



VFX Fundamentals

Visual Special Effects Using Fusion 8.0

—

Wallace Jackson

Apress®

VFX Fundamentals

Visual Special Effects Using Fusion 8.0



Wallace Jackson

Apress®

VFX Fundamentals: Visual Special Effects Using Fusion 8.0

Wallace Jackson
Lompoc, California
USA

ISBN-13 (pbk): 978-1-4842-2130-3
DOI 10.1007/978-1-4842-2131-0

ISBN-13 (electronic): 978-1-4842-2131-0

Library of Congress Control Number: 2016948843

Copyright © 2016 by Wallace Jackson

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

Trademarked names, logos, and images may appear in this book. Rather than use a trademark symbol with every occurrence of a trademarked name, logo, or image we use the names, logos, and images only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

The use in this publication of trade names, trademarks, service marks, and similar terms, even if they are not identified as such, is not to be taken as an expression of opinion as to whether or not they are subject to proprietary rights.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Managing Director: Welmoed Spahr
Lead Editor: Steve Anglin
Technical Reviewer: Chád Darby
Editorial Board: Steve Anglin, Pramila Balan, Laura Berendson, Aaron Black, Louise Corrigan,
Jonathan Gennick, Robert Hutchinson, Celestin Suresh John, Nikhil Karkal,
James Markham, Susan McDermott, Matthew Moodie, Natalie Pao, Gwenan Spearing
Coordinating Editor: Mark Powers
Copy Editor: April Rondeau
Compositor: SPi Global
Indexer: SPi Global
Artist: SPi Global


Distributed to the book trade worldwide by Springer Science+Business Media New York, 233 Spring Street, 6th Floor, New York, NY 10013. Phone 1-800-SPRINGER, fax (201) 348-4505, e-mail orders-ny@springer-sbm.com, or visit www.springeronline.com. Apress Media, LLC is a California LLC and the sole member (owner) is Springer Science + Business Media Finance Inc (SSBM Finance Inc). SSBM Finance Inc is a **Delaware** corporation.

For information on translations, please e-mail rights@apress.com or visit www.apress.com.

Apress and friends of ED books may be purchased in bulk for academic, corporate, or promotional use. eBook versions and licenses are also available for most titles. For more information, reference our Special Bulk Sales—eBook Licensing web page at www.apress.com/bulk-sales.

Any source code or other supplementary materials referenced by the author in this text are available to readers at www.apress.com/9781484221303. For detailed information about how to locate your book's source code, go to www.apress.com/source-code/. Readers can also access source code at SpringerLink in the Supplementary Material section for each chapter.

Printed on acid-free paper



This book is dedicated to affordable software developers like Blackmagic Design as well as to all members of the open source new media software community who are working so diligently to make professional new media application development software, audio video, 2D image compositing, digital painting, and 3D content development tools freely available for new media application developers so that they can utilize these tools to achieve their creative dreams and their financial goals. Last, but not least, I dedicate this book to my loving father, Parker Jackson; my family; my life-long friends; my content production ranch neighbors; and my business partners for their continual help, assistance, and those relaxing, beautiful sunset BBQs underneath pink clouds on Point Conception.

Contents at a Glance

About the Author	xv
About the Technical Reviewer	xvii
Acknowledgments	xix
Introduction	xxi
■ Chapter 1: Visual Effects: Set Up Your VFX Content Development Workstation	1
■ Chapter 2: The Foundation of Raster for VFX: Pixels, Color, and Alpha	13
■ Chapter 3: The Foundation of Motion for VFX: Frames and Codecs	27
■ Chapter 4: The Foundation of Audio for VFX: MIDI, Wave, and Sample.....	37
■ Chapter 5: The Foundation of 2D Vector for VFX: Point, Path, and SVG	47
■ Chapter 6: The Foundation of 3D Vector for VFX: Models and OpenGL	59

■ Chapter 7: Professional VFX Software: Blackmagic Design Fusion ...	77
■ Chapter 8: VFX Pipeline Composition: Using the Flow Node Editor....	89
■ Chapter 9: VFX Pipeline Animation: Using the Timeline Editor	101
■ Chapter 10: VFX Pipeline Motion Control: Using the Spline Editor ...	113
■ Chapter 11: VFX Pipeline Pixel Isolation: Animated Polyline Masking.....	127
■ Chapter 12: VFX Pipeline Automated Masking: Matte Generators...	147
■ Chapter 13: VFX Pipeline Pixel Tracking: Using Motion Tracking ...	165
■ Chapter 14: VFX Pipeline 3D Production: Compositing 3D Assets ...	183
■ Chapter 15: VFX Pipeline 3D Rendering: Shader, Material, and Texture.....	205
■ Chapter 16: VFX Pipeline 3D Modeling: 3D Text-Title Creation ...	221
■ Chapter 17: VFX Pipeline 3D Animation: 3D Text-Titling Modifiers ...	233
■ Chapter 18: Advanced VFX Pipeline Effects: 3D Particle Systems ...	247
■ Chapter 19: Advanced VFX Pipeline Physics: 3D Particle Physics...	269
■ Chapter 20: Advanced Interactive VFX: i3D Content Publishing	295
Index.....	309

Contents

About the Author	xv
About the Technical Reviewer	xvii
Acknowledgments	xix
Introduction	xxi
■ Chapter 1: Visual Effects: Set Up Your VFX Content Development Workstation	1
The VFX Content Production Workstation	2
New Media Content Production: Hardware Is Key!	2
VXF Multimedia Asset Development: Open Source	4
Visual Effects Production: Fusion 8	4
VFX Content Production: New Media Apps	7
GIMP 2.8: Digital Image Editing and Compositing	7
Blender: 3D Modeling, Rendering, and Animation	8
Inkscape: Digital Illustration and Digital Painting	8
Audacity: Digital Audio Editing and Special Effects	9
Digital Video Editing: Editshare Lightworks 12.6	10
Office Productivity Suite: Apache OpenOffice 4.1.2	10
Summary	11

- **Chapter 2: The Foundation of Raster for VFX: Pixels, Color, and Alpha** 13
 - Raster Image Concepts: Arrays of Pixels..... 14
 - Picture Elements: Pixels Are the Raster Image Building Blocks 14
 - Image Resolution: The Number of Pixels in Your Raster Image 15
 - Image Aspect Ratio: A Ratio of W:H Pixels in an Image or Video 16
 - Digital Color Theory: Each Pixel Contains 3 RGB Color Channels 17
 - Image Color Depth: Bit Levels Will Define Your Number of Colors 18
 - Alpha Channels: Defining a Transparency Level for Each Pixel 22
 - Porter-Duff: Algorithmic Pixel-Blending Modes for Each Layer 23
 - Smoothing the Edges in Digital Image Composites: Anti-Aliasing..... 24
 - Summary 25

- **Chapter 3: The Foundation of Motion for VFX: Frames and Codecs ...** 27
 - Digital Video: Concepts and Terminology 28
 - Digital Video Is Animated: Frames and Frame Rate..... 28
 - Digital Video Mathematics: Doing the Multiplication 29
 - Digital Video Algorithms: Digital Video Codecs 29
 - Video Content Delivery: MPEG4 H.264 and WebM 30
 - Digital Video Resolutions: Industry Standards 31
 - Digital Video Compression: Bit Rates and Playback 32
 - Digital Video Optimization: Encoder-Decoder Use 32
 - Digital Video Optimization: Encoder Settings..... 33
 - Summary 35

- **Chapter 4: The Foundation of Audio for VFX: MIDI, Wave, and Sample**..... 37
 - Digital Audio Concepts and Terminology 38
 - Foundation of Analog Audio: Sound Waves of Air 38
 - Digital Audio: Samples, Resolution, and Frequency..... 40

Digital Audio Publishing: Popular Audio Formats.....	43
MIDI: Musical Instrument Data Interface	43
MPEG3 Audio: The Popular MP3 Data Format.....	44
FLAC: The 24-bit Free Lossless Audio Codec.....	45
OGG Vorbis: A Lossy Open Source Audio Codec.....	45
MPEG4 Audio: Advanced Audio Coding (AAC)	45
PCM Audio: Pulse Code Modulated Codec	46
Summary.....	46
■ Chapter 5: The Foundation of 2D Vector for VFX: Point, Path, and SVG	47
Digital Illustration Is Rendered, Not Stored	48
Vector Components: Vertices and Curves.....	48
The Vertex: The Foundation for 2D Shapes.....	48
The Path: Connecting Vertices to Create a Shape.....	49
The Fill: Filling Your Closed Shapes with Colors	52
The Stroke: Controlling How Lines and Curves Look.....	55
SVG Format: Coding Vector Shape Data	55
Summary.....	58
■ Chapter 6: The Foundation of 3D Vector for VFX: Models and OpenGL.....	59
3D New Media Assets: 3D Vector Content.....	60
The Foundation of 3D: The Geometry for the Model	60
Skinning the 3D Model: Texture-Mapping Concepts.....	66
3D Animation: Keyframes, Motion Curves, and IK.....	72
Summary.....	75

- Chapter 7: Professional VFX Software: Blackmagic Design Fusion ... 77**
 - Fusion vs. Fusion Studio: Two Versions 77
 - Fusion Studio: Flow, Stereo 3D, Nodes, and Plug-ins 78
 - Fusion 8: Visual Effects Software User Interface 81
 - Fusion 8: Free Visual Effects Software Features 82
 - Summary 87
- Chapter 8: VFX Pipeline Composition: Using the Flow Node Editor 89**
 - Flow Node Editor: VFX Compositing Tool 89
 - The Fusion Bin: Using Predefined VFX and Tools 91
 - Adding Imagery: Drag and Drop with File Manager 92
 - The Color Correction Tool: Lighten Shadow Levels 92
 - Saving a VFX Project Pipeline: Using “File ► Save As” 93
 - Flow Branches: Multiple Flows from a Single Node 94
 - Grouping Flow Nodes: Organizing a VFX Pipeline 97
 - Summary 99
- Chapter 9: VFX Pipeline Animation: Using the Timeline Editor 101**
 - Timeline Editor: Creating Animated VFX 101
 - Animating Multiple Nodes: Asynchronous Motion 104
 - Motion Paths: Keyframing 2D Spatial Animation 107
 - Summary 112
- Chapter 10: VFX Pipeline Motion Control: Using the Spline Editor ... 113**
 - Spline Editor: Control Time Using Curves 113
 - Navigate the Spline Editor: Independent Zooming 114
 - Coloring the Spline Editor: Customize Spline Color 115
 - Viewing Splines: Pan, Show, and Hide Splines 116
 - Controlling Spline Curvature: Tensioning Handles 118

Spline Scaling Tools: Time Stretch and Shape Box.....	121
Control Point Macros: Spline Curve Algorithms.....	122
Summary.....	125
■ Chapter 11: VFX Pipeline Pixel Isolation: Animated Polyline Masking.....	127
Polylines: Masks, Rotoscope, and Motion.....	128
Polyline Types: Cubic Bézier and Natural B-Spline.....	128
Fusion's Polyline Toolbar: Working with Polylines.....	131
Visual Effects Masking: Selective Pixel Processing.....	132
Animated Polyline Masking: Keyframing the Mask.....	141
Double Polylines: Blurring the Edges of Your Mask.....	143
Summary.....	145
■ Chapter 12: VFX Pipeline Automated Masking: Matte Generators... 147	147
Fusion 8 Keying: Concepts and Tools.....	147
Professional Keyer: Using Basic Primatte V Keyer.....	148
Chroma Keying: Using the Fusion 8 Chroma Keyer.....	151
Bluescreen and Greenscreen Keying: Ultra Keyer.....	155
Summary.....	163
■ Chapter 13: VFX Pipeline Pixel Tracking: Using Motion Tracking.... 165	165
Motion Tracking: Concepts and Tools.....	165
Track a Pattern: Algorithmic Pixel Region Analysis.....	166
Create a Motion Path: Generate Tracker Keyframes.....	169
Track Multiple Points: Use More Than One Tracker.....	172
Corner Positioning: Add Content to a Motion Track.....	174
Summary.....	182

- **Chapter 14: VFX Pipeline 3D Production: Compositing 3D Assets ... 183**
 - Advanced Compositing: Fuse 2D with 3D..... 183
 - Fusion 3D Scenes: 3D Tools for 3D Environments 184
 - Bridge 3D and 2D VFX Projects: Merge and Render 185
 - Basic 3D Scene: Shapes, Camera, Light, and Merge 186
 - Advanced Lighting: Shadows and Shadow Maps 194
 - Summary 203
- **Chapter 15: VFX Pipeline 3D Rendering: Shader, Material, and Texture 205**
 - 3D Shaders: Concepts and Terminology 206
 - Material: Illumination Models to Define Appearance 206
 - Textures: 2D Images Create Surface Characteristics..... 207
 - Composite Materials: Complex 3D Surface Shaders 208
 - Exploring Fusion 8 Shaders: Bin Presets..... 209
 - Gargoyle Project Setup: Lighting an FBX Mesh 3D 209
 - Sand Shader: Using FastNoise and BumpMap Tools 212
 - Brushed Metal: Add Reflect and SphereMap Tool..... 215
 - Lizard Skin: Add Crop, Blur, Ellipse, and ColorGain 216
 - Summary 219
- **Chapter 16: VFX Pipeline 3D Modeling: 3D Text-Title Creation 221**
 - 3D Text Tool: Create Professional 3D Text..... 221
 - Classic 3D Text Extrusion: Basic 3D Text Modeling..... 222
 - Custom 3D Text Extrusion: Complex 3D Text Model..... 226
 - Summary 232
- **Chapter 17: VFX Pipeline 3D Animation: 3D Text-Titling Modifiers 233**
 - 3D Titles: Spacing, Texture, and Animation 234
 - Character Spacing: Give Your Logo Some Space..... 234
 - Texture Mapping: Skin Your Logo Using 2D Images..... 235

