

Kelly L. Murdock's Autodesk®

# 3ds Max® 2021

## COMPLETE REFERENCE GUIDE



Better Textbooks. Lower Prices.  
[www.SDCpublications.com](http://www.SDCpublications.com)



**ACCESS CODE**  
UNIQUE CODE INSIDE

Visit the following websites to learn more about this book:



[amazon.com](https://www.amazon.com)

[Google books](https://books.google.com)

[BARNES & NOBLE](https://www.barnesandnoble.com)



# Table of Contents

---

Table of Contents .....	xiii
<b>PART I .....</b>	<b>1</b>
<b>GETTING STARTED WITH AUTODESK 3DS MAX 2021 .....</b>	<b>1</b>
<b>CHAPTER 1 .....</b>	<b>3</b>
<b>EXPLORING THE INTERFACE.....</b>	<b>3</b>
Learning the Interface Elements .....	4
Using the Menus.....	6
Using the Toolbars.....	8
Using the Viewports .....	14
Using the Command Panel.....	14
Using the Lower Interface Bar Controls .....	18
Interacting with the Interface .....	19
Using Workspaces .....	22
Getting Help.....	24
Summary.....	27
<b>CHAPTER 2 .....</b>	<b>29</b>
<b>CONTROLLING AND CONFIGURING THE VIEWPORTS.....</b>	<b>29</b>
Understanding 3D Space .....	30
Using the Navigation Gizmos .....	32
Controlling Viewports with a Scroll Wheel Mouse.....	37
Using the Viewport Navigation Controls .....	37
Changing the Viewport Display .....	43
Enhancing the Viewport.....	47
Displaying Materials, Lighting, and Shadows in the Viewport .....	51
Working with Viewport Backgrounds .....	56
Setting Viewport Visual Style and Appearance .....	59
Altering the Viewport Layout.....	65
Using Safe Frames .....	66
Setting Display Performance.....	68
Defining Regions .....	69
Viewing Statistics.....	71
Configuring the ViewCube and SteeringWheels .....	72
Summary.....	72
<b>CHAPTER 3 .....</b>	<b>73</b>
<b>WORKING WITH FILES, IMPORTING AND EXPORTING.....</b>	<b>73</b>
Working with 3ds Max Scene Files.....	73
Importing and Exporting .....	81
Accessing the 3ds Max Asset Library .....	93
Using the File Utilities .....	94
Accessing File Information and Sharing Views .....	96
Working with Asset Tracking.....	99
Summary.....	103
<b>CHAPTER 4 .....</b>	<b>105</b>
<b>SETTING PREFERENCES .....</b>	<b>105</b>
Setting General Preferences .....	105
Setting File Preferences.....	109
Configuring Paths .....	112
Setting Interaction Mode .....	118

Setting Gamma and Look-Up Table (LUT) Preferences .....	119
Setting Rendering and Radiosity Preferences.....	121
Setting Animation Preferences.....	125
Setting Inverse Kinematics Preferences.....	127
Setting Gizmo Preferences .....	129
Setting Global Container Preferences .....	130
Setting Help Preferences .....	131
Summary .....	132
<b>PART II .....</b>	<b>135</b>
<b>MANIPULATING OBJECTS .....</b>	<b>135</b>
<b>CHAPTER 5 .....</b>	<b>137</b>
<b>CREATING AND EDITING PRIMITIVE OBJECTS.....</b>	<b>137</b>
Selecting System Units.....	137
Creating Primitive Objects .....	139
Using Modeling Helpers.....	149
Summary .....	152
<b>CHAPTER 6 .....</b>	<b>155</b>
<b>SELECTING OBJECTS AND SETTING OBJECT PROPERTIES .....</b>	<b>155</b>
Selecting Objects.....	155
Setting Object Properties .....	167
Hiding and Freezing Objects.....	171
Using the Scene Explorer .....	175
Summary .....	180
<b>CHAPTER 7 .....</b>	<b>183</b>
<b>TRANSFORMING OBJECTS, PIVOTING, ALIGNING, AND SNAPPING.....</b>	<b>183</b>
Translating, Rotating, and Scaling Objects .....	183
Working with the Transformation Tools .....	186
Using Pivot Points .....	195
Using the Align Commands.....	199
Using Grids .....	202
Using Snap Options.....	205
Summary .....	210
<b>CHAPTER 8 .....</b>	<b>213</b>
<b>CLONING OBJECTS AND CREATING OBJECT ARRAYS .....</b>	<b>213</b>
Cloning Objects .....	213
Understanding Cloning Options .....	216
Mirroring Objects.....	219
Cloning over Time .....	221
Spacing Cloned Objects .....	223
Using the Clone and Align Tool.....	226
Creating Arrays of Objects.....	228
Summary .....	234
<b>CHAPTER 9 .....</b>	<b>235</b>
<b>GROUPING, LINKING, AND PARENTING OBJECTS .....</b>	<b>235</b>
Working with Groups.....	235
Understanding Parent, Child, and Root Relationships.....	237
Building Links between Objects.....	238
Displaying Links and Hierarchies .....	240
Working with Linked Objects.....	241
Summary .....	243

