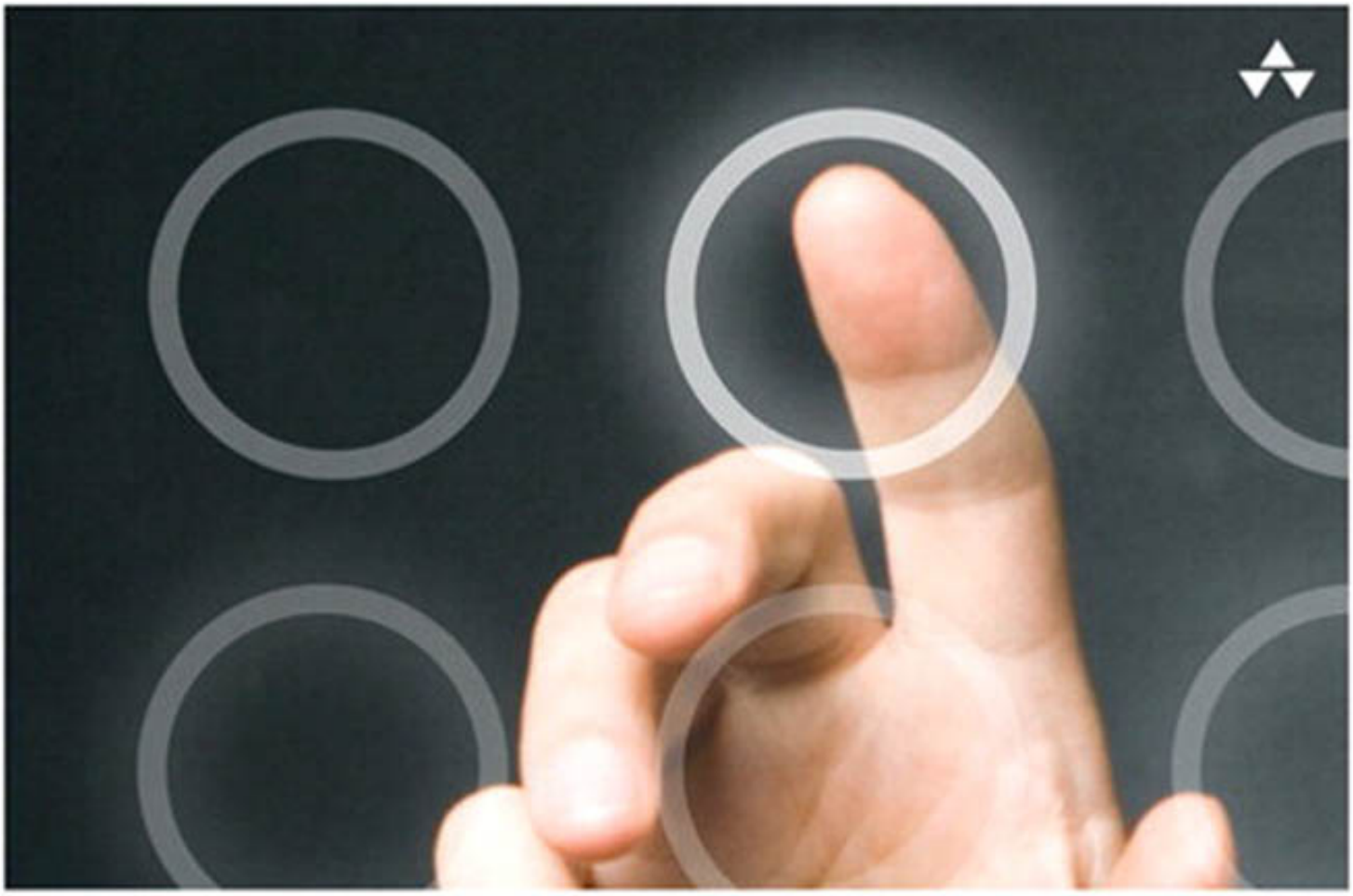


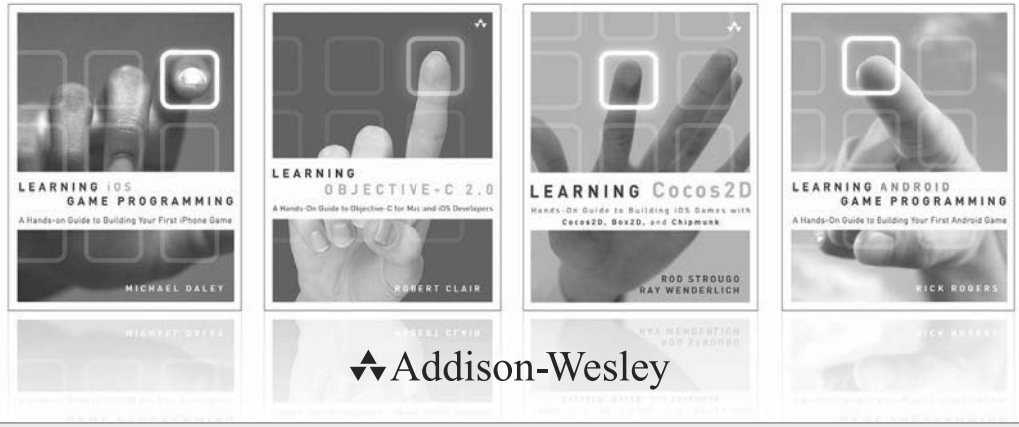
LEARNING QUARTZ COMPOSER

A Hands-on Guide to Creating Motion Graphics with Quartz Composer

GRAHAM ROBINSON
SURYA BUCHWALD

Learning Quartz Composer

Addison-Wesley Learning Series



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The Addison-Wesley Learning Series is a collection of hands-on programming guides that help you quickly learn a new technology or language so you can apply what you've learned right away.

Each title comes with sample code for the application or applications built in the text. This code is fully annotated and can be reused in your own projects with no strings attached. Many chapters end with a series of exercises to encourage you to reexamine what you have just learned, and to tweak or adjust the code as a way of learning.

Titles in this series take a simple approach: they get you going right away and leave you with the ability to walk off and build your own application and apply the language or technology to whatever you are working on.

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❖

I would like to acknowledge Jesus as my inspiration and the source of my creativity and talent. My wife Natalie, my muse and the most caring, supportive, fun human I have ever met, thank you so much! My father Bruce, without your support and encouragement I never would have been able to become self-employed and start this whole journey.

—Graham

I dedicate this book to my Mom for always telling me to do what I love (it's working!), to my Dad for instilling in me a talent and love for the arts, and to my Grandma Theda for getting us our first computer when I was but a wee lad, giving a jump-start to my tech education. Thanks to my friends in Stargaze and LAVA for encouraging and believing in me when I had the crazy idea to get into making interactive ridiculousness.

—Surya

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Contents at a Glance

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Contents

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Preface

Welcome to *Learning Quartz Composer*! We guarantee this will be the most fun geek book you have read, and by the end your digital world will be a better-looking place. Whether you dream of live visuals, interactive installations, Cocoa apps, dashboard widgets, or extra awesomeness for your film and motion graphics projects, Quartz Composer will enable you to develop beautiful solutions in amazingly short periods of time.