3D Title Animation: Using Keyframes and Modifiers	237
Complex Animation: Animating Multiple Attributes.....	243
Summary	246
Chapter 18: Advanced VFX Pipeline Effects: 3D Particle Systems	247
Common Controls: 3D Particle Attributes	247
Particle Regions: Where Your Particles Will Exist.....	248
Particle Style: Particle Color, Fade, and Lifespan	249
Particle Sets: Grouping Particles Together.....	253
Particle Conditions: How Particles Will Be Affected.....	254
Particle Renderer: Making Particle Systems Visible	255
Particle System Project: Adding Core Nodes	257
Particle Spawn: Particles Birthing Other Particles.....	261
Background Plate Optimization: ColorCorrector Node	266
Summary	267
Chapter 19: Advanced VFX Pipeline Physics: 3D Particle Physics....	269
Particle Physics: Natural Force Algorithm	269
Friction: Applying Resistance to Velocity and Spin	270
Turbulence: Adding Chaos to the Particle System	272
Vortex: Adding Radial Motion to a Particle System.....	275
Shake: Using Modifiers with Particle Systems	277
Refining a Particle System: Debugging Algorithms	279
Perturb: Use Modifiers with Particle Color Gradient	280
Imaging Effects: Post-Processing Particle Systems	283
Reflections: Transforming Your Particle System	284
Particle Mattes: Masking Your Particle System	286
Tweaking the Particle System: Reality Refinement	290
Summary	293

- Chapter 20: Advanced Interactive VFX: i3D Content Publishing295**
- Open Source Formats: PDF, HTML5, EPUB..... 296
 - Portable Document Format: Visual Effects in a PDF 296
 - HyperText Markup Language: HTML5 Digital Video 297
 - Electronic Publishing: EPUB Digital Video Support 298
 - Amazon Lumberyard: Royalty-Free AAA 3D Engine..... 299
- Open Device: iTV, e-Reader, Tablet, Phone..... 300
 - e-Book e-Readers: Kindle Fire, Android, Java, or PDF 301
 - iTV Sets: Android TV, Java, JavaScript, and HTML5 302
 - Smartwatches: Android WEAR 2, Java, and HTML5 302
 - Smartphone and Tablet: Android, Java, and HTML5 303
 - Game Console: Lumberyard, Android, Java, HTML 304
 - Future Devices: Robots, VR, and Home Appliances..... 305
- Paid Software Platforms: iOS or Windows..... 305
 - Apple iPhone and iPad: Supported Media Formats 306
 - Windows Phone: Supported Digital Media Formats..... 306
- Summary..... 307
- Index..... 309**

About the Author

Wallace Jackson has written for several leading multimedia publications about production for the media content development industry since contributing an article about advanced computer processing architectures for the centerfold (a removable “mini issue” insert) of the original issue of *AV Video Multimedia Producer* magazine, which was distributed at the SIGGRAPH trade show.

Jackson has written for a number of popular publications regarding his work in interactive 3D and new media advertising campaign design, including *3D Artist*, *Desktop Publisher Journal*, *CrossMedia*, *Kiosk*, *AV Video Multimedia Producer*, and *Digital Signage*, as well as for many other publications.

Wallace Jackson has authored more than twenty Apress book titles, including several titles in the ever popular Apress *Pro Android* series, Java and JavaFX game engine development titles, digital image compositing titles, digital audio editing titles, digital video editing titles, digital illustration titles, VFX special effects titles, digital painting titles, Android 7 new media content production titles, and JSON and HTML5 titles.

In this current book on digital video editing and effects, Wallace focuses on Blackmagic Design Fusion 8 digital visual effects software, using it to demonstrate digital video special effects as well as digital video editing and compositing fundamentals to beginners who want to become more digital effects editing-savvy.

Wallace is currently the CEO of MindTaffy Design, the new media advertising agency that specializes in new media content production and digital campaign design and development. It is located by La Purisima State Park in Northern Santa Barbara County on the Point Conception Peninsula, halfway between their clientele in Silicon Valley to the north and Hollywood, the OC, West Los Angeles, and San Diego to the south.

Mind Taffy Design has created open source, technology-based (HTML5, JavaScript, Java 9, JavaFX 9, and Android 7.0) digital new media i3D content deliverables for more than a quarter century, since January 1991.

The company's clients consist of a significant number of international brand manufacturers, including IBM, Sony, Tyco, Samsung, Dell, Epson, Nokia, TEAC, Sun Microsystems (Oracle), Micron, SGI, KDS USA, EIZO, CTX International, KFC, Nanao USA, Techmedia, EZC, and Mitsubishi Electronics.

Jackson received his undergraduate bachelor's degree in Business Economics from the University of California at Los Angeles, or UCLA, and his graduate degrees in MIS/IT, Business Information Systems Design, and Implementation, from University of Southern California, located in South Central Los Angeles (USC).

He also received post-graduate degrees from USC in Entrepreneurship and Marketing Strategy and completed the USC Graduate Entrepreneurship Program. Jackson earned his two USC degrees while at USC's evening Marshall School of Business MBA Program, which allowed him to work full time as a COBOL and RPG-II programmer while completing his business and IT degrees.

You can visit Wallace's blog at www.wallacejackson.com to view his multimedia production content. You can also follow him on Twitter at [@wallacejackson](https://twitter.com/wallacejackson) or connect with him on LinkedIn at [LinkedIn.com/in/wallacejackson](https://www.linkedin.com/in/wallacejackson).

About the Technical Reviewer



Chád (“Shod”) Darby is an author, instructor, and speaker in the Java development world. As a recognized authority on Java applications and architectures, he has presented technical sessions at software development conferences worldwide (in the United States, United Kingdom, India, Russia, and Australia). In his fifteen years as a professional software architect, he’s had the opportunity to work for Blue Cross/Blue Shield, Merck, Boeing, Red Hat, and a handful of startup companies.

Chád is a contributing author to several Java books, including *Professional Java E-Commerce* (Wrox Press), *Beginning Java Networking* (Wrox Press), and *XML and Web*

Services Unleashed (Sams Publishing). Chád has Java certifications from Sun Microsystems and IBM. He holds a bachelor’s degree in Computer Science from Carnegie Mellon University.

You can visit Chád’s blog at www.luv2code.com to view his free video tutorials on Java. You can also follow him on Twitter at @darby1uvs2code.

Acknowledgments

I would like to acknowledge all my fantastic editors and their support staff at Apress who worked long hours and toiled diligently on this book to make it the leading visual effects fundamentals title currently available in the marketplace.

I would like to thank the following people:

Steve Anglin, for his work as the acquisitions editor for this book, and for recruiting me to write development titles at Apress that cover widely popular open source content development platforms (Android, Java, JavaFX, HTML5, CSS3, JS, JSON, etc.).

Matthew Moodie, for his work as the development editor on this book, and for his experience and guidance during the process of making this book one of those fantastic digital visual effects editing, image compositing and 3D special effects titles.

Mark Powers, for his work as the coordinating editor for this book, and for his constant diligence in making sure that I either hit my chapter delivery deadlines or far surpassed them.

Chád Darby, for his work as the technical reviewer on this book, and for making sure that I didn't make technical mistakes.

Introduction

VFX Fundamentals is intended for the digital artist, digital videographer, multimedia producer, illustrator, application developer, website developer, user interface design architect, user experience designer, social media user, effects compositor, matte painter, or just about anyone who is interested in generating superior quality digital visual effects and 3D VFX, and delivering them in popular MPEG4 and MOV video data formats.

This book covers digital visual effects concepts, editing, special effects, titling, bluescreen mattes, masking, particle systems, physics, motion tracking, compositing, blending modes, 3D, and more. This equates to digital video and special effects fundamentals combined into one unified title that includes technical terms, topics, concepts, and definitions.

Each chapter will build upon the knowledge learned in the previous chapter. Thus, later chapters in the book will have readers creating advanced digital visual effects projects using mattes, motion tracking, image compositing, special effects algorithms, 3D particle systems and similar VFX software features, dialogs, and tools, all using Fusion's powerful visual programming language.

There is even coverage at the end of this book regarding content publishing across consumer electronics devices via the use of open source platforms such as Java 9, JavaFX, HTML5, CSS3, iOS, Android 7.0, Kindle, Fire OS, EPUB, PDF, and JavaScript.

In Chapter 1, you will install open source **Fusion 8** as well as other related 3D and new media software packages that would be useful for your digital visual effects production workstations, including the impressive Blender 3D 2.8 for modeling, rendering, and animation and Editshare Lightworks 12.6 for collaborative digital video editing. You'll also download and install GIMP 2.

In Chapter 2, you will take a look at **raster** imaging and video concepts, like pixels, resolution, aspect ratios, compositing, color channels, alpha channels, masking, blending modes, and so forth. This information will provide your VFX technical foundation.

In Chapter 3, you will build on the raster concepts by adding **motion** to the pixels and by covering digital video or 2D/3D animation concepts such as codecs, frame rates, keyframes, bit rates, and similar concepts used for visual effects animation workflows.

In Chapter 4, you will learn about **digital audio** content production, since audio is a primary component of digital video and visual FX. You'll cover sound waves and sampling, amplitude and frequency, MIDI and Digital Audio data formats, and sound design concepts and fundamentals, all in one, unified chapter.

In Chapter 5, you'll explore the mathematical world of **2D vector** graphics, including points, lines, curves and paths, and the SVG, or Scalable Vector Graphics, format, and how these are used and even animated in Fusion visual effects processing pipelines.

In Chapter 6, you will be introduced to the next level of **i3D vector** graphics, including 3D modeling, 3D rendering, animation, and programming. This is important for visual effects, as Fusion 8 contains both 2D and 3D (both unified) compositing pipelines.

In Chapter 7, you will take a look at the core user interface, features, and approach of Fusion 8. You will get a bird's eye tour of the entire software package, as well as an overview of how each part of this software works together with the other components.

In Chapter 8, you will start to delve into the inner workings of Fusion 8, starting with the all-important visual algorithmic editing language utilized in the Fusion **Flow Node Editor**. Nodes and VFX tools and tiles are covered, as you learn how to create VFX processing pipelines using Hollywood studio-level software.

In Chapter 9, you will cover another core Fusion feature, the **Timeline Editor**, as well as the **Time Ruler**, where you will control the fourth dimension of time for all your VFX projects. We'll look at keyframing and the playback head and learn how to animate any VFX tool, setting, and attribute in your VFX project pipelines, increasing your VFX power by an order of magnitude.

In Chapter 10, you'll learn about Fusion's **Spline Editor**, which allows you to create vector assets such as mattes, masks, and LUT (Look Up Table) control curves, thus allowing your advanced VFX visual control representations to be edited mathematically.

In Chapter 11, you'll continue learning about how to best utilize Spline Editor in Fusion by taking a look at **animated polyline masking**. We'll look at how to create morphing and warping masks using animated polylines, as well as animated blend areas using double polyline masking techniques.

In Chapter 12, you will learn how to leverage Fusion chroma or luma keying algorithms to have Fusion 8 create your mattes and masking for you by utilizing popular bluescreen or greenscreen technology and workflows. We will look at several of Fusion's keying algorithms, including **Primatte V**, **UltraKeyer**, and **ChromaKeyer**.

In Chapter 13, you'll learn Fusion's workflow for another popular VFX software feature, called **motion tracking**. We will take a look at single-point motion tracking, as well as at more complex multi-point motion tracking, using public digital video assets. Motion tracking is a popular VFX topic allowing VFX artisans to bridge 3D software packages with VFX software such as Fusion 8.

In Chapter 14, you'll learn all about the **i3D compositing** engine in Fusion, which we will cover over the next six chapters of the book. We will cover how to import 3D models into Fusion using an FBX file format. We will also look at how to set up cameras, lighting, and texture maps with these 3D assets by using geometry, shaders, materials, and textures that are rendered in real-time. This is done using advanced GPU hardware rendering support that allows VFX artisans to work in real-time, seamlessly fusing 2D VFX pipelines and 3D VFX scenes together.

In Chapter 15, you will get more advanced in Fusion 3D VFX by learning about how **Shaders** are constructed using your materials algorithm in conjunction with texture mapping. You'll dissect advanced Shader pipelines in Fusion so you learn how to create custom advanced 3D Shader pipelines for your own 3D VFX.

In Chapter 16, you will learn about how to model 3D text title assets in Fusion, which can be used in advanced **3D text titling** animated sequences, which are popular in VFX project workflows. We cover extrusion, beveling, chamfering, advanced profiles and selective face texture mapping, and 3D text object lighting.

In Chapter 17, we will continue with 3D text titling and create an **animated 3D text titling** project by using the 3D text model created in Chapter 16. We will look at Fusion modifiers, which allow VFX artisans to create animation using algorithmic tools and custom settings with the Flow Node Editor tools and their control panel settings.

In Chapter 18, you will learn about Fusion's **particle systems**. Particles allow advanced visual effects, such as rain and snow, explosions, fluid dynamics, crowd simulations, flocking, sparks and fire, and just about

anything else you can imagine. I will cover particle emitters and particle effects, particle rendering, and the difference between Fusion 8's 2D and 3D particle systems.

In Chapter 19, you will get into advanced particle systems by covering the **particle physics** algorithms found in Fusion, as well as by using Fusion modifiers in particle systems. We will continue with the advanced version of your VFX particle simulation from Chapter 18 and apply digital imaging techniques and matte and masking effects to particle systems, assembling your complex 20-node Fusion VFX processing pipeline, spanning the two chapters.

In Chapter 20, I will cover **publishing** 2D or 3D visual effects content deliverables using leading content-delivery platforms and popular hardware devices, from smartwatches to UHD 4K iTV sets to legacy HD 2K iTV sets and everything in between, including eBook eReaders, tablets, gaming consoles, automobile dashboards, home appliances, IoT devices, and UHD smartphones.

If you are interested in digital visual effects, 2D image compositing, and 3D special effects, and you want to learn about each of these areas along with the basic fundamentals behind them, as well as about how everything works together in the visual effects domain, this is the book that you need to begin your journey with.

This book is overflowing with tips, tricks, tools, topics, terminology, techniques, concepts, and work processes. Indeed, this book should give you the boost to transition from being a visual effects compositing beginner to being that knowledgeable digital visual effects professional you seek to become, at least where a digital video, 3D VFX, or 2D VFX visual effects compositing pipeline is concerned. This book is a great follow-up to the earlier titles in the new media fundamentals series from Apress.

