

---

# Contents

---

Preface, xi	
About the Author, xv	
Introduction, xvii	
WHAT IS 3D ART? HOW DOES IT WORK?	xvii
RENDERING, LIGHTING, AND MATERIALS	xviii
ANIMATION	xviii
<hr/> <b>CHAPTER 1 ■ Understanding 3D Space</b>	<hr/> <b>1</b>
HOW DO WE KNOW WHERE THINGS ARE IN 3D GRAPHICS?	1
Cartesian Mapping and 3D Coordinates	1
HOW DO WE DETERMINE THESE POSITIONS?	1
The Grid	1
WHAT ARE THE COORDINATE SYSTEMS? ARE THERE MORE THAN JUST ONE?	4
Global and Local Coordinate Systems	4
WHAT IS LOCAL SPACE?	7
Hierarchies and Local Transforms	7
HOW DO I CHANGE AN OBJECT'S POSITION IN SPACE?	8
Transforms	8
FROM WHERE DOES AN OBJECT MOVE WHEN YOU MOVE IT?	11
Pivots and Snaps	11
CAN I RESET THE TRANSFORMS AFTER MOVING MY OBJECT?	13
Freezing and Re-Setting Transforms	13

<b>EXERCISE: TRANSFORMING OBJECTS IN SPACE WITH MAYA</b>	14
Step 1	15
Step 2	15
Step 3: Type-in Transforms	18
Step 4: The Pivot, the Manipulator, and Transforming in 3D Space	18
Step 5: Adjusting the Pivot	20
Step 6: Building a Staircase	20
Conclusion	22
<hr/> <b>CHAPTER 2 ■ Polygonal Geometry</b>	23
<b>WHAT IS A MODEL?</b>	23
Basic Polygon Concepts	23
<b>BUT HOW CAN TRIANGLES BUILD SMOOTH SURFACES?</b>	25
Triangulation and Polygons	25
<b>HOW DO I CREATE POLYGON MODELS?</b>	30
Polygon Primitives	30
<b>HOW DO I EDIT POLYGON MODELS?</b>	35
Sub-Object Editing	35
Chamfer and Bevel	35
Extrude	40
Combining and Merging Multiple Polygon Objects	44
Advanced Polygon Modeling Tools	46
Smoothing	52
<b>EXERCISE: MODELING WITH POLYGON TOOLS</b>	58
Step 1: Create Polygon Tool	59
Step 2: Extruding the Object	59
Step 3: Beveling Edges	60
<hr/> <b>CHAPTER 3 ■ NURBS and Curve-Based Geometry</b>	63
<b>QUESTIONS TO BE ANSWERED</b>	63
<b>WHAT IS A CURVE?</b>	64

WHAT ARE NURBS CURVES AND HOW DO THEY WORK?	67
HOW DO YOU CREATE NURBS CURVES?	72
HOW DO I EDIT NURBS CURVES?	73
WHAT ARE NURBS CURVES USED FOR? WHAT DO I DO WITH THEM?	75
WHAT ARE NURBS SURFACES? HOW ARE THEY CREATED?	78
HOW DO I EDIT NURBS SURFACES?	86
HOW DO I CREATE NURBS SURFACES OUT OF MY CURVE OUTLINES?	88
IS THERE A WAY TO CUT A HOLE IN A NURBS SURFACE?	96
Projected Curves and Trim Surfaces	96
HOW DO I CONVERT NURBS INTO POLYGONS?	102
NURBS CONCEPTS CONCLUSION—WHEN DO I USE NURBS?	106
EXERCISE: THE WINE GLASS	107
Step 1: Creating the Profile Curve	107
Step 2: Re-Building the Curve	107
Step 3: Creating the Surface	110
<hr/> <b>CHAPTER 4 ■ Lighting, Materials, Textures, and UVs</b>	111
WHAT IS "RENDERING"?	111
GPU vs. CPU Rendering	113
WHAT ARE THE THINGS REQUIRED TO RENDER A SCENE?	115
Lights, Camera, Materials!	115
HOW DO CAMERAS WORK IN 3D?	117
Cameras and Camera Attributes	117
WHAT IS SHADING?	121
The Polygon Normal	121
WHAT ARE LIGHTS?	126
Lights and Lighting	126
Types of Lights	127
<i>Ambient Light</i>	127
<i>Directional Light</i>	127

<i>Point Light</i>	129
<i>Spotlight</i>	130
Common Light Attributes	130
Spotlight-Specific Parameters	133
Shadows	135
WHEN DO I USE DEPTH MAP SHADOWS? WHEN DO I USE RAY TRACING?	140
Choosing Shadow Types	140
Shaders and Materials	141
Non-Specular Shaders	142
Specular Shaders	142
Materials	147
Common Material Properties and Channels	148
Specular Material Channels	153
WHAT ARE TEXTURES?	156
Effective Texture Use	158
WHAT IS “UV MAPPING”?	162
UV Mapping	162
WHEN DO I NEED TO CREATE UV MAPPING?	163
HOW DO I CREATE UV MAPS?	166
HOW DO I CREATE MORE COMPLEX UV MAPPINGS?	171
HOW DO I RENDER AN IMAGE?	172
Software Rendering	172
EXERCISE: CREATING A COMPLEX MATERIAL	174
Step 1: Set up Scene and Lighting	174
Step 2: Creating a Material Network and Assigning It to Your Object	174
Step 3: Editing your Material	175
WHAT YOU LEARNED	180
CHAPTER 5 ■ Animation	181
WHAT IS ANIMATION?	181
Definition and Basic Concepts	181

HOW DO YOU ANIMATE?	184
Keyframes and Keyframing	184
WHAT CAN I ANIMATE?	185
WHAT ARE THE DIFFERENT METHODS OF ANIMATING?	185
Pose-Based Animation	186
WHAT ARE OTHER WAYS TO ANIMATE?	192
Rotoscoping and Motion Capture	192
HOW DO I CREATE GREAT HAND-KEYFRAMED ANIMATIONS?	195
Editing Your Motion Curves	195
HOW DO I CREATE ACCELERATION AND DECELERATION?	198
Graph Curves and Tangents	198
HOW DO I BECOME A GOOD ANIMATOR?	206
Final Words about Animation	206
EXERCISE: THE BALL THAT BOUNCES ITSELF	207
Step 1: Set up the Ball	207
Step 2: Setting the Key Poses	208
Step 3: Setting up Tangents for Editing	211
What You Learned	212
Step 4: Acceleration and Deceleration	212
What You Learned	214
Step 5: Generating Cycles	214
CHAPTER 6 ■ Conclusion	215
INDEX	217