With the introduction of Quartz Composer in Mac OS X Tiger, Apple delivered a very powerful and unique tool, and with each operating system upgrade it becomes better and better. Quartz Composer is like your graphics card's special sauce; hidden away on your Developer Tools disk, it's your Mac's best kept secret.

Creating with Quartz Composer is superfast because it is a live, constantly rendering environment. Thus, if you make a change, you will see the result immediately, rather than having to wait for RAM previews or long renders. In performance environments, a Quartz Composer file can take live inputs from music or cameras, allowing for unique interaction and improvisation. Another massive advantage is that you don't ever have to define your project dimensions, so you can work on them freely and later choose to output a video file to devices ranging from a tiny phone screen to a high-definition video editing program.

So if Quartz Composer is so great, why isn't everyone using it? Well, there is a little bit more to the story. Quartz Composer is a graphical programming environment, which sounds scary enough to make most creative types run for the hills. When you add in an unusual (though highly usable) interface, you can see why it has remained in the dark. Fear not—we will break it all down into plain English and give you the confidence to do anything you want with this handy tool.

This book launches you directly into building and manipulating beautiful compositions. Each concept is introduced as part of a hands-on project, with video tutorial, steadily building your "qc-fu" and demonstrating/encouraging experimentation every step of the way. The projects start out very simple, and the first focus is always on beautiful visual feedback, so you know why you are learning what you are learning and want to explore the systems they are creating.

Audience for This Book

With only the very basics of computer literacy, this book/DVD combination launches the unsophisticated user into creating art projects, visuals for a band or party, wild

screensavers, and RSS-powered trade-show kiosks. For anyone with a programming background, the material quickly opens up a new world of visual potential.

