Table of Contents

Chapter 1 The Rise of 3D Printing 1

3D Printing Will Change the World 2

Chapter 2 Basic Principles of 3D Printing 5

How 3D Printing Works 5

Layered Approach to 3D Printing 5

Printing Time for Layers 17

A More Realistic 3D Printing Example 18

Two Basic Types of Printers 20

Deposition—Deposit This... 20

Fusion—Take This Material And Stick It... 20

Stacking Up: The Third Type of 3D Printing Process 21

Pros and Cons of 3D Printing Processes 21

Pros and Cons of Deposition Printers 21

Pros and Cons of Fusion Printers 24

Summary 24

Chapter 3 123D Creature for iPad 25

Creating a Creature 26

Adding Bones and Joints 30

Moving the Model 31

Sculpting Your Creature 32

Working with Control Options 34

Sharing Your Creature 45

Summary 50

Chapter 4 Creating 3D Objects with Cameras and 123D Catch 51

Photographing Objects 52

Correcting the Model 56

Orienting the Model 59

Repairing the Model 60

Summary 62

Chapter 5 Introducing 123D Design for iPad 63

123D Design Interface 65

Primitives Parts 66

Parts Kit Library 68
Rotate Tool 70
Scale Tool 70
Adjust 71
Combine Tools 74
Reshape Tools 76
Take a Picture Option 80
Object Editing Tools 80
Project/File Menu Options 82
Projects and Galleries 83
Additional Support 83
Saving to the Cloud 84
Camera View 85
Summary 85
Chapter 6 123D Design Exercises for iPad 87
Creating New Projects 87
Scaling and Smoothing Edges 91
Using the Chamfer Tool 94
Manipulating Existing Projects 96
Aligning the Model 100
Finishing the Model 103
Sending a File to a 3D Printer 105
Summary 106
Chapter 7 Workspace Basics of 123D Design for Mac and PC 107
123D Design Templates 108
Starting a New Project 109
Toolbar Controls 111
Menu Options 113
Summary 120
Chapter 8 123D Design Exercises for Mac and PC 121
Exercise: Create a Coffee Mug 122
Making the Mug Handle 129
Exercise: Create a Business Card Holder 140
Summary 149

Chapter 9 Preparing 3D Models for Printing 151

Code Used for Printing a 3D Model 152

Scale and Dimension 155

Manifold Geometry 156

Orientation 158

Adding Support Material 159

Place Good Side of Model Against Print Bed 160

Consider Print Orientation 160

Summary 161

Chapter 10 The Difference Between Surface and Solid Models 163

The Solid Facts About CAD 163

Animated 3D CAD Models 166

Show Me Some Skin Models 168

AutoCAD Versus Inventor 171

Summary 172

Chapter 11 Why and How to Use 3D Printing 173

What Can Possibly Go Wrong, Go Wrong, Go Wrong... 173

Using 3D Prototypes to Verify Designs 176

Manufacturing Small Quantities with 3D Printing 181

Creating Metal Parts with 3D Printing 182

Allowing for Shrinkage 183

Using 3D Printing for Large Parts 184

Summary 184

Chapter 12 Designing Easy-to-Print Parts 185

Design Versus Make—Know the Process 185

We Can Do This the Hard Way... 187

...Or We Can Do This the Easy Way 189

Helpful Hints to Minimize Problems 191

Size of the Little Details Matters 192

No Visible Means of Support 192

Fusion-Type Printers 194

Deposition-Type Printers 194

Creating Usable 3D-Printable Threads 196

Solutions to 3D Printing Large Objects 197

Summary 198

Chapter 13 Designing Multipart Models to Print Preassembled 199

Effects of Printer Resolution on Parts 199

Using Derived Part Functionality 200

Resolving Interference Problems 203

Problems Unique to AutoCAD 203

Issues with Ball and Roller Bearings 203

Ball and Bearing Solutions 205

Considerations Before Using 3D Printing for Parts 208

When Not to Use 3D Printing 209

Summary 211

Chapter 14 Exporting Models to a 3D Printer 213

Exporting STL Files 213

Using Inventor to Export Files 213

Using AutoCAD to Export Files 215

Scale 216

Optional Extras 217

Resolution Setting Options 219

Assemblies as Separate Files Option 219

Viewing STL Parts 220

Inventor 2013 Users, Do NOT Try This at Home 220

Inventor 2014's Own File Naming Quirk 221

Using STL Files to Translate CAD Models 222

Something Completely Nerdy 222

The STL File Format Explained 222

The Three Sides of STL Files 224

G-Code Used to Send STL Files 225

Summary 227

Chapter 15 Using Inventor to Print Directly to Third-Party 3D Printing Services 229

Connecting to a Third-Party Print Service 229

Options for 3D Printing 232

More Inventor STL Export Options 232

3D Print Preview Button Bar Options 234

Using the Assembly One File Option 237

Summary 239

Chapter 16 Using a Third-Party 3D Printing Service Bureau 241

Reasons to Use a Third-Party Service Bureau 241

Capability of Service Bureau Machines 242

Players in the Third-Party Service Arena 242

Uploading 3D Projects to Third-Party Services 242

Ordering a 3D Print 242

Using the Edit Details Tab 247

Pricing and Materials Options 249

Checkout Options 252

Summary 252

Chapter 17 The Future of 3D Printing 253

The Future According to Bill 253

The Future According to John 255

Index 257