Visual Effects: Set Up Your VFX Content Development Workstation

In this first chapter, let's put together your foundation for a highly professional visual effects (VFX) content development workstation. This is an important fusion of hardware and professional software, allowing you to reach your goal of doing interactive multimedia production VFX development. Let's spend a chapter considering your new media hardware needs and the software infrastructure that you will want to put together to create a professional, well-rounded visual effects software development workstation. This will put a bunch of arrows in your multimedia software development quiver right off the bat. You will then have everything you need to develop new media content for use in your visual effects pipeline throughout this book, no matter what type of VFX applications you decide you want to develop for your VFX clients!

We will get all of these tedious setup tasks out of the way, putting together a professional new media content production workstation using professional open source software.

Electronic supplementary material The online version of this chapter (doi:[10.1007/978-1-4842-2131-0_1](https://doi.org/10.1007/978-1-4842-2131-0_1)) contains supplementary material, which is available to authorized users.

If you already have your workstation configured, you can proceed to Chapter 2 for an overview of raster concepts. If you are already familiar with these raster concepts, proceed to the rest of the book. Since we want the readers of this book to use similar visual effects development environments, we'll outline all of the steps involved in putting together an enviable new media production workstation. You'll learn where to go to download and how to install several of the most professional open source software packages on the face of this planet. You are about to max out your new VFX workstation!

The VFX Content Production Workstation

The first thing that we'll do after taking a look at hardware requirements is to download and install visual effects new media asset development tools. These are used in conjunction with VFX software package Fusion 8.0 for things such as image editing (GIMP); non-linear digital video editing (Lightworks); digital audio sweetening or editing (Audacity); i3D modeling, rendering, and animation (Blender); digital illustration (Inkscape); and business productivity (OpenOffice). This chapter will take your development to an all-new level, showing you how to create the new media development and VFX workstation that will run your visual effects content development business.

All of these software development tools, which you'll be downloading and installing, will come close to matching all the primary feature sets of expensive paid software packages, such as those from Apple (Final Cut Pro), Autodesk (3D Studio Max), Adobe (Photoshop, Illustrator, After Effects), and Avid (ProTools), and all at ZERO cost to your production company!

Open source software is free to download, install, and even upgrade, and is continually adding features. It's becoming more and more like professional software every day. You will be completely amazed at how professional your open source software packages have become over the last decade or so.

New Media Content Production: Hardware Is Key!

Since during this chapter you will put together what will be the foundation for the VFX content production workstation you will use for the duration of this book, I want to take a moment to review new media content development workstation hardware requirements first. This will influence your VFX development performance (speed). This is clearly as important as the software itself, since hardware is what is actually running the VFX software package's algorithms.

Let's discuss what you need to make a multimedia content production workstation usable. You will need an **HDTV** (1920 x 1080 resolution using a 120FPS refresh rate) or **UHD** (4096 x 2160 at a 120FPS refresh rate) **widescreen display**. These are affordable and give you four to sixteen times the display "real estate" that the XGA displays typically provided. HDTVs are now \$140 to \$300; UHD TVs are now under \$1,000. Two displays are always better than one!

I recommend using, at a bare minimum, the **Intel i7** quad-core processor or the **AMD 64-bit** octa-core processor. Install at least 16GB of DDR3-1600 memory; 32GB or 64GB would even be better. I'm using a 64-bit AMD octa-core with 16GB of DDR3-1600.

Intel also has a new hexa-core i7 processor. This will be the equivalent of having **twelve cores**, as each i7 core can host two threads. Similarly, the i7 octa-core will look like sixteen cores to a 64-bit operating system's thread-scheduling algorithm.

There are also high-speed DDR3-1866 as well as DDR3-2133 clock-speed memory module components available. A high number signifies fast memory access speeds. To calculate the actual megahertz speed the memory is cycling at, divide the number by 4 (1333 = 333 MHz, 1600 = 400 MHz, 1866 = 466 MHz, 2133 = 533 MHz).

Memory access speed is a massive workstation performance factor, because your processor is usually "bottlenecked" by the speed at which processor cores can access the data (in memory) that it needs to process your VFX algorithms.

With high-speed processing and memory access going on inside the workstation while it is operating, it's extremely important to keep everything cool so that you do not experience **thermal problems**. I recommend using a wide, full-tower enclosure with **120mm** or **200mm** cooling fans (one or two at least), as well as a captive liquid induction cooling fan for your CPU.

It is important to note that the cooler the system runs, the faster it can run, and the longer it will last, so load the workstation up with lots of silent, high-speed fans!

If you really want to maximize performance, install an SSD (solid state disk drive) as your primary disk drive that your applications and operating system software load from. Use legacy HDD hardware for your D:\ hard drive for the slower data storage (long term). Put your current project files on the SSD.

Finally, make sure you have a modern GPU graphics card in your system's PCI slot, as Fusion 8 can offload complex processing of calculations to the dozens, if not hundreds, of parallel DSPs that this card is hosting—calculations that are central to VFX software such as Fusion 8. Fusion forums recommend at least a 2GB DDR5 nVidia GTX 660, which is less than \$200 on PriceWatch.com, or a 4GB DDR5 GTX 670, which is less than \$350. If you've got a cool G (\$1,000) to spend, get a 12GB DDR5 GTX Titan X from nVidia and call it a day.

As far as the OS goes, I'm using a 64-bit Windows 10 operating system, which is fairly memory efficient. The Linux 64-bit OS is extremely memory efficient. I recommend using any 64-bit OS so you can address more than 3GB of system memory. The more memory you have to work with the better, so try and get 64GB or even 128GB into your workstation. Fusion 8 is going to support Mac, Windows 10, and Linux (I use Ubuntu Mate and SUSE), so you can use the OS that you prefer as long as it is 64 bit and up to date! The Linux and Fusion software are both free, so spend your money on hardware if you have a limited budget, as VFX is very processor intensive and requires lots of fast memory and processor cores!

VXF Multimedia Asset Development: Open Source

To create a professional and well-rounded VFX content development workstation, you will be installing all of the primary genres of software. I'll show you how to download and install Fusion, GIMP, Blender, Inkscape, Audacity, Lightworks, and Open Office, all of which are highly professional open source software packages. You will be putting together a 100 percent open source workstation. Open source software has reached the same level of professionalism as paid software packages, which can often cost more than a thousand dollars each. By using open source software packages, you can put together VFX content development workstations (as many as you need) that will rival any paid application development software workstation. Let's get started!

Visual Effects Production: Fusion 8

BlackMagic Design Fusion 8.0 used to be called Eyeon Fusion, and it used to cost thousands of dollars. Now it is available for free, with a "Studio" version offered for around a thousand dollars. Fusion offers a professional visual effects software package that can be used for film and television, eBooks, smartphone applications, iTV set programs, smartwatch face design, virtual reality simulations, and other new media endeavors. Download Fusion 8.0 now at <https://www.blackmagicdesign.com/products/fusion/>.

Once you get to the Fusion 8 homepage, click the blue **Download** button, which can be seen in Figure 1-1, to start the download process. Once you have the software in your Downloads folder, copy it to the Software folder where you keep installers. Unzip the software package into its own folder.

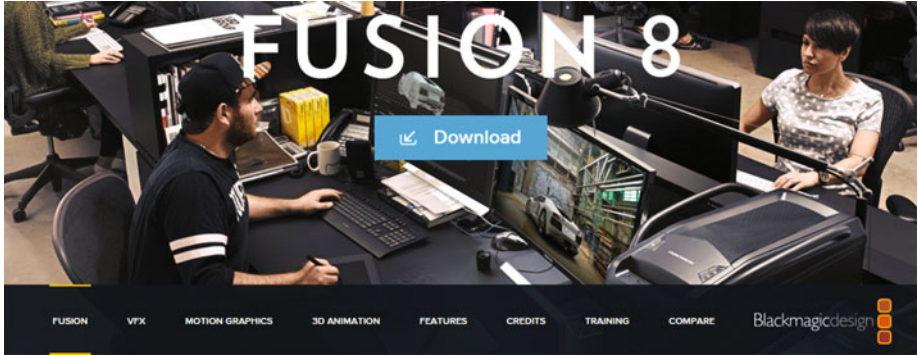
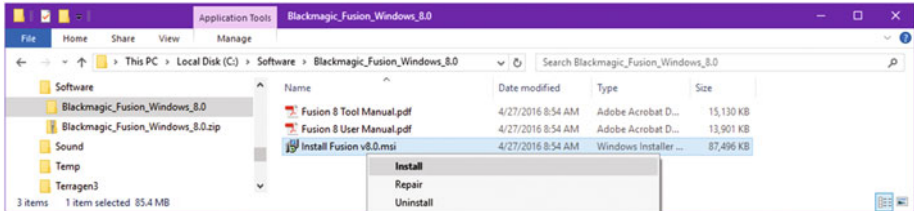


Figure 1-1. Go to blackmagicdesign.com and download Fusion 8

Figure 1-2 shows this C:\Software\Blackmagic_Fusion_Windows_8.0 folder. Find the `Install Fusion v8.0.msi` file and right-click on it; select the **Install** option to start the installation process.



*Figure 1-2. Right-click `Install Fusion .MSI`, and select **Install***

Accept the license and click **Install**, as seen in Figure 1-3.