<b>CHAPTER 10 .....</b>	<b>245</b>
<b>ORGANIZING SCENES WITH LAYERS, CONTAINERS, XREFS AND THE SCHEMATIC VIEW .....</b>	<b>245</b>
Using Layers .....	245
Working with Containers.....	249
Referencing External Objects .....	253
Using the File Link Manager .....	263
Using the Schematic View Window .....	266
Working with Hierarchies.....	274
Setting Schematic View Preferences .....	278
Using List Views .....	282
Summary.....	283
<b>PART III .....</b>	<b>285</b>
<b>MODELING 3D ASSETS .....</b>	<b>285</b>
<b>CHAPTER 11 .....</b>	<b>287</b>
<b>ACCESSING SUBOBJECTS AND MODIFIERS AND USING THE MODIFIER STACK.....</b>	<b>287</b>
Exploring the Model Types.....	288
Understanding Normals .....	290
Working with Subobjects .....	292
Introducing Modifiers.....	297
Exploring the Modifier Stack .....	299
Summary.....	309
<b>CHAPTER 12 .....</b>	<b>311</b>
<b>DRAWING AND EDITING 2D SPLINES AND SHAPES .....</b>	<b>311</b>
Drawing in 2D .....	311
Editing Splines.....	324
Summary.....	346
<b>CHAPTER 13 .....</b>	<b>347</b>
<b>MODELING WITH POLYGONS .....</b>	<b>347</b>
Understanding Poly Objects.....	347
Creating Editable Poly Objects .....	348
Editing Poly Objects.....	349
Summary.....	380
<b>CHAPTER 14 .....</b>	<b>381</b>
<b>USING THE GRAPHITE MODELING TOOLS AND PAINTING WITH OBJECTS .....</b>	<b>381</b>
Working with the Graphite Modeling Tools .....	381
Using the Freeform Tools.....	397
Using the Selection Tools .....	403
Using the Object Paint Tools .....	406
Summary.....	414
<b>CHAPTER 15 .....</b>	<b>415</b>
<b>WORKING WITH COMPOUND OBJECTS.....</b>	<b>415</b>
Understanding Compound Object Types.....	415
Morphing Objects.....	416
Creating a Terrain Object .....	419
Working with BlobMesh Objects .....	421
Working with ProBoolean and ProCutter Objects.....	423
Summary.....	430

<b>CHAPTER 16 .....</b>	<b>431</b>
<b>DEFORMING SURFACES AND USING THE MESH MODIFIERS .....</b>	<b>431</b>
Using Selection Modifiers.....	431
Using Primitive Maintenance Modifiers.....	433
Using Spline Modifiers .....	434
Using Edit Geometry Modifiers .....	443
Using Parametric Deformer Modifiers .....	453
Using Free Form Deformer Modifiers .....	468
Miscellaneous Modifiers.....	470
Subdivision Surface Modifiers .....	472
The Basics of Deformation Painting .....	474
Using the Deformation Brushes .....	476
Setting Painter Options.....	478
Summary .....	480
<b>PART IV .....</b>	<b>481</b>
<b>APPLYING MATERIALS AND TEXTURES.....</b>	<b>481</b>
<b>CHAPTER 17 .....</b>	<b>483</b>
<b>CREATING AND APPLYING STANDARD MATERIALS WITH THE SLATE MATERIAL EDITOR.....</b>	<b>483</b>
Understanding Material Properties .....	483
Working with the Slate Material Editor .....	486
Using the Standard Material.....	494
Using Shading Types .....	495
Accessing Other Parameters .....	501
Using the Material/Map Browser.....	505
Using the Material Explorer.....	508
Summary .....	511
<b>CHAPTER 18 .....</b>	<b>513</b>
<b>ADDING MATERIAL DETAILS WITH MAPS.....</b>	<b>513</b>
Understanding Maps .....	513
Selecting Maps.....	514
Editing Maps .....	523
Working with Environment Maps .....	527
Creating Textures with External Tools .....	529
Summary .....	533
<b>CHAPTER 19 .....</b>	<b>535</b>
<b>USING SPECIALIZED MATERIAL TYPES .....</b>	<b>535</b>
Using the Physical Material .....	536
Using the Ink 'n Paint Material .....	538
Using Architectural and Autodesk Materials .....	540
Using PBR Materials.....	543
Using the DirectX Material .....	543
Accessing the ShaderFX Editor .....	544
Selecting and Applying Substance Textures.....	548
Randomizing Substance Textures.....	552
Summary .....	554
<b>CHAPTER 20 .....</b>	<b>557</b>
<b>CREATING COMPOUND MATERIALS AND USING MATERIAL MODIFIERS.....</b>	<b>557</b>
Using Compound Materials.....	557
Applying Multiple Materials .....	564
Using the Matte/Shadow Material.....	566
Material Modifiers .....	568
Summary .....	572

---

<b>CHAPTER 21 .....</b>	<b>573</b>
<b>UNWRAPPING UVS AND MAPPING TEXTURES.....</b>	<b>573</b>
Mapping Modifiers .....	573
Using the Unwrap UVW Modifier .....	577
Using the Edit UVWs Interface.....	579
Summary.....	597
<b>CHAPTER 22 .....</b>	<b>599</b>
<b>PAINTING IN THE VIEWPORT CANVAS.....</b>	<b>599</b>
Using the Viewport Canvas .....	599
Using Vertex Colors .....	609
Summary.....	613
<b>CHAPTER 23 .....</b>	<b>615</b>
<b>CREATING BAKED TEXTURES, NORMAL AND SURFACE MAPS.....</b>	<b>615</b>
Using Channels .....	615
Bake to Texture .....	617
Rendering to a Texture.....	619
Creating Normal Maps .....	624
Rendering Surface Maps .....	629
Using Surface Maps .....	631
Summary.....	632
<b>PART V .....</b>	<b>633</b>
<b>WORKING WITH CAMERAS AND LIGHTS .....</b>	<b>633</b>
<b>CHAPTER 24 .....</b>	<b>635</b>
<b>CONFIGURING AND AIMING CAMERAS.....</b>	<b>635</b>
Learning to Work with Cameras .....	635
Setting Camera Parameters .....	643
Using the Camera Sequencer.....	650
Loading a Background Image and Camera .....	651
Perspective Matching the Background Image.....	652
Summary.....	656
<b>CHAPTER 25 .....</b>	<b>657</b>
<b>USING LIGHTS AND BASIC LIGHTING TECHNIQUES.....</b>	<b>657</b>
Understanding the Basics of Lighting.....	657
Getting to Know the Light Types.....	661
Creating and Positioning Light Objects .....	664
Viewing a Scene from a Light .....	667
Altering Light Parameters.....	669
Using HDRI Lights.....	676
Positioning the Sun and Setting the Lighting Environment.....	678
Summary.....	683
<b>CHAPTER 26 .....</b>	<b>685</b>
<b>WORKING WITH ADVANCED LIGHTING, LIGHT TRACING, AND RADIOSITY.....</b>	<b>685</b>
Selecting Advanced Lighting.....	685
Understanding Radiosity .....	691
Working with Advanced Lighting Materials.....	697
Summary.....	698

<b>PART VI .....</b>	<b>699</b>
<b>RENDERING A SCENE .....</b>	<b>699</b>
<b>CHAPTER 27 .....</b>	<b>701</b>
<b>RENDERING A SCENE WITH ARNOLD.....</b>	<b>701</b>
Working with Render Parameters.....	701
Using the Rendered Frame Window .....	708
Working with Arnold.....	712
Summary .....	727
<b>CHAPTER 28 .....</b>	<b>729</b>
<b>RENDERING WITH ART AND QUICKSILVER .....</b>	<b>729</b>
Enabling ART and Quicksilver .....	729
Working with Autodesk RayTracer (ART).....	730
Using the Quicksilver Hardware Renderer.....	733
Using the Scanline Renderer .....	735
Summary .....	738
<b>CHAPTER 29 .....</b>	<b>739</b>
<b>MANAGING SCENE STATES.....</b>	<b>739</b>
Using State Sets.....	739
Summary .....	744
<b>CHAPTER 30 .....</b>	<b>745</b>
<b>BATCH AND NETWORK RENDERING.....</b>	<b>745</b>
Batch Rendering Scenes .....	745
Using the A360 Cloud Rendering System.....	746
Understanding Network Rendering .....	747
Setting Up a Network Rendering System.....	748
Starting the Network Rendering System.....	755
Configuring the Network Manager and Servers .....	760
Logging Errors .....	762
Using the Monitor.....	763
Summary .....	766
<b>CHAPTER 31 .....</b>	<b>767</b>
<b>COMPOSITING WITH RENDER ELEMENTS AND THE VIDEO POST INTERFACE .....</b>	<b>767</b>
Using External Compositing Packages.....	768
Using Render Elements.....	772
Completing Post-Production with the Video Post Interface .....	774
Working with Sequences .....	776
Adding and Editing Events .....	777
Working with Ranges.....	785
Summary .....	788
<b>PART VII .....</b>	<b>789</b>
<b>ANIMATING OBJECTS AND SCENES .....</b>	<b>789</b>
<b>CHAPTER 32 .....</b>	<b>791</b>
<b>UNDERSTANDING ANIMATION AND KEYFRAMES.....</b>	<b>791</b>
Using the Time Controls .....	791
Working with Keys .....	794
Using the Track Bar .....	797
Viewing and Editing Key Values.....	799
Using the Motion Panel .....	800
Using Ghosting .....	803
Animating Objects.....	804



Working with Previews.....	808
Using the RAM Player.....	810
Summary.....	813
<b>CHAPTER 33 .....</b>	<b>815</b>
<b>USING ANIMATION LAYERS AND ANIMATION MODIFIERS .....</b>	<b>815</b>
Using the Animation Layers Toolbar.....	815
Working with Animation Layers.....	817
Saving and Loading Animation Files.....	819
Using the Animation Modifiers.....	823
Using More Animation Modifiers.....	828
Summary.....	835
<b>CHAPTER 34 .....</b>	<b>837</b>
<b>WIRING PARAMETERS .....</b>	<b>837</b>
Wiring Parameters.....	837
Collecting Parameters.....	841
Adding Custom Parameters.....	843
Summary.....	845
<b>CHAPTER 35 .....</b>	<b>847</b>
<b>ANIMATING WITH CONSTRAINTS AND SIMPLE CONTROLLERS .....</b>	<b>847</b>
Restricting Movement with Constraints.....	847
Understanding Controller Types.....	858
Assigning Controllers.....	858
Examining Some Simple Controllers.....	862
Summary.....	866
<b>CHAPTER 36 .....</b>	<b>867</b>
<b>EDITING ANIMATION CURVES IN THE TRACK VIEW .....</b>	<b>867</b>
Learning the Track View Interface.....	867
Working with Keys.....	876
Editing Time.....	882
Editing Curves.....	883
Filtering Tracks and Creating Track Sets.....	892
Working with Controllers.....	894
Using the ProSound Plug-in.....	895
Summary.....	898
<b>CHAPTER 37 .....</b>	<b>899</b>
<b>EXPLORING THE COMPLEX CONTROLLERS .....</b>	<b>899</b>
Examining Complex Controllers.....	899
Working with Expressions in Spinners.....	919
Understanding the Expression Controller Interface.....	920
Using Expression Controllers.....	926
Summary.....	929
<b>PART VIII .....</b>	<b>931</b>
<b>WORKING WITH CHARACTERS .....</b>	<b>931</b>
<b>CHAPTER 38 .....</b>	<b>933</b>
<b>UNDERSTANDING RIGGING, KINEMATICS, AND WORKING WITH BONES .....</b>	<b>933</b>
Understanding Rigging.....	933
Building a Bones System.....	935
Using the Bone Tools.....	939
Forward Kinematics versus Inverse Kinematics.....	942
Creating an Inverse Kinematics System.....	942

Summary .....	949
<b>CHAPTER 39 .....</b>	<b>951</b>
<b>SKINNING CHARACTERS .....</b>	<b>951</b>
Understanding Your Character .....	951
Animated Skin Modifiers .....	952
Using Character Animation Techniques.....	966
Summary .....	967
<b>CHAPTER 40 .....</b>	<b>969</b>
<b>ANIMATING CHARACTERS WITH CAT .....</b>	<b>969</b>
Character Creation Workflow.....	969
Creating a CAT Rig.....	970
Animating a CAT Rig.....	979
Summary .....	987
<b>CHAPTER 41 .....</b>	<b>989</b>
<b>CREATING CROWDS AND USING POPULATE .....</b>	<b>989</b>
Creating Crowds.....	989
Creating a Crowd of Bipeds .....	994
Using Populate .....	996
Summary .....	1000
<b>PART IX .....</b>	<b>1001</b>
<b>ADDING SPECIAL EFFECTS.....</b>	<b>1001</b>
<b>CHAPTER 42 .....</b>	<b>1003</b>
<b>CREATING PARTICLES AND PARTICLE FLOW .....</b>	<b>1003</b>
Understanding the Various Particle Systems .....	1003
Creating a Particle System .....	1004
Using the Spray and Snow Particle Systems .....	1005
Using the Super Spray Particle System.....	1007
Using the Blizzard Particle System.....	1019
Using the PArray Particle System .....	1019
Using the PCloud Particle System.....	1022
Using Particle System Maps .....	1022
Controlling Particles with Particle Flow.....	1024
Working with Actions .....	1026
Using Particle Flow Helpers .....	1028
Debugging Test Actions .....	1030
Summary .....	1034
<b>CHAPTER 43 .....</b>	<b>1035</b>
<b>USING SPACE WARPS .....</b>	<b>1035</b>
Creating and Binding Space Warps .....	1035
Understanding Space Warp Types .....	1036
Combining Particle Systems with Space Warps.....	1052
Summary .....	1055
<b>CHAPTER 44 .....</b>	<b>1057</b>
<b>USING ATMOSPHERIC AND RENDER EFFECTS .....</b>	<b>1057</b>
Adding an Environment Background .....	1057
Using Exposure Controls.....	1059
Creating Atmospheric Effects .....	1063
Using the Fire Effect.....	1064
Using the Fog Effect .....	1069
Adding Render Effects .....	1072

Using Render Effects .....	1074
Summary .....	1078
<b>CHAPTER 45 .....</b>	<b>1079</b>
<b>ADDING VOLUME LIGHT AND LENS EFFECTS .....</b>	<b>1079</b>
Using Volume Lights .....	1079
Creating Lens Effects .....	1083
Working with Lens Effects Filters .....	1095
Summary .....	1101
<b>PART X .....</b>	<b>1103</b>
<b>USING DYNAMIC ANIMATION SYSTEMS .....</b>	<b>1103</b>
<b>CHAPTER 46 .....</b>	<b>1105</b>
<b>SIMULATING PHYSICS-BASED MOTION WITH MASSFX .....</b>	<b>1105</b>
Understanding Dynamics .....	1105
Using MassFX .....	1106
Setting Object Properties .....	1110
Using Constraints and Baking Keys .....	1115
Working with mCloth and Ragdolls .....	1119
Summary .....	1121
<b>CHAPTER 47 .....</b>	<b>1123</b>
<b>WORKING WITH HAIR AND CLOTH .....</b>	<b>1123</b>
Understanding Hair .....	1123
Working with Hair .....	1124
Styling Hair .....	1129
Rendering Hair .....	1134
Using Hair Dynamics .....	1135
Understanding Cloth .....	1137
Creating Cloth .....	1137
Simulating Cloth Dynamics .....	1143
Summary .....	1146
<b>CHAPTER 48 .....</b>	<b>1147</b>
<b>CREATING FLUID SIMULATIONS .....</b>	<b>1147</b>
Understanding Fluids .....	1147
Getting Started with Fluids .....	1148
Setting Fluid Simulation Parameters .....	1151
Adding Foam .....	1153
Controlling Fluids with Motion Fields .....	1154
Using a Guide System .....	1156
Rendering Fluids .....	1158
Summary .....	1159
<b>PART XI .....</b>	<b>1161</b>
<b>EXTENDING 3DS MAX .....</b>	<b>1161</b>
<b>CHAPTER 49 .....</b>	<b>1163</b>
<b>CUSTOMIZING THE INTERFACE .....</b>	<b>1163</b>
Using the Customize User Interface Window .....	1163
Customizing the Ribbon .....	1175
Customizing Modify and Utilities Panel Buttons .....	1177
Working with Custom Interfaces .....	1178
Summary .....	1182

<b>CHAPTER 50 .....</b>	<b>1183</b>
<b>CREATING PROCEDURAL CONTENT WITH MAX CREATION GRAPHS .....</b>	<b>1183</b>
Installing a Max Creation Graph .....	1183
Creating a Max Creation Graph .....	1184
Summary .....	1190
<b>CHAPTER 51 .....</b>	<b>1191</b>
<b>EXPLORING 3DS MAX INTERACTIVE .....</b>	<b>1191</b>
Installing 3ds Max Interactive.....	1191
Learning the 3ds Max Interactive Interface .....	1191
Creating a Live Link .....	1192
Building a Level .....	1193
Working with Assets .....	1196
Adding Interactions.....	1199
Deploying the Level .....	1202
Summary .....	1203
<b>CHAPTER 52 .....</b>	<b>1205</b>
<b>AUTOMATING WITH MAXSCRIPT .....</b>	<b>1205</b>
What Is MAXScript? .....	1205
MAXScript Tools .....	1206
Setting MAXScript Preferences .....	1218
Types of Scripts .....	1219
Writing Your Own MAXScripts .....	1220
Learning the Visual MAXScript Editor Interface.....	1234
Laying Out a Rollout.....	1237
Summary .....	1242
<b>CHAPTER 53 .....</b>	<b>1243</b>
<b>EXPANDING 3DS MAX WITH THIRD-PARTY PLUG-INS.....</b>	<b>1243</b>
Working with Plug-Ins.....	1243
Locating Plug-Ins .....	1248
Summary .....	1249
<b>APPENDIX A .....</b>	<b>1251</b>
<b>WHAT'S NEW WITH AUTODESK 3DS MAX 2021 .....</b>	<b>1251</b>
Major Improvements.....	1251
Minor Improvements.....	1252
<b>APPENDIX B.....</b>	<b>1255</b>
<b>INSTALLING AND CONFIGURING AUTODESK 3DS MAX 2021 .....</b>	<b>1255</b>
Choosing an Operating System .....	1255
Hardware Requirements .....	1255
Installing 3ds Max 2021 .....	1256
Registering and Activating the Software.....	1257
Setting the Display Driver .....	1258
Updating 3ds Max.....	1259
Moving 3ds Max to Another Computer .....	1259
<b>APPENDIX C.....</b>	<b>1261</b>
<b>KEYBOARD SHORTCUTS.....</b>	<b>1261</b>
Using Keyboard Shortcuts .....	1261
Using the Hotkey Maps.....	1262
Using the Search Command Field .....	1263
Main Interface Shortcuts .....	1263
Dialog Box Shortcuts.....	1269

Miscellaneous Shortcuts .....	1274
<b>INDEX.....</b>	<b>1275</b>