Who Should Read This Book

The target audience for this book consists of Maker types: people who are delighted and excited by projects that enable them to create new things from what they have, but who need a helping hand to get them going. The nature of Quartz Composer means that its appeal spans many genres. Motion graphics designers, filmmakers, VJs, artists, interactive programmers, and Cocoa developers—all can learn something here that will apply to their jobs tomorrow.

Who Shouldn't Read This Book

If you are an advanced Quartz Composer user looking for detailed knowledge about using GLSL and OpenCL in Quartz Composer or creating your own plugins in Objective-C Quartz Composer, this book may be a little too basic. However, even a long-time Quartz Composer user could benefit from some of the tips and tricks we've discovered on our own learning journeys.

We'd Like to Hear from You

This book is about your experimentation, and we expect great things from you, so please drop in and share what you have created. You will also be able to access any updates, download the book's projects, and more at this site: `http://iloveqc.org`.

As a reader of this book, you are our most important critic and commentator. We value your opinion and want to know what we're doing right, what we could do better, which areas you'd like to see us publish in, and any other words of wisdom you're willing to pass our way.

When you write to the publisher, please be sure to include this book's title and the names of the authors, as well as your name, phone, and/or email address. The editor will carefully review your comments and share them with the authors and others who have worked on this book. Please note that due to the volume of email we cannot respond to all inquiries/comments.

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For more information about Pearson Education books or conferences, see our website at: `http://iloveqc.org`.

Organization of This Book

There are 14 chapters in this book, each of which builds on the last, transforming you from total beginner to Quartz Composer Ninja. The book is divided into two parts: Part I teaches the basics of how the different tools or patches can be used and Part II builds on what you have learned to make more advanced compositions.

Part I: Quartz Beginner

- **Chapter 1, "What Is Quartz Composer and Why Should I Learn It?"** This chapter introduces Quartz Composer, explaining what it is and how it can be used. It describes the range of outputs—Quartz file, movie, screensaver, and so on. The emphasis here is on flexibility and encouragement for the reader to experiment at every stage.
- **Chapter 2, "The Interface and Playing a Movie."** This chapter covers the very basics of Quartz Composer launching it, the layout of the interface, and the concept of the Quartz Composer Editor versus a traditional "what you see is what you get" (WYSIWYG) program.
- **Chapter 3, "Adding Visual Effects (Pimping It Out)."** Quartz Composer comes with a variety of built-in image filters for effects. It's easy to start routing your graphics and video through these filters, but some quirks and caveats that pop up could easily frustrate you. This chapter introduces the different types of effects available and the tools you'll need to come to grips with them.
- **Chapter 4, "Using LFOs, Interpolation, and Trackballs to Move Stuff."** One of the important concepts of the book is teaching you to create beautiful organic motion; Chapter 4 describes the tools you need to do so. The best part of the lesson is that all of these tools can work together and allow you to control many different things, from size to positioning to color. Trackballs and the **3D Transformation** patches help you control which part of your virtual world you are looking at.
- **Chapter 5, "Debugging (When Things Go Wrong)."** With the power of experimentation in Quartz Composer comes the inevitable "What did I do wrong?" moments. There are some helpful patches to get users through these tough times.
- **Chapter 6, "Particles (Little Flying Bits of Bling)."** This chapter explains what particles are, along with Quartz Composer's **Particle System** patch and how to use it to make cool stuff like rain and fire. You can even use an image or movie as the particle! A brief introduction to blend modes for layering images and video together is provided as well.
- **Chapter 7, "Mouse Input (Making Your Mouse Do Cool Stuff)."** The mouse is an excellent input device for interactive work, and most computers

will have one (or else a trackpad). In this chapter, we teach you how to put the mouse to work inside Quartz Composer.

- **Chapter 8, "MIDI Interfacing (Getting Sliders and Knobs Involved)."** MIDI controllers have historically been used to control audio software and hardware. With Quartz Composer, you can now use keyboards, drum machines, and banks of sliders and knobs to control visual images.
- **Chapter 9, "Interacting with Audio (Get Stuff Grooving to the Beat)."** Now that you have an understanding of the use of LFOs, the mouse, and MIDI, the concept of using audio processing to control values within compositions can be easily introduced. Initially, ways to manipulate the volume peak and microphone input are demonstrated for a quick "Wow" factor, but then we move on to splitting the spectrum, using smooth and math functions to enhance the aesthetics of the application. In addition, we cover how to export your compositions as normal movie files.
- