Gorner, Kory Heinzen, K. C. Ladnier, Lewis, David Maldonado, Ed McDonough, Elmar Moelzer, Angel Nieves, Chris O'Riley, Rob Powers, Jay Roth, Kurt Smith, Glen Southern, Lee Stringer, Aristomenis Tsirbas, Ben Vost, Farrah L. Welch, and James Willmott.

I'd like to thank Karyn Johnson and the entire team at New Riders for the opportunity to create this book and for their support in its creation. Special thanks to Corbin Collins for his attention to detail, guidance, and countless hours devoted to this project. I'm without a doubt a better writer thanks to Corbin's shared expertise.

Images play a major role in this book, and I'd like to thank the following for either contributing images they created or worked on, and/or images they allowed me to use that I produced for/with them:

Deuce Bennett, Eric Braddock, Bruce Branit, Alan Chan, Ed Chichik, Joe DiDomenico, The Foundation TV Productions Limited/Decode/Blue Entertainment, Fabian Nicieza, Steve Lerner, Dave Jacobs and the entire crew at FunGoPlay, Frima Studio, Ed Gabel, Erik Gamache, Kory Heinzen, John Karner, Kari Kim, Johan Lefkowitz and the team at Inhance Digital, Dan Katzenberger, Lewis, Dave Maldonado, Sam Mendoza, Steve Mitchum, Elmar Moelzer, Jon Troy Nickel, Chris O'Riley, Alejandro Parrilla, Chris Patchell, Demi Patel, Jason Pichon, Rob Powers, Serena Martinez, Kevin Reher and the entire team at Pixar, Marv Riley, Sylvain Saintpère, Jay Schneider, Baj Singh, Kurt Smith, Kevin Snoad, Sound-o-Rama, Glen Southern, Lee Stringer and the team of Iron Sky, Rocco Tartamella, Graham Toms, Steve Varner, April Warren, Worldwide Biggies, and Joe Zeff.

Although they've been thanked already, I'd like to give David Maldonado special recognition for his pep talks, unwavering support, and advice during the creation of this book—and Glen Southern for his guidance and contributions to the digital sculpting sections of the book.

I'd also like to thank my business partners at Applehead Factory, Joe DiDomenico and Phil Nannay, for supporting this book and for their friendship over the years.

I'd like to thank my wife Addie and dog Jack for waiting patiently over the two months it took to write the book and for understanding my absence and allowing me to work.

And last but certainly not least, I'd like to thank you, the reader, for your interest in this book. I hope it aids you in the creation of countless digital models.

## About the Author

Originally from Texas, now happily residing in Philadelphia with his wife Addie and dog Jack, William Vaughan's CG work can be seen in all forms of media over the past 20 years. He's worked on projects ranging from children's books to toys, video games, broadcast, and film, and for clients like *Rolling Stone* magazine, Hasbro Toys, and Pixar Animation Studios.

William has always had a passion for creating as well as teaching. For over six years, he played a major role in the evolution of the industry-leading software, LightWave 3D. While working for NewTek as its LightWave Evangelist, he helped write the manual and provided the training for CGI artists all over the world, authoring more than 300 tutorials and instructional videos. His online tutorials are required reading for anyone interested in learning 3D. William has been published by every major CGI magazine and has contributed to 17 books. However, his writing is not limited to tutorials and case studies. He has also written and directed several award-winning animated short films, such as *Batman: New Times*, *X-Men: Dark Tide*, and the Tofu the Vegan Zombie animated short, *Zombie Dearest*.

For several years, William was the Director of Industry Relations and Head of Curriculum at the Digital Animation and Visual Effects School at Universal Studios in Orlando, Florida. He has personally trained hundreds of students to become professional animators at major studios, such as Rhythm and Hues, Digital Domain, Weta Digital, Monolith, and EA Sports. Among his prized pupils are the art department at NASA's Johnson Space Center and actor Dick Van Dyke.

After spending two years in New York creating content for Nickelodeon, SyFy, Spike TV, and others, William recently moved to focus on his Philly-based toy company, Applehead Factory. As co-owner and Creative Director, he works with his business partners Joe DiDomenico and Phil Nannay on building brands and creating memorable characters.

## About the Technical Reviewer

Jack “Deuce” Bennett II is a freelance CGI artist whose background is in physical special effects for motion pictures and television. Deuce has been working in the film industry his entire life and has such movies as *Robocop*, *Lonesome Dove*, and *Jimmy Neutron: Boy Genius* to his credit, as well as TV shows such as *Walker, Texas Ranger*. Deuce has been using computers since he was nine, and he started off writing his own graphic programs. He is a unique combination of physical knowledge and virtual know-how.

# Table of Contents

<b>Foreword</b>	<b>xx</b>
<b>Chapter One Introduction</b>	<b>2</b>
What Is Digital Modeling?	4
Who Can Become a Professional Digital Modeler?	5
Who Should Read This Book?	7
What Can You Expect from This Book?	8
What You Should Know	9
What You Will Need	10
RAM	10
CPU Speed and Number of Cores	10
Graphics Card and GPU	11
Two Monitors	11
About This Book's Approach to Software	13
Software Requirements	14
3D Software	14
2D software	15
What's on the Disc	15
A Final Word: Change Your Thinking	16
<b>Chapter Two Understanding a Modeler's Role</b>	<b>20</b>
Production Pipelines: Stages of Production	22
Stage 1: Pre-production	25
Story	25
Visual Design	28
Storyboard	33
Audio: Scratch Voice Recording	35
Animatics	37
Audio: Voice Recording	39

Stage 2: Production	40
Modeling	40
Rigging	43
Scene Setup	45
Texturing	48
Animation	50
Effects	53
Lighting	56
Rendering	59
Stage 3: Post-production	61
Compositing	61
Audio	64
Final Edit and Delivery	67
Evolution of Production Pipelines	68
Virtual Art Department (VAD)	69
Stereo Department	72
<b>Chapter Three Preparing for Modeling</b>	<b>76</b>
Tools of a Digital Modeler	78
Reference	78
Observation	81
Problem Solving	82
Gathering Reference Material	84
Physical Reference	84
Digital Camera	85
Tape Measure	86
Sketchbook	87
Digital Reference	89
Printed Reference	89
Movie Reference	90
Note on Copyrighted Material	91
References to Avoid	91

Preparing Reference Material	96
Scan or Transfer	96
Adjust Color and Levels	96
Rotate, Size, and Crop	97
Composite	98
Rename and Organize	99
<b>Chapter Four</b> <b>Fundamentals of a Digital Model</b>	<b>100</b>
A Model's Anatomy	102
Points	102
Vertex Maps	103
Edges	107
Polygonal Models	108
NURBS	109
Subdivision Surfaces	112
Model Classification: Hard Surface and Organic	113
Production Driven	113
Attribute Driven	114
Construction Driven	114
Model Classification Evaluation	114
Model Styles	117
Photo-real	118
Stylized	118
Choosing a Style	118
<b>Chapter Five</b> <b>Digital Modeling Methods</b>	<b>120</b>
Build Out	122
Point by Point	123
Edge Extend	123
Primitive Modeling	124
Box Modeling	126
Patch Modeling	127
Digital Sculpting	128
3D Scanning	131

Modeling with Texture and Animation Tools	134
Texture Displacement	134
Bones	135
Dynamics	136
The Importance of Mixing Methods	138
<b>Chapter Six Professional Modeling Practices</b>	<b>140</b>
Naming Conventions and Directory Structure	142
Content Directory	142
Naming Conventions	145
Don't Agonize, Organize	147
Clean Modeling	147
Polygon-count	148
Topology	153
Preparing a Model for Production	159
General Production Preparation	159
Texturing Preparation	160
Rigging Preparation	162
<b>Chapter Seven Polygonal Modeling</b>	<b>166</b>
Modeling 3D Polygonal Text	168
Vector and Raster Images	169
Getting Started	170
Creating the 2D Base Mesh	170
From 2D to 3D	174
Micro-bevels, Chamfers, and Fillets	174
Clean Up	177
Modeling a 3D Polygonal Object with Seams	180
Getting Started	182
House Cleaning	185
Layout Foundations	186
Final Stages	190
Gooool!!!	195



<b>Chapter Eight</b>	<b>Subdivision Surface Modeling</b>	<b>196</b>
	Modeling 3D Text with SubDs	198
	Getting Started	198
	Adding Support Edges	199
	Patching in Polygons	201
	Adding Depth	203
	Adding Detail	204
	Modeling a SubD Object	205
	Reference	205
	Getting Started	206
	Creating the Metal Spring	209
<b>Chapter Nine</b>	<b>Modeling a Realistic Head</b>	<b>212</b>
	Choosing a Method: Edge Extend vs. Box Modeling	214
	Using Reference	216
	Preparing the Background Templates	217
	Taking Advantage of Symmetry	218
	Modeling the Head's Components	219
	Eyes	219
	Nose	225
	Laugh Line	228
	Mouth	228
	Jawline	231
	Ears	232
	Finishing Off the Head	234
<b>Chapter Ten</b>	<b>Modeling a Stylized Character</b>	<b>238</b>
	Box Modeling a Character Mesh	240
	Getting Started	242
	Detailing the Face	247
	Building the Body	253
	Give 'em a Hand	256
	Final Character Review	262

<b>Chapter Eleven</b>	<b>Product Modeling for Print Graphics</b>	<b>264</b>
	Building a Better Product	266
	Reference: CAD Geometry, Photos, and Blueprints	268
	Getting Started: Creating Splines	270
	Spline Patching	272
	Final Details	278
<b>Chapter Twelve</b>	<b>Digital Sculpting</b>	<b>280</b>
	Digital Sculpting with Glen Southern	282
	Creating a Digital Creature Maquette	284
	Sculpting Legs	286
	Sculpting Arms	288
	Sculpting the Head	289
	Second Pass over the Sculpt	292
	Detailing	294
<b>Chapter Thirteen</b>	<b>Game Modeling</b>	<b>298</b>
	Next-Gen Game Modeling with Glen Southern	300
	Creating the Creature Sculpt	300
	Performing Retopology to Create the Game Model	305
	Creating UVs for the Low-Poly Model	314
	Generating Maps for the Low-Poly Model	315
	Color Map	315
	Bump Map	317
	Normal Map	318
<b>Chapter Fourteen</b>	<b>3D Printing of Digital Models</b>	<b>320</b>
	3D Printing Overview	322
	3D Printing Applications	328
	Preparing a Digital Model for 3D Printing	329
	Using Closed Meshes	329
	Avoiding Texture or Displacement Maps	330
	Getting the Right File Format	331
	Guidelines for 3D Printing	332
	From 3D Printing to Manufactured Toy	334

<b>Chapter Fifteen</b>	<b>Getting a Job in Digital Modeling</b>	<b>342</b>
Overview of the Industry and Markets		344
Film		344
Television		350
Games		353
Visualization		356
Print Graphics		360
Demo Reels		361
Demo Reel Case and Sleeve		361
Demo Reel Content		365
Demo Reel Length		368
Demo Reel Audio		368
Demo Reel DVD Burning and Labeling		369
Personal Site		370
The Seven Deadly Job Search Sins		374
Sin #1: Homesickness		374
Sin #2: Greed		375
Sin #3: Inflexibility		376
Sin #4: Putting All Your Eggs in One Basket		377
Sin #5: Sloppiness		378
Sin #6: Playing Hard to Get		378
Sin #7: Sloth		379
Get a Job!		380
Staying Current		380
Skill Set		380
Software		381
Networking: Online Communities		382
Staying on Top of Industry Trends and News		384
Reel and Resume		385
Health		386
Advancing in Your Career		387
<b>Final Thoughts</b>		<b>390</b>
<b>Index</b>		<b>395</b>

*This page intentionally left blank*

## Foreword

Several years ago, while I was trying to finish my first book, exhausted, demoralized, and with a deadline looming, my publisher told me I needed some sort of CG expert—some well-known public figure—to read a draft and write a foreword for my book. I told him I didn't know anyone who matched the description, because back in those days I was just a struggling artist and had met only a handful of others who pursued computer animation as a career. You have to remember, there just weren't that many of us in those days. "I have just the person," he said. "Proton."

"What's a Proton, other than a positively charged subatomic particle?" I asked.

"Exactly," he replied.

I was pretty puzzled at the time, but I soon came to learn exactly what he meant.

"Positively charged." That's the key. William Vaughan is one of those people who is able to discover the amazing in anything that possesses it and who has no compunction about sharing those discoveries with the world. If something is awesome, he lets everyone know about it. So when I received his feedback from the first draft, it was so positive and filled with such excitement that it gave me the energy I needed to finish the book and get it out there. That was very early in my career, and the success of that book is reflected in nearly everything I do professionally today.

Now here we are many years later, and I am faced with the privilege and problem of writing this foreword for William. My immediate urge is to write, without regard for the contents of the book, a glowing review so that I can repay William for his enthusiasm and advice over the years. But I don't need to do that because the book stands on its own, without my platitudes. William is an artist of immense integrity, which means that he puts the best of himself into everything he does.

Over the years, I have seen so many artists, hundreds certainly, perhaps thousands, benefit from the influence of this man's work, and I know this book is simply another expression of William's love for the art—just another way he can share his passion with the world, just another in a long list of gifts to us.

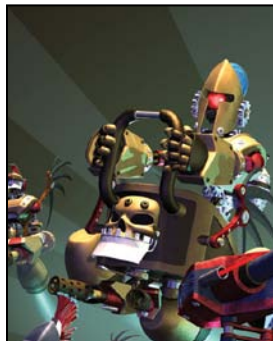
So why should you read this book? Because passion drives excellence and because William is one of the most passionate artists I have ever known, so I know with certainty that he brings all his excellence to it. Why on earth would anyone not want to read that?

Nicholas Boughen  
VFX Supervisor  
Owner CG-Masters.com



# Fundamentals of a Digital Model

Before we go too far down the rabbit hole, I want to introduce some of the elements of digital models and the terms you'll encounter throughout the book. If you have some experience already, you may be inclined to skip this section, but I recommend you at least skim through it just to make sure we're on the same page. You can think of this chapter as a refresher course of 3D models 101.





## A Model's Anatomy

Digital models can be broken down into three types:

- Polygonal models are made up of a collection of points, edges, and polygons.
- NURBS surfaces consist of a network of curves with smooth surfaces between them.
- Subdivision surfaces are similar to polygonal models because they are made up of points, edges, and polygons but also share some of the benefits of NURBS surfaces, placing them into their own category.

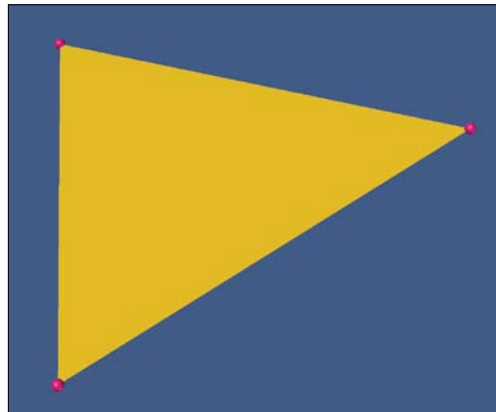
In this section I explain some of the terminology used in the creation of all three types of digital models.

### Points

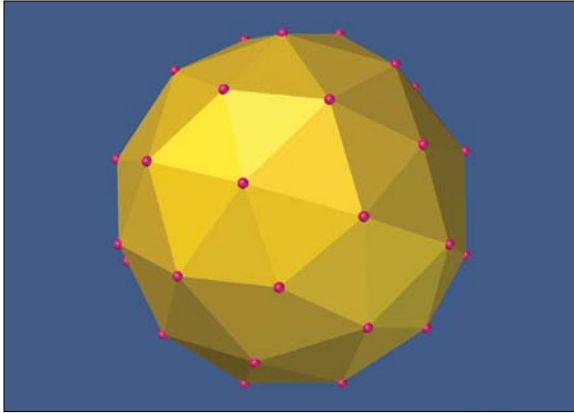
A *point*, also called a *vertex* (plural: vertices), is the lowest-level component that makes up a 3D model. Each point exists in 3D space with a specific X, Y, and Z coordinate. Because points alone do not have height, width, or depth, they cannot be rendered.

When two points are connected, a *line* is drawn. When three points are connected, they can become corners of surfaces on a model called a *polygon*. Without points, there would be no polygons. A triangle, for example, consists of three points and one polygon, as shown in **Figure 4.1**.

**[Figure 4.1]** The three points (shown here in pink) define the shape of the triangle and its placement in 3D space.



Multiple polygons can share the same points when used on a *contiguous* (seamless) mesh. The tessellated sphere in **Figure 4.2** shows individual points being used to define the multiple polygons that make up the object.



**[Figure 4.2]** Polygons that share a common edge also share points to define their shape.

## Vertex Maps

Every point in an object stores information about its position and rotation, although you normally don't access the rotational values of an individual point. Points also have the ability to store a variety of additional information using vertex maps. Simply put, a *vertex map* is information saved to a point.

The most common types of vertex maps include:

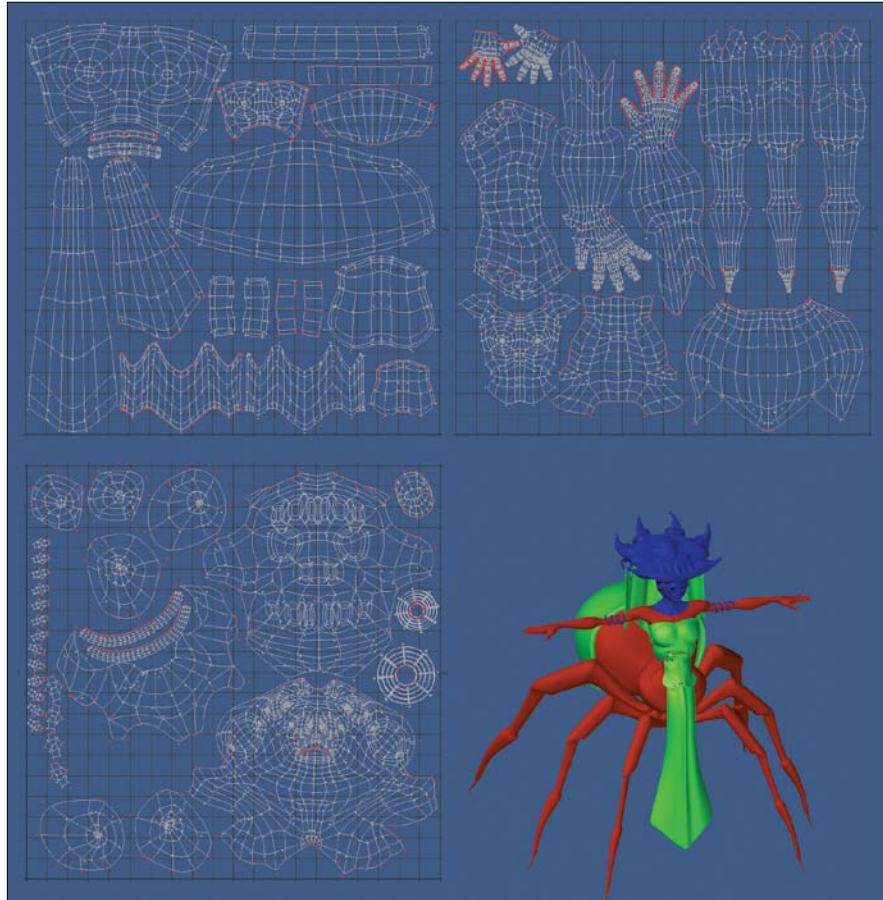
- Texture (UV)
- Weight
- Morph
- Color
- Selection

## Texture (UV)

Texture, or UV, maps store texture placement information and are the most common vertex map. UV mapping adds two extra coordinates to the points in your object; those on the U (horizontal) and V (vertical) axes, running horizontally and vertically through the flat plane of the texture map, on which you can paint your texture. UV coordinates are a 2D representation of 3D space. They set up a relationship between a two-dimensional image and the three-dimensional surface the image will be applied to.

Points can have as many UV maps assigned to them as you'd like. **Figure 4.3** shows three UV maps that were created for the Spiderbait character that you can download from my site at [www.pushingpoints.com/2011/07/spiderbait-rig](http://www.pushingpoints.com/2011/07/spiderbait-rig).

**[Figure 4.3]** Three separate UV maps were assigned to the points that make up the character mesh on the right.



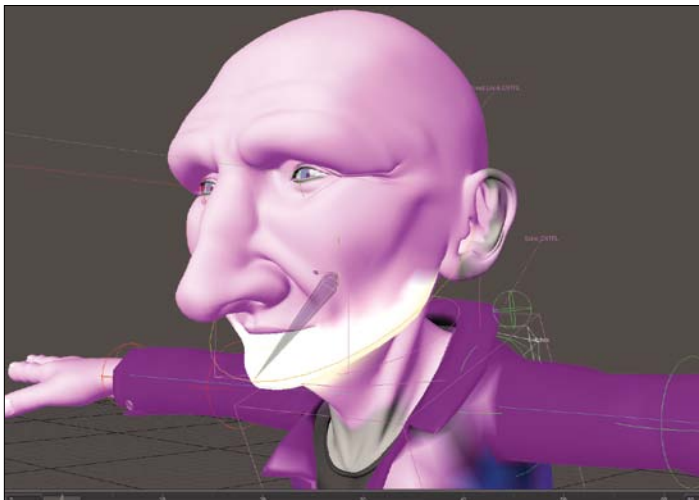
## Weight

*Weight maps* store a single value, usually between -100 and 100 (although in some instances lower and higher values are possible). The most common use of a weight map is for defining a bone's influence on a point when *rigging* (placing bones and controls to allow a model to be deformed for animation).

**Figure 4.4** shows positive weight values applied to the points that make up the character's jaw. When the weight map is assigned to the jaw bone, the points will move when the bone moves. This allows for seamless organic meshes to deform in localized areas.



**[Figure 4.4]** Weight values assigned to points in the mesh (top) can be assigned to a specific bone (bottom) during the rigging process.



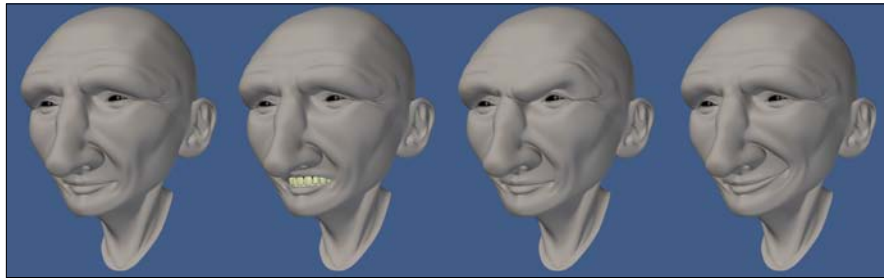
There are far more uses for weight maps than rigging. For example, you can use weights to mask a surface when texturing, influence dynamic simulations over an object, aid during the modeling process, and do much more.

## Morph

*Morph maps* store offset information (alternate XYZ values) for a point's position and are commonly used for creating morph targets for animation.

**Figure 4.5** shows several morphs applied to the base mesh. Each morph relies on multiple points being moved to new coordinates, and that information is saved to each vertex.

**[Figure 4.5]** Morph maps are commonly used to create facial poses for animation.



Similar to weight maps, morph maps have a variety of uses during the modeling and texturing processes.

## Color

*Color maps* hold values for Red, Green, Blue, and Alpha (RGBA) color information. I often use color maps on my character models to add color variation to the object's surfaces, like adding blush to a character's face. **Figure 4.6** shows an example of using a color map to add a five o'clock shadow and some color to a character's face.

**[Figure 4.6]** A color map was applied to the character's face (right) to give the appearance of a five o'clock shadow.



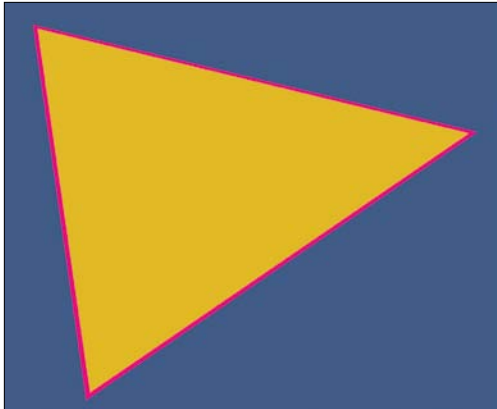
## Selection

A *selection map*, also referred to as a *selection set*, stores a single state of a point—either selected or unselected. Selection maps allow a modeler to recall a selected group of points quickly and can be extremely useful for defining which points will be affected by dynamic simulations.

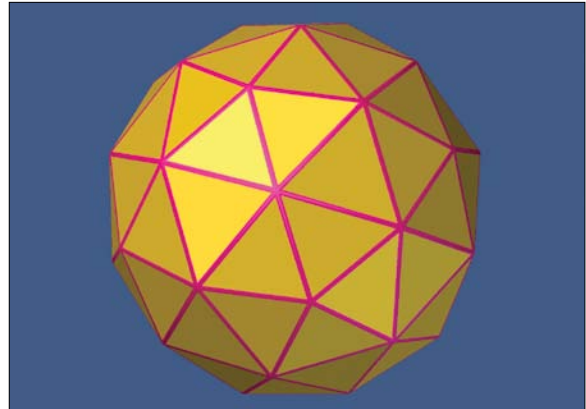
## Edges

An *edge* is a one-dimensional line that connects two points in a polygon. Another way to describe edges would be to say that they are the line segments that border a polygon. A triangle, for example, has three edges, three points, and one polygon, as shown in **Figure 4.7**.

Similar to points, multiple polygons can share the same edges when used on a contiguous mesh. The tessellated sphere in **Figure 4.8** shows individual edges bordering the multiple polygons.



**[Figure 4.7]** The polygon in this image consists of three edges, shown here in pink.



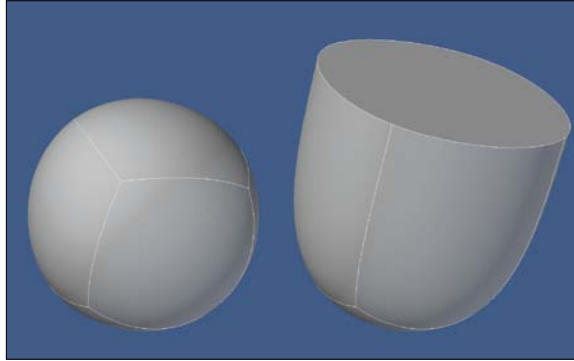
**[Figure 4.8]** Each polygon shares common edges in this mesh.

## Edge weights

*Edge weighting* increases or decreases the sharpness of an edge between two subdivision surface (SubDs) polygons, allowing for harder or softer corners without additional geometry being added (**Figure 4.9**). The main issue with edge weights is that there is no universal, widely supported format that allows you to transfer edge weights from one 3D application to another. In today's

mixed software pipeline, this can be a showstopper. Most modelers I know avoid edge weighting and opt for additional geometry to accomplish the same end goal.

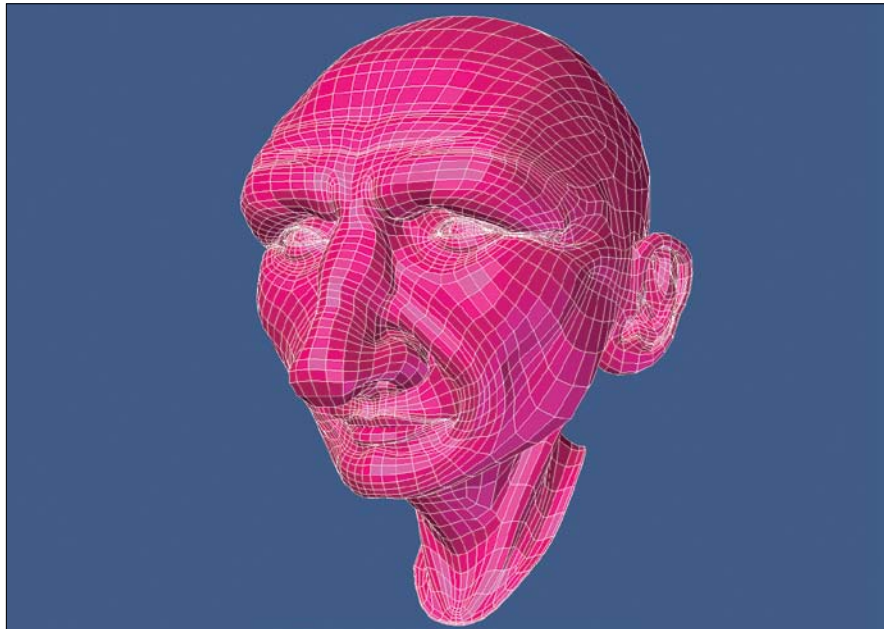
**[Figure 4.9]** Edge weighting has been increased to 100 percent to the four edges on the top of the SubD object on the left to produce harder edges.



## Polygonal Models

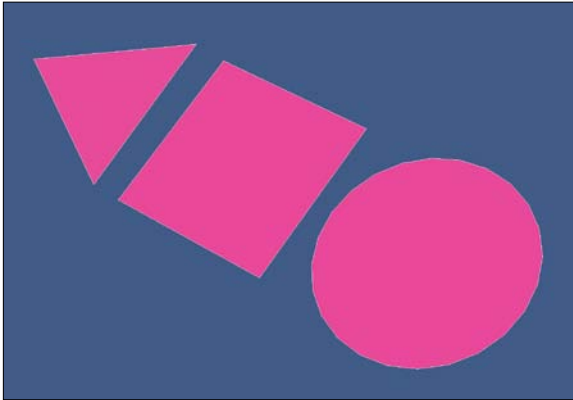
*Polygons*, often shortened to *polys* and commonly referred to as *faces*, are geometric shapes consisting of a number of points that define the surface of a 3D object. A polygon is what you actually see in a render, and a typical 3D model will consist of hundreds or thousands of polygons (**Figure 4.10**).

**[Figure 4.10]** This head mesh consists of over 6000 polygons.





Although some 3D applications allow the creation of one- and two-point polygons, it's more common that a polygon be made up of at least three points. Three-point polygons are commonly called *triangles* or *tris*. Polygons made up of four points are called *quads*, and a polygon that has more than four points is usually referred to as an *n-gon*. The term *n-gon* means a polygon with  $n$  sides, where  $n$  is the number of the polygon's sides. For example, a polygon with six sides is a 6-gon. Examples of a triangle, a quad, and an *n-gon* are shown in **Figure 4.11**.



**Figure 4.11** Polygons come in all shapes and sizes. The triangle (left) consists of three points, the quad (middle) is made up of four points, and the *n-gon* (right) is made up of 24 points.

## NURBS

A *Non-Uniform Rational B-Splines (NURBS)* surface is a smooth mesh defined by a series of connected *splines*, which are polynomial curves. This smooth surface is converted to polygons at render time, so NURBS surfaces can contain an arbitrary number of polygons. NURBS can be converted to polygons or subdivision surfaces and are useful for constructing many types of organic 3D forms because of the minimal nature of their curves. NURBS geometry is smooth by default and doesn't need to be subdivided to “become” smooth like polygon geometry does.

*Non-Uniform* refers to the parameterization (defining the parameters) of the curve. Non-Uniform curves allow, among other things, the presence of *multi-knots* (a sequence of values that determines how much and where the control points influence the shape), which are needed to represent Bézier curves.

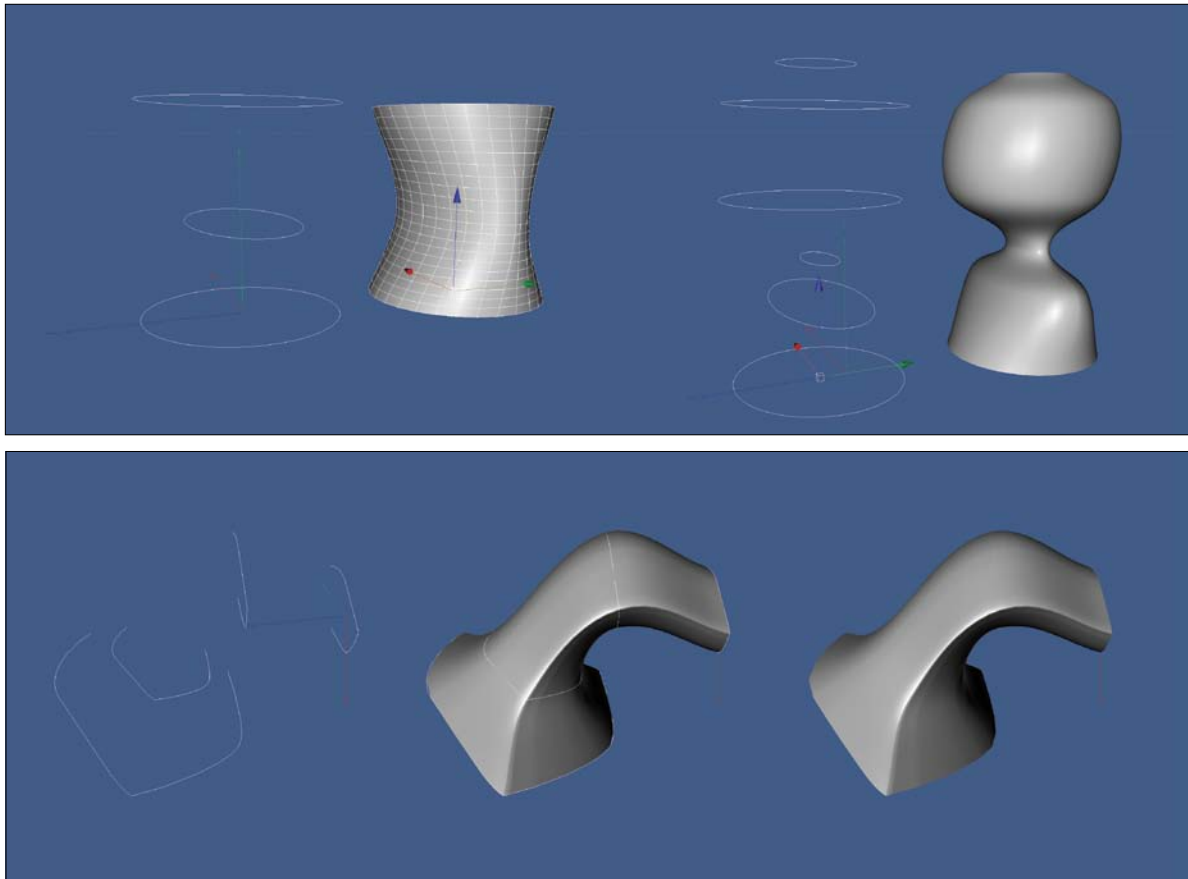


*Rational* refers to the underlying mathematical representation. This property allows NURBS to represent exact conics (such as parabolic curves, circles, and ellipses) in addition to free-form curves.

*B-splines* are *piecewise* (a function that changes) polynomial curves (splines) that have a parametric representation. Simply put, a B-spline is based on four local functions or control points that lie outside the curve itself.

The best way to understand NURBS is to see them in action. **Figure 4.12** shows multiple examples of the splines that define the NURBS surfaces.

**[Figure 4.12]** Each of these three NURBS surfaces are defined by a series of splines, shown to the left of each object.



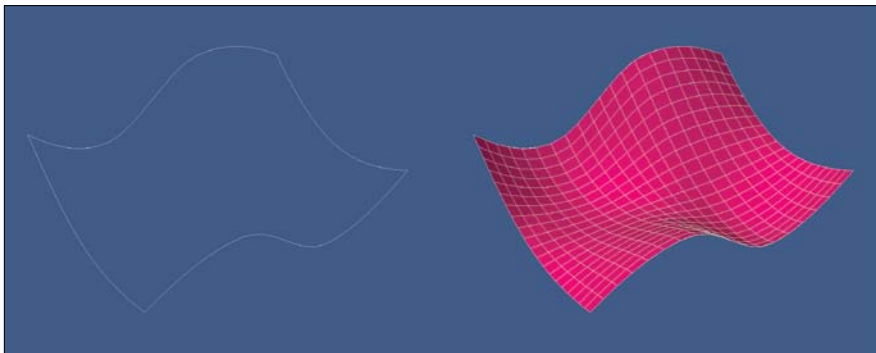
NURBS are most commonly used in computer-aided design (CAD), manufacturing, and engineering. Although they were once used heavily for organic objects (see the forthcoming section “Model Classification: Hard Surface and Organic”) in the film and broadcast markets, subdivision surfaces have since replaced them in almost all instances in movies and television.

## Splines

A *spline* is a curve in 3D space defined by at least two points. The most common spline used in digital modeling is the Bézier curve. *Bézier curves* are used to model smooth curves using far fewer points than a polygonal model would require. *Control points* make up the curve and can be used to dramatically manipulate the curve with little effort. Also, splines are resolution independent, unlike a polygonal mesh, which can appear faceted when you zoom in close enough to a curved surface.

Splines in 3D applications can be likened to vector curves in software such as Illustrator, Flash, and Photoshop. Splines are similar to NURBS in that they can create a “patch” of polygons that extends between multiple splines, forming a 3D skin around the shape (**Figure 4.13**), a feature which is extremely useful when modeling. Unlike NURBS, the splines must be converted to polygons before rendering.

Splines are also useful in many other modeling techniques, including but not limited to, *extrusion* (adding depth to a flat surface) and *cloning* (duplicating) along a spline and deforming a mesh based on the curves of a spline.

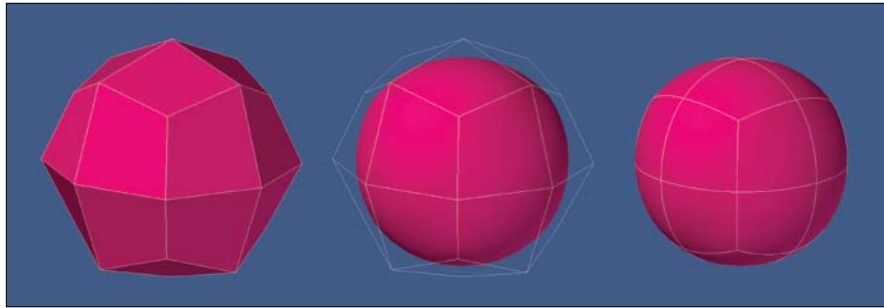


**[Figure 4.13]** The four splines on the left were used to patch the polygonal mesh on the right.

## Subdivision Surfaces

*Subdivision surface (SubD)* is a refinement algorithm that creates a smooth curved surface from a coarse *polygonal mesh* (also called a *base mesh*). This process takes the base mesh and creates a smooth surface using the original vertices as control points, also referred to as the control cage. **Figure 4.14** shows the polygonal mesh (left), the control cage (middle), and the resulting SubD mesh (right).

**[Figure 4.14]** Subdivision surfaces allow you to work with a very light and simple polygonal mesh to create smooth organic shapes.



The number of polygons, or subdivisions, generated from SubDs can be adjusted to a varying level of density, and complex smooth objects can be created in a fast and predictable way from simple base meshes, as shown in the character model in **Figure 4.15**. This makes SubDs a popular option for most digital modelers.



**[Figure 4.15]** This character was created with a very simple polygonal mesh (left). But with SubDs applied (middle), a smooth, high-poly mesh was generated (right).

## Model Classification: Hard Surface and Organic

When 3D was still in its infancy, digital modelers were usually put into one of two distinct groups based on the type of meshes they constructed. Although the lines have become blurred, these groups still exist today and play a role in how modelers define themselves in the industry. Also, the distinction of the types of meshes a modeler creates makes it easier for studios looking for talent to find the right digital modeler for their specific modeling needs.

Every 3D mesh can be grouped or classified as either a hard surface or organic. What's the difference? What defines an object as hard surface? What defines an object as organic? So many objects nowadays seem to blur the lines between the two. How would you make a distinction between these classifications?

What may come as a surprise is that if you ask 20 professional digital modelers what the difference between these two classifications is, you'll receive 20 different responses. I did just that before writing this section of the book and was quite surprised at some of what I heard.

How can something so seemingly clear-cut bring about so many different ways to classify a 3D model? Before coming to a conclusion, let's explore the most common responses.

### Production Driven

Many artists felt that a model would be classified by how it would be used in a production. A static object, such as a stone statue, gas pump, or street sign, would be considered a hard surface object, whereas objects that would deform or animate, such as an animated human character, flag, or animal would fall into the organic category.

The same item could be classified two different ways depending on what the object is called to do for the shot/project. A statue is made of stone and doesn't usually deform; therefore, it is a hard surface object. But if it becomes a moving statue, as in the world of Harry Potter, it is organic.

Although a gun has moving parts that can be animated, it is still a rigid object, which makes it a hard surface object, unless of course, someone with

super human strength comes along and bends (deforms) the barrel—then it becomes organic.

If the mesh is going to deform in some way, it needs to be modeled differently and it should then be classified as an organic object.

## Attribute Driven

Some believed that it was a model's *attributes*, or what an object looks like, that defined whether it was hard surface or organic. So if the mesh had flowing “organic” curves where any shape could smoothly transform into any other, like a character, ornate piece of furniture, or a sleek sports car, it was an organic mesh.

Hard surface objects would be defined as meshes typically involving tight edges or simpler shapes joining together with distinct edges, even if the shapes were soft or sleek, like guns, power tools, and retro robots.

Also, if the object's surface attributes were that of stone, metal, or glass, it would fall into the hard surface category, whereas objects made up of living tissue, like animals, plants, and people, would be considered organic.

## Construction Driven

One artist defined the two by focusing solely on the modeling aspect. Objects that require a more “organized” topology could be classified as an organic mesh and easily created using “organic” modeling tools and techniques. He believed that organic meshes tend to have more polygons and could benefit from SubDs more than hard surface objects. Hard surface objects don't require an organized, semi-regular topology and could be created with fewer polygons with less concern about the object's underlying mesh.

## Model Classification Evaluation

Although each of these schools of thought has valid arguments and may work for a particular artist, we simply can't classify an object based on how it is constructed, will be used in production, or by its appearance. To do that would cause confusion, because every object could find its way into each category.

Take, for example, my dog Jack. He's a chocolate lab, which is classified as being part of the *Canidae* family. For the most part, Jack acts like your average dog, wanting to eat, play, and sleep most of the time. He does, however, show attributes of a cat at times, and every now and then he will scratch at the ground after he urinates, like a cat pawing at its litter box. Although this is common in cats, it doesn't make Jack part of the *Felidae* family.

Organic modeling goes beyond the fact that the shape of the model is rounded. Many hard surface objects have organic shapes, like cars, cell phones, and robots, whereas organic objects can have rigid shapes like rocks, insects, and crustaceans. Industrial design has moved more towards organic shapes over the years, and the entertainment industry is taking things that were traditionally hard surface, static objects and deforming them in animation—having gas pumps dance in commercials, for example.

Also, modeling something to perform well when animated is just good modeling technique and shouldn't determine whether something is hard surface or organic. For example, look at a mesh sculpted in ZBrush, or modeling with metaballs or voxels. You can create something very organic, but these modeling techniques will make the model nonconductive to animating. Would that then be considered hard surface modeling? Of course not.

Most modelers don't limit their tool and technique use based on whether a model is organic or hard surface. Generally, they use good modeling techniques, which include building a model that'll hold up if deformed, even if it's not intended to, and apply those same techniques regardless of whether the model is hard surface or organic.

You hear the terms *hard surface* and *organic modeling* all the time in the 3D modeling community, and artists are often defined as one or the other. If you make mostly characters meshes, you are an organic modeler. If you make more architectural or mechanical objects, you are a hard surface modeler. I usually describe myself as an organic character modeler, but it is simply not that straightforward, because I create products and vehicles that are defined as hard surface too.

So back to the point: What's the difference between hard surface and organic models, and how do we define the two? I suppose, essentially, there is no difference at all, and it is a question of semantics. For the purposes of this book (and based on my personal philosophy), I use the following distinction: Characters, creatures, plant life, and more naturalistic environments are organic models, and architectural environments, vehicles, and mechanical products are hard surface. This is very loose as a definition, and as I've tried to emphasize, the lines between the two are indeed very blurred.

### Hard surface

*Hard surface* objects are anything man-made or constructed. Architectural structures, vehicles, robots, and anything machined or manufactured could fall into this category. The robots from FunGoPlay's *Grid Iron Gladiators* ([www.fungoplay.com](http://www.fungoplay.com)), shown in **Figure 4.16**, would fall into the hard surface category.



**[Figure 4.16]** Although these robots have smooth organic shapes, they still fall into the hard surface category.



## Organic

*Organic* models are subjects that naturally exist in nature. This would include humans, animals, plants, trees, rocks, boulders, terrains, clouds, and even lightning bolts. The nonplayer characters that roam the world of FunGoPlay (Figure 4.17) would be considered organic models.



[Figure 4.17] These characters from FunGoPlay would be classified as organic models.

## Model Styles

As with a model's classification, a mesh usually has a specific style associated with it. A *style* refers to a specific philosophy, goal, or look. Realism, impressionism, abstract expressionism, and surrealism are common styles found in traditional art. Although a digital model could easily fall into any of the traditional art styles, the 3D industry usually places them into one of two different model styles: photo-real and stylized.



## Photo-real

When a model depicts an object with realistic accuracy, the term *photo-real* is applied. Digital artists use photographic reference and their observation skills to transfer the realistic properties to the details that make up their models.

It's important to understand that the subject matter is not required to be a real-world object, like a car, human, or architectural structure. Models of robots, dragons, and other fictional subjects can also be modeled in a photo-realistic style using real-world reference as a guide.

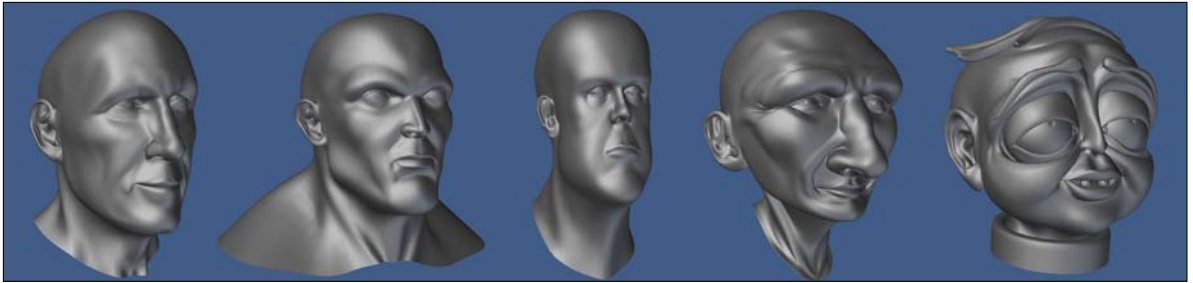
## Stylized

When a digital model consists of artistic forms and conventions in a non-realistic style, it is referred to as a *stylized* model. Simply put, a stylized model is one that is not photo-real. Cartoon characters and environments are classic examples of stylized models.

The best stylized modelers I know still gather and use just as much real-world reference material as a photo-real modeler. The only difference is how they interpret it and apply that information to the model.

## Choosing a Style

Although many artists would argue otherwise, I don't find either style of modeling to be more difficult than the other. Both styles require the same attention to detail, and the same care needs to be put into the poly-count and topology of the mesh. At the end of the day, the only real difference between the two styles is where the points are arranged on the model, as shown in the head models in **Figure 4.18**.



**[Figure 4.18]** Each of these head models consists of the same elements, but only the head on the far left would be classified as photo-real.

Most artists gravitate towards a particular style. I prefer creating stylized models and creating meshes that have otherworldly proportions and attributes, but I also tackle photo-real models on a regular basis. My modeling toolset and techniques don't change depending on the style of the mesh I'm tasked with. Digital modelers' goals should be to hone their observational skills and to have the ability to work across styles.

Learning to work in both styles will only enhance your ability in the style of your choice and will open up more opportunities to you as a professional modeler.

# Index

- 2D animatics, 37
  - 2D base mesh, 170–174
  - 2D paint programs, 9, 14, 15
  - 2D software, 15
  - 2D to 3D conversions, 72–73, 74, 174
  - 3D animatics, 37
  - 3D Artist, 385
  - 3D Art to Part, 327
  - 3D characters, 239–263
    - and box modeling method, 240–241
    - building body for, 253–256
    - and clean geometry, 239
    - creating head for, 242–246
    - detailing face for, 247–253
    - reviewing/changing, 262–263
  - 3D-Coat, 282, 300
  - 3D films, 344
  - 3D gaming, 299–300. *See also* game modeling
  - 3D graphics, 5
  - 3D graphics programs, 9
  - 3D illustration, 321
  - 3D meshes, 4. *See also* 3D models; meshes
  - 3D modeling. *See also* digital modeling
    - applications, 9, 10
    - hardware required for, 10–12
  - 3D models. *See also* digital models
    - for computer games, 299 (*See also* game modeling)
    - creating, 4
    - examples of, 6
    - of human head, 213–237 (*See also* head model)
    - reference materials for, 78–81
    - sources of, 4
      - of stylized character, 239–263 (*See also* 3D characters)
  - 3D polygonal objects, 180–195
  - 3D printers, 322–327, 338
  - 3D printing, 321–341
    - cost considerations, 327
    - defined, 321
    - file format considerations, 331
    - guidelines, 332–334
    - how it works, 322–327
    - preparing digital model for, 329–334
    - producing toys via, 334–341
    - sealing considerations, 326–327
    - service bureaus, 327, 331
    - ways of using, 328–329
  - 3D product visualization, 358–359
  - 3D scanning, 131–133
  - 3D.sk, 91
  - 3ds Max, 14
  - 3D software, 14
  - 3D space, 72
  - 3D text, 168–179, 198–204
  - 3DTotal, 11, 383, 385
  - 3D visualization, 356–359
  - 3D World, 385
  - 3-point polygons, 109, 156–157, 270, 278
  - 4-point polygons, 156–157, 262
- 
- ## A
- active scanners, 132
  - Adair, Dustin, 355
  - additive manufacturing, 322
  - ADG (Art Directors Guild), 69, 70

Adobe Photoshop  
   and 2D paint/image manipulation, 15  
   adjusting color/levels with, 96  
   alternatives to, 15  
   applying skin details with, 48  
   mirroring images with, 218  
   scaling/rotating images with, 217  
   template tools, 371  
   and texturing, 48  
*Adventures of Tintin, The*, 70  
 Agency typeface, 198  
 alpha maps, 317  
 alphas, 283  
 anatomy, digital model, 102–112, 286, 302  
 anatomy reference, 85, 89  
 Android devices, 355  
 animated shorts  
   production pipeline for, 24  
   recording scratch track for, 36  
   as testing ground for new artists,  
     348–349  
   voice recording for, 39  
 animatics, 37–38  
 animation  
   common departments for, 23  
   importance of audio in, 64–67  
   post-production stage, 61–75  
   pre-production stage, 25–39  
   production stage, 40–61  
   and rigging process, 45, 53  
 animation director, 50  
 Animation Factory, 80  
 animation tools, 134–137  
 animators, 50, 52  
 API (Application Programming Interface),  
   11  
 Applehead Factory  
   content directories, 143  
   creating logo for, 168–179

  reference collection, 89  
   storyboarding at, 34–35  
   toy manufacturing experience, 338, 341  
 Application Programming Interface (API),  
   11  
 architectural visualization, 357–358  
 armatures, 282–283  
 art department, virtual, 69–72  
 art directors, 28, 40  
 Art Directors Guild (ADG), 69, 70  
 attribute-driven models, 114  
 audio engineers, 64  
 audio recording  
   scratch voice, 35–36  
   voice, 39  
 Autodesk, 383  
*Avatar*, 69, 70

## B

Baker, Rick, 39  
 Barker, Clive, 39  
 base mesh, 112, 170–174  
 base pose, 45, 162–164  
 bases, model support, 333  
*Battle for Terra*, 72, 74  
*Battlestar Galactica*, 59, 63  
 beveled edges, 199, 222  
 Bézier curves, 109, 111, 172  
 binding agents, 322, 325, 326  
 Blair, Linda, 39  
 Blender, 14  
 blocking, 52  
 Blogger, 371  
 blueprints, 25, 33, 268–270  
 blurry images, 92–93  
 boat images, 92  
 bones, 135–136  
 bookstores, 89

- bottle caps, 275–276
  - bottles, 266, 268–279
  - Boughen, Nicholas, 58
  - box modeling
    - creating character models with, 126–127, 240–241
    - creating head models with, 214–215
    - first step in process, 126
    - as Holy Grail of modeling, 122
    - vs. edge extend method, 214–215
  - Branit, Bruce, 350
  - Branit | FX, 350, 352
  - Breaking Bad*, 350
  - brushes, sculpting, 283–284. *See also* ZBrush
  - B-splines, 110
  - Bubble Guppies*, 350
  - build out method, 122–124
  - bump maps, 180, 317
  - business cards, 87
- C**
- CAD (computer-aided design), 111, 128, 268
  - cameras, 85–86, 96
  - Cameron, James, 69, 70
  - Canon PowerShot, 85
  - Captain America*, 74
  - career advancement, 387–388
  - careers, digital modeling, 5, 344–361
  - Carnivores Cityscape*, 381
  - cartoon characters, 118, 127. *See also*
    - character models
  - CBeebies*, 350
  - CG (computer graphics)
    - careers in, 7
    - online communities, 11, 383, 385
    - production pipeline, 41
    - software, 13–14
  - CG Arena, 385
  - CG\_Content folder, 143–144
  - CG Society, 11, 383, 385
  - chamfers, 175
  - Chan, Alan, 26–27, 81
  - character designers, 31
  - character models, 239–263
    - box modeling, 240–241
    - building body for, 253–256
    - for console games, 299
    - creating hands for, 256–262
    - creating heads for, 242–246
    - detailing face for, 247–253
    - gathering reference material for, 84–85
    - prepping for production, 40–41
    - questions to ask about, 82
    - reviewing final mesh for, 262–263
  - character technical directors, 43
  - Christmas Carol*, A, 70
  - Cinefx*, 385
  - Clarke, Jamie, 89
  - Clay Buildup brush, ZBrush, 302
  - Clay Polish brush, ZBrush, 304
  - clay sculptures, 29, 321
  - clean modeling, 147–159
  - cloning, 111, 318
  - closed meshes, 329–330
  - cloth effects, 55
  - clothespin model, 205–211
  - color correction, 61, 63
  - color maps, 106, 315–316
  - color stylists, 29
  - color texture maps, 315–316
  - color theory, 61
  - commercials, 352
  - compositing, 61–64, 98
  - compositing programs, 64
  - compositors, 61
  - compound curves, 268
  - computer-aided design (CAD), 111, 128, 268

- computer games, 353
- computer graphics
  - careers in, 7
  - online communities, 11, 383, 385
  - production pipeline, 41
  - software, 13–14
- Computer Graphics World*, 385
- computer processor speed, 10
- concept artists, 29
- conferences, industry, 382
- console games, 353
- construction-driven models, 114
- contact information, 373
- contact scanners, 131–132
- content directory structure, 142–147
- contests, 380
- contiguous mesh, 103, 107
- control cage, 112
- copyrighted material, 91
- cores, 10
- CPU speed, 10
- creature models, 284–319
  - adding surface detail to, 294–297
  - creating creature sculpt for, 300–305
  - creating UVs for, 314–315
  - doing second pass for, 292–293
  - generating maps for, 315–319
  - performing retopology for, 305–313
  - producing 3D sketch for, 284–285
  - sculpting arms for, 288–289
  - sculpting head for, 289–292
  - sculpting legs for, 286–288
- cropping images, 98
- CSI: Crime Scene Investigators*, 133, 350
- CT scans, 132–133
- curves, 109, 110, 111, 172, 268
- cutaways, 35
- cut-ins, 35
- cutscenes, 356
- Cyberware, 131

## D

- Davis, Jarrod, 55–56
- death mask region, 231
- Deep Exploration, 331
- deformations, 158
- Demo Reel Breakdowns (DRBs), 366–367
- demo reels, 361–369
  - burning, 369
  - case/sleeve for, 361–364
  - essential content for, 365–367
  - importance of, 361
  - labeling, 369, 378
  - offering online versions of, 371, 373
  - recommended length for, 368
  - sending out, 377
  - sound track for, 368
  - updating, 385–386
- depth artists, 74
- depth effect, 203
- diamond polygons, 157
- DiDomenico, Joe, 34–35
- digital cameras, 85–86, 96, 99
- digital creature maquettes, 284–297
  - adding surface detail to, 294–297
  - doing second pass for, 292–293
  - producing 3D sketch for, 284–285
  - sculpting arms for, 288–289
  - sculpting head for, 289–292
  - sculpting legs for, 286–288
- Digital Domain, 345
- digital modelers. *See also* digital modeling
  - hard surface *vs.* organic, 113–117
  - job market for, 5, 343–361
  - networking with other, 382–384
  - as problem solvers, 17
  - role of, in production pipeline, 40–42
  - skills required for, 7, 141, 147
  - tools used by, 78–84, 134–137, 381
- digital modeling

- careers in, 5, 344–361
  - changing your thinking about, 16–19
  - defined, 4–5
  - examples (See digital modeling examples)
  - hardware required for, 10–12
  - industry insights (See industry insights)
  - industry overview, 344–361
  - key to succeeding in, 16, 391
  - knowledge/skills required for, 7, 9, 77–78, 147, 380–381
  - methods, 121–139
  - production pipelines, 22–75
  - staying current on, 380–386
  - teamwork required for, 21–22
  - digital modeling examples
    - 3D polygonal object with seams, 180–195
    - 3D polygonal text, 168–179
    - 3D text with SubDs, 198–204
    - digital sculpting, 281–297
    - game modeling, 299–319
    - product modeling for print graphics, 265–279
    - realistic head, 213–237
    - stylized character, 239–263
    - SubD object, 205–211
  - digital models
    - 3D printing of, 321–341
    - preparing for production, 159–165
    - as reference material, 94
    - terminology, 102–112
    - types of, 102
  - digital reference material, 89
  - digital sculpting, 281–297
    - adding surface details, 294–296
    - of arms, 288–289
    - creating creature maquette with, 284–297
    - defined, 128, 281
    - Glen Southern’s approach to, 282–283
    - of heads, 289–292
    - of legs, 286–288
    - for next-gen game model, 300–305
    - programs/tools, 122, 132, 282–284, 300
    - second pass, 292–297
    - ways of using, 128–130, 281
  - directories, content, 142–147
  - directors, 26, 28, 67–68
  - Directory of Illustration, The*, 370
  - directory structure, 142–145, 147
  - displacement maps, 330
  - Documents folder, 144
  - “Do My Job” button, 17, 78
  - Drag Rectangle option, ZBrush, 294
  - Draw mode, ZBrush, 290
  - DRBs (Demo Reel Breakdowns), 366–367
  - dual monitor setups, 11–12
  - DVDs, burning/labeling, 369
  - DVD training videos, 15
  - Dynamesh feature, ZBrush, 284–285, 289, 304
  - dynamics, 136–137
- ## E
- ears, 232–234, 251–252
  - Ebay, 89
  - edge extend modeling, 123–124, 214–215
  - edge loops, 154–155, 199, 202
  - edges, 107–108
  - edge weights, 107–108
  - editors, 37, 67–68
  - effects artists, 53–56
  - Einstein, Albert, 153
  - elemental effects, 53
  - EPS files, 169, 198
  - Etter, Ryan, 372

events, industry, 382  
 exercise, 386  
 extrusion, 111, 203  
 eye masks, 225  
 eyes, 219–225, 247, 330

## F

fabric dynamics, 53  
 Facebook, 382  
 faces, 108, 213, 247–253. *See also* head model  
 facial animation, 53, 106  
 facial expressions, 216  
*Falling Skies*, 350  
 feather effect, 55  
 feature films, 345  
 FGP virtual world, 181  
 fillets, 175  
 film industry, 344–349  
 film terminology, 35  
 final edit, 67  
 final pass, 160  
 fingers, 256–262  
 fire effect, 53, 55  
 Flash, 111, 372  
 focal shift, 292  
 Foundation 3D, 11, 383  
 Foundry, 64  
 four-point polygons, 156–157, 262  
 four-point triangles, 157  
 Freeform, 132, 359  
 Frima, 355  
 FunGoPlay, 116, 117, 134, 181, 355  
 fur effect, 55

## G

Gamache, Erik, 345  
 game industry, 353–356, 381  
 game modeling, 299–319  
   creating creature sculpt, 300–305  
   creating UVs for low-poly model, 314–315  
   generating maps for low-poly model, 315–319  
   Glen Southern's approach to, 300  
   growth of, 299  
   next-gen, 299, 300  
   performing retopology, 305–313  
 GIF files, 373  
 GIMP, 15  
 Google, 89  
 Google Groups, 382  
 Gordon, Johnny, 52–53  
 GPU-based rendering, 11  
 graphics cards, 11  
 Graphics Processing Unit (GPU)  
   technology, 11  
 graphics tablets, 282  
 grayscale images, 283, 317  
 greed, 375  
*Grid Iron Gladiators*, 116

## H

hair fibers, 53  
 handheld devices, 355  
 hands, 152, 256–262  
 hard surface modeling, 113–117  
 hard surface objects, 116  
 Harryhausen, Ray, 90  
 head model, 213–237  
   build out approach to, 122  
   challenge to creating, 213



- choosing modeling method for, 214–215
    - choosing style for, 118–119
    - for creature maquette, 289–292
    - defining surface of, 108
    - modeling components of, 219–237
    - reference photos for, 97, 216–218
    - ways of using, 213
  - health considerations, 386
  - Heinzen, Kory, 29–32, 372
  - Hellhound creature, 300–319
    - creating creature sculpt for, 300–305
    - creating UVs for, 314–315
    - generating maps for, 315–319
    - performing retopology for, 305–313
  - hinge joints, 45
  - hi-res textures, 11
  - homesickness, 374–375
  - horse illustration, 93
  - How to Train Your Dragon*, 72
  - human head. *See* head model
- I**
- Illustration, The Directory of*, 370
  - illustrations, 93–94
  - Illustrator, 111, 169, 198
  - image-based meshing, 132
  - image manipulation software, 14, 15, 96
  - images
    - adjusting color/levels for, 96–97
    - compositing multiple, 98
    - cropping, 98
    - naming, 99
    - overprocessing, 97
    - rotating, 97
    - scanning, 96
    - sizing, 97–98
  - Images folder, 145
  - indie films, 346–347
  - industry conferences/events, 382
  - industry insights (by contributor)
    - Boughen, Nicholas, 58
    - Chan, Alan, 26–27
    - Davis, Jarrod, 55–56
    - DiDomenico, Joe, 34–35
    - Gordon, Johnny, 52–53
    - Heinzen, Kory, 29–32
    - Ladnier, K. C., 65–67
    - Maldonado, David, 74
    - McDonough, 46–47
    - Nieves, Angel, 49–50
    - Powers, Rob, 70–72
    - Smith, Kurt, 44–45
    - Southern, Glen, 41–42
    - Stringer, Lee, 63–64
    - Tsirbas, Aristomenis, 38
    - Welch, Farrah L., 59–61
  - industry insights (by topic)
    - animatics, 38
    - animation, 52–53
    - compositing, 63–64
    - effects artists, 55–56
    - lighting, 58
    - render artists, 59–61
    - rigging, 44–45
    - role of 3D modelers, 41–42
    - set decoration, 46–47
    - sound design, 65–67
    - stereoscopic 3D, 74
    - storyboarding, 34–35
    - story development process, 26–27
    - texturing, 49–50
    - virtual art departments, 70–72
    - visual design, 29–32
  - industry news/trends, 384–385
  - Inflate brush, ZBrush, 292

inflexibility, 376–377  
Inhance Digital, 22, 59  
ink jet 3D printers, 322–324  
*Inside the Living Baby*, 133  
Internet  
    forums, 11  
    as source of reference images, 89  
    as tool for self-promotion, 370  
internships, 375  
interviews, job, 378  
iPad, 355  
iPhone, 355  
*Iron Sky*, 346

## J

*Jack the Giant Killer*, 70  
jawlines, 231–232  
*Jimmy Neutron*, 350  
job interviews, 378  
job opportunities, digital modeling, 5,  
    344–361  
job search sins, 374–380  
Joe Zeff Design, 360  
joints, 338  
JPEG files, 373

## K

keys, 79  
Kraftwurx, 327

## L

Ladnier, K. C., 64–67  
laugh lines, 228  
layout artists, 37, 45, 46, 52

layout foundations, 186–190  
Lee, Jason, 372  
legs, 286–288  
“less is more” rule, 153  
letterforms. *See* text  
level design, 381  
libraries, 89  
light, color of, 63  
lighting artists, 56–58  
lighting conditions, photos with extreme,  
    92–93  
lighting technical directors, 56  
LightWave 3D, 14, 15, 71, 157, 367  
lines, 102, 107  
LinkedIn, 382  
lip sync, 53  
Littlest Pet Shop, 341  
localized detail, 151–152  
logos, 168–169  
loops, edge, 154–155, 199, 202  
low-poly models  
    creating UVs for, 314–315  
    generating maps for, 315–319  
    poly-count considerations, 306  
Lucasfilm, 63  
Luxology, 383

## M

magazines, trade, 385  
Makerbot, 327  
Maldonado, David, 74  
maps  
    alpha, 317  
    bump, 180, 317  
    color, 106, 315–316  
    displacement, 330  
    morph, 106  
    normal, 300, 318–319

- selection, 107
- texture, 15, 48, 104, 315–316, 330
- UV, 40, 48, 104
- vertex, 103–107
- weight, 40, 105–106
- maquettes, 284–297
  - adding surface detail to, 294–297
  - defined, 29
  - digital sculpting of, 129
  - doing second pass for, 292–293
  - producing 3D sketch for, 284–285
  - sculpting arms for, 288–289
  - sculpting head for, 289–292
  - sculpting legs for, 286–288
- Mars Needs Moms*, 70
- mattes, 63
- Maya, 14
- McDonough, Ed, 46–47
- measuring, 86–87
- medical illustrations, 132–133
- memory, 10
- MeniThings, 38
- Merton, Robert K., 16
- meshes
  - closed, 329–330
  - contiguous, 103, 107
  - controlling poly-count for, 148
  - delivering production-ready, 40
  - hard surface *vs.* organic, 113–117
  - hiding portions of, 292–293
  - image-based, 132
  - polygonal, 112
  - position/rotation of, 160
  - tools for generating, 13–14
- metal printing, 327
- metal spring model, 209–211
- Method Studios, 58
- micro-bevels, 174–177
- microphone model, 136–137
- MicroScribe G2 scanner, 131
- Minolta Vivid Laser scanner, 132
- mirroring, 218, 224, 278
- M&Ms, 219, 360
- mobile apps, 355
- model classification, 113–117
- modelers, 5–7, 40, 141. *See also* digital modelers
- modeling. *See also* digital modeling
  - 3D polygonal object with seams, 180–195
  - 3D polygonal text, 168–179
  - 3D text with SubDs, 198–204
  - clean, 147–159
  - departments, 40
  - edge extend, 123–124, 214–215
  - game, 299–319 (*See also* game modeling)
  - methods (*See* modeling methods)
  - pilates, 83
  - practices (*See* modeling practices)
  - preparing for career in, 77–78
  - product, 265–279
  - realistic head, 213–237
  - to scale, 159–160
  - software/tools, 13–15, 42, 78–84, 134–137, 381
  - stylized character, 239–263
  - SubD object, 205–211
  - supervisors, 40
- modeling methods, 121–139
  - 3D scanning, 131–133
  - box, 122, 126–127, 214–215, 240–241
  - build out, 122–124
  - digital sculpting, 128–130, 291–297
  - mixing, 138–139
  - patch, 127–128
  - primitive, 124–125

- modeling practices, 141–165
  - clean modeling, 147–159
  - directory structure, 142–145
  - naming conventions, 142, 145–147
  - preparing model for production, 159–165

- models
  - creating multiple versions of, 165
  - positioning, 160
  - preparing for production, 159–165
  - as reference material, 94
  - terminology, 102–112
  - types of, 102

- model sheets, 29, 40

- model styles, 117–119

- Modo, 14, 282

- monitors, 11–12

- morph maps, 106

- mouths, 228–230, 246

- Move brush, ZBrush, 286

- movie industry, 344–349

- movie reference, 90

- MTM, 49

- Mudbox, 42, 122, 282, 300

- multi-core CPUs, 10

- multi-knots, 109

## N

- naming conventions, 99, 142–147

- National Geographic Channel, 133

- networking, 382–384

- news, industry, 384–385

- NewTek, 15, 71, 383

- NextEngine 3D Scanner, 131

- NextFab, 327

- next-generation models, 299, 300

- n-gons, 49, 109, 149, 157, 201

- Nickel, Jon-Troy, 129

- Nickelodeon, 350

- Nieves, Angel, 49–50

- noncontact scanners, 132–133

- Non-Uniform curves, 109

- normal mapping, 300, 318–319

- noses, 225–227, 245

- notebooks, 87–88

- Nuke, 64

- NURBS surfaces, 102, 109–112, 127

- nurnies, 60

- NVIDIA graphics cards, 11

## O

- objects, naming, 146–147

- Objects folder, 145

- OBJ files, 312, 315

- observational skills, 81–82

- offline rendering, 148–149

- online communities, 382–384

- online forums, 11, 382, 383

- online reference material, 89

- OpenGL, 11

- open source software, 14

- organic modeling, 113–117

- organic models, 117

- organization skills, 147

- origin, centering model at, 160

- O’Riley, Chris, 80, 94, 372

## P

- Paint.net, 15

- Paint Shop Pro, 15, 96

- Partly Cloudy*, 126, 240, 241, 348–349

- patching, spline, 272–277

- Patchkey Kidz*, 4

- patch modeling, 127–128
- persistence, 379–380
- personal Web sites, 370–374
- perspective, 31
- photo-real models, 118
- photos, reference, 97, 216–218, 268
- Photoshop
  - and 2D paint/image manipulation, 15
  - adjusting color/levels with, 96
  - alternatives to, 15
  - applying skin details with, 48
  - mirroring images with, 218
  - scaling/rotating images with, 217
  - template tools, 371
  - and texturing, 48
- physics-based simulations, 136
- PICNIC, 19
- piecewise polynomial curves, 110
- pilates, modeling, 83
- Pixar, 25, 36, 126, 240, 348
- Pixologic, 15, 282
- Pixomondo, 44
- PlayStation, 353
- PNG files, 373
- point by point modeling, 123
- points, 102–103
- Pokemon, 341
- Poker with Bob app, 355
- pole polygons, 157
- Polly Pocket, 341
- Polycount, 383
- poly-count, 148
- poly-flow, 153, 156
- polygonal mesh, 112
- polygonal modeling, 167–195
- polygonal models, 102, 108–109. *See also*
  - polygons
- polygon-count, 148–153
- polygon flow, 153, 156, 282
- polygons
  - and 3D printing, 332
  - controlling flow of, 156
  - counting, 149–151
  - deciding on number of, 151–153
  - defined, 102, 108
  - patching in, 201–202, 272–273
  - and rule of three, 158–159
  - sharing of edges by, 107
  - sharing of points by, 103
  - and texturing, 49
  - types of, 109
  - and visual effects, 55
- Polypaint feature, ZBrush, 316
- PolyTrans, 331
- Ponoko, 327
- portfolios, 361, 370, 373, 377. *See also* demo
  - reels
- poses, 45, 162–164
- Postcards from the Future*, 26, 81
- post-production stage, 61–68
  - audio, 64–67
  - compositing, 61–64
  - final edit/delivery, 67–68
- powder prints, 326
- Powerhouse Punter*, 355
- PowerPoint, 198
- Powers, Rob, 69, 70–72
- Praying Mantis*, 80
- pre-production stage, 25–39
  - animatics, 37–38
  - purpose of, 25
  - scratch voice recording, 35–36
  - storyboarding, 33–35
  - story development, 25–28
  - visual design, 28–32
  - voice recording, 39
- primitive modeling, 121, 124–125
- printed reference material, 89–90

- print graphics
    - product modeling for, 265–279
    - role of digital artists in, 360–361
  - printing, 3D. *See* 3D printing
  - printing service bureaus, 327, 331
  - problem solving, 82–84
  - production
    - illustrators, 29
    - pipelines (*See* production pipelines)
    - preparing model for, 159–165
    - stage (*See* production stage)
  - production-driven models, 113–114
  - production pipelines, 22–75
    - defined, 22
    - evolution of, 68–75
    - graphical representation of, 24
    - post-production stage, 61–68
    - pre-production stage, 25–39
    - production stage, 40–61
  - production stage, 40–61
    - animation, 50–53
    - effects, 53–56
    - lighting, 56–58
    - modeling, 40–42
    - purpose of, 40
    - rendering, 59–61
    - rigging, 43–45
    - scene setup, 45–47
    - texturing, 48–50
  - product modeling, 265–279
    - advantages over photography, 265
    - creating splines for, 270–271
    - details to avoid in, 266–267
    - final details for, 278–279
    - goals for, 267
    - reference types for, 268–270
    - spline patching in, 272–277
  - product visualization, 358–359
  - professional digital modelers, 5–7, 141. *See also* digital modelers
  - project folders, 143–145
  - protrusions, 332
  - proxy models, 37
  - pushingpoints.com, 392
  - pyramids, 184–185
- ## Q
- quads, 109, 156
  - queue managers, 59
  - Quick Forge, 327
- ## R
- RAM (random access memory), 10
  - raster images, 169
  - Ratatouille*, 36
  - real-time 3D gaming, 299–300
  - real-time rendering, 149
  - reels. *See* demo reels
  - Reference folder, 144
  - reference material, 84–99
    - copyright considerations, 91
    - as digital modeling tool, 78
    - gathering, 84–95
    - for head models, 97, 216–218
    - importance of, 78–81
    - naming/organizing, 99
    - preparing, 96–99
    - for product modeling, 268–270
  - reference photos, 97, 216–218, 268
  - reflections, 265
  - relaxed pose, 164
  - rendering
    - GPU-based, 11
    - offline, 148–149

- real-time, 149
- render nodes, 59
- render wranglers, 59–61
- resin, 326, 327
- resolution, 96
- resumes, 371, 385–386
- retopology, 122–123, 305–313
- RGBA color information, 106
- Rhythm + Hues Commercials, 46
- rigged characters, 43
- rigging, 43–45, 53, 105, 162–165
- rigging artists, 43
- Riley, Marv, 356
- Romano, Lou, 36
- rotating images, 97
- rule of three, 45, 158–159
- Runners*, 33–34, 36

**S**

- Saintpère, Sylvain, 357–358
- scale, 159–160
- scanners, 131–133
- scanning, 96, 131–133
- scenes, animating, 52–53
- scene setup, 45–47
- Scenes folder, 145
- Schneider, Joseph, 67–68
- scratch tracks, 35–36
- scratch voices, 35–36
- screenplays, 25, 26
- scripts, 25
- Sculpteo, 327
- sculpting. *See also* digital sculpting
  - brushes, 283–284
  - programs, 122, 132, 282, 359
- Sculptris, 300
- seams
  - avoiding, in product shots, 266–267

- in manufactured toys, 338
  - modeling 3D object with, 180–195
  - UV, 161
- selection maps, 107
- selection sets, 40, 107
- self-fulfilling prophecies, 16
- self-promotion, 370, 374
- Serious Sam*, 381
- service bureaus, 3D printing, 327
- set decorators, 45–47
- shaders, 48
- shadows, 94–95
- shapes, 171
- ShapeWays, 327
- Shoemaker, Dave, 39
- short films, 348–349. *See also* animated
  - shorts
  - Sifaka World*, 33
- Silo, 14, 282
- simplicity, 153, 159, 373
- simulations, physics-based, 136
- Singh, Baj, 353–354
- Sister Act* logo, 168
- sizing images, 97–98
- skeleton rigs, 135
- sketch artists, 29
- sketchbooks, 87–88
- skin details, 48
- sloppiness, 378
- sloth, 379–380
- smartphones, 87
- Smith, Kurt, 44–45
- smoke effect, 53, 55
- soccer ball, 180–195
- social networking sites, 382
- software
  - animation, 134–137
  - digital sculpting, 122, 132, 282–284, 300

- modeling, 13–15, 42, 78–84, 134–137, 381
- open source, 14
- staying up to date on, 381
- this book’s approach to, 13–14
- wars, 13
- Sohn, Peter, 36
- sound designers, 64
- sound effects, 64. *See also* audio
- Sound “O” Rama, 64
- source books, 370
- Southern, Glen, 41–42, 128, 282–283, 300, 372
- SouthernGFX Limited, 41, 372
- Spiderbait character, 104
- Splashlight, 360
- spline patching, 272–277
- splines
  - creating, 270–271
  - defined, 111
  - and NURBS surfaces, 110
  - as shape-creation technique, 172
  - ways of using, 111
- Spoonman*, 53–54
- spring model, 209–211
- sprite sheets, 355
- stages of production, 22–75
  - overview, 22–25
  - stage 1: pre-production, 25–39
  - stage 2: production, 40–61
  - stage 3: post-production, 61–68
- stars, 44
- Star Wars*, 63, 90
- static objects, 153–154
- Steinbichler Comet 5 White Light scanner, 132
- stereo artists, 72
- Stereo D, 74
- Stereo Lighography file format, 331
- stereoscopic 3D, 72–75
- sticky notes, 25
- STL files, 331
- stop-motion animators, 90
- story
  - artists, 33
  - constructing timeline for, 25
  - developing, 27–28
  - fleshing out, 33
  - importance of, 25
  - reels, 37
- Storyboard folder, 144
- storyboards, 33–35, 144
- strawberry model, 94
- Stringer, Lee, 63–64, 90, 142
- stunt doubles, 350
- styles, model, 117–119
- stylized characters, 239–263
  - and box modeling, 240–241
  - building body for, 253–256
  - creating hands for, 256–262
  - creating head for, 242–246
  - detailing face for, 247–253
  - reviewing final mesh for, 262–263
- stylized models, 118. *See also* stylized characters
- subdivision surfaces, 102, 112. *See also* SubDs
- SubDs, 197–211
  - edge weighting, 107–108
  - modeling 3D text with, 198–204
  - modeling clothespin with, 205–211
  - purpose of, 112, 197
  - vs. NURBS surfaces, 197
- subtractive manufacturing, 322
- support edges, 199–200
- surface names, 161–162
- symmetry, 218, 224, 242, 285



## T

tape measures, 86–87  
 teapot images, 95  
 technical directors (TDs), 40, 58  
*Teddy Scars*, 28, 39, 56  
 television market, 350–352  
 terminology, digital model, 102–112  
*Terra Nova*, 350  
 tests, studio, 379  
 tetrahedrons, 184–185  
 text
 

- modeling 3D, with SubDs, 198–204
- modeling 3D polygonal, 168–179

 texture artists, 48, 49, 160  
 texture displacement, 134–135  
 texture maps, 15, 48, 104, 315–316, 330  
 texturing, 48–50, 160–162  
*Thor*, 74  
 three, rule of, 45  
 three-dimensional models. *See* 3D models  
 three-point polygons, 109, 156–157, 270, 278  
*Titanic*, 74  
 title cards, demo reel, 365–366  
*Tofu the Vegan Zombie*, 15, 25, 335–341, 359. *See also* *Zombie Dearest*  
 Toms, Graham, 93  
 topology, 44–45, 49, 153–159, 244, 282. *See also* retopology  
 toys, 334–341  
 T-pose, 45, 163  
 trade magazines, 385  
 training videos, 15  
 Tralfazz, 4  
 Transpose feature, ZBrush, 290–291, 294  
 trends, industry, 384–385  
 triangles, 109, 149, 157  
 Tsirbas, Aristomenis, 38  
 TV commercials, 352

## U

United States Mint, 359  
 Unity 3 game development tool, 300, 319  
*Up*, 72  
 UV layout, 161  
 UV maps, 40, 48, 104  
 UV options, 162  
 UV seams, 161  
 UV unwrapping, 49–50, 312

## V

VAD (virtual art department/direction), 69–72  
 Varner, Steve, 132, 338  
 Varner Studios, 132, 338, 341  
 vector curves, 111  
 vector graphics, 169  
 vertex maps, 103–107  
 vertices, 102  
 video games, 353–356  
 video slot machines, 356  
 Viewsonic monitors, 11  
 virtual art department/direction (VAD), 69–72  
 visual design, 28–32  
 visual development artists, 29  
 visual effects artists, 53–56  
 visualization, 82–83, 356–359  
 viz-dev artists, 29  
 voice recording, 35–36, 39  
 Volumedic, 132–133

**W**

Wacom graphics tablets, 282  
 Walt Disney Studios, 33, 65  
 Warren, April, 215

water effect, 53, 55  
*Waybuloo*, 350, 351  
Web addresses, 373  
Web sites, personal, 370–374  
weight maps, 40, 105–106  
Welch, Farrah L., 59–61  
Whole Body Color 3D Scanner, 131  
wide-screen monitors, 12  
Wii, 353  
Will Vinton Studios, 376  
WordPress, 371, 372  
workstations, 11–12

## X

Xbox, 353  
XSI, 14

## Y

Young, Greg, 36  
YouTube, 90

## Z

ZBrush  
    alternatives to, 282, 300  
    built-in brushes, 284–285  
    Clay Buildup brush, 302  
    Clay Polish brush, 304  
    creating Hellhound creature with,  
        300–305  
    creators of, 282  
    Drag Rectangle option, 294  
    Draw mode, 290  
    Dynamesh feature, 284–285, 289, 304  
    Inflate brush, 292

    Move brush, 286  
    and noncontact scanners, 132  
    performing retopology with, 122  
    Polypaint feature, 316  
    posing figures in, 295  
    and product visualization, 359  
    training videos, 15  
    Transpose feature, 290–291, 294  
    Web site, 14  
    ZSphere tool, 306–308  
Z Corporation, 327  
Z-depth information, 72–73  
Zoic, 89, 133  
*Zombie Dearest*  
    animated sequence of Addie in, 50–51  
    audio engineer for, 65  
    character models for, 40–41, 335  
    compositing for, 61–62  
    model sheet/maquette for, 29  
    proxy models for, 37  
    script for, 25–26  
    set decoration for, 46  
    skin details for, 48  
    stereo 3D conversion for, 72–73  
    viewing, 15  
Zorro masks, 225  
ZPrinter, 327  
ZSphere tool, ZBrush, 306–308

*This page intentionally left blank*



# WATCH READ CREATE

Unlimited online access to all Peachpit, Adobe Press, Apple Training and New Riders videos and books, as well as content from other leading publishers including: O'Reilly Media, Focal Press, Sams, Que, Total Training, John Wiley & Sons, Course Technology PTR, Class on Demand, VTC and more.

No time commitment or contract required! Sign up for one month or a year. All for \$19.99 a month

**SIGN UP TODAY**  
[peachpit.com/creativeedge](http://peachpit.com/creativeedge)

creative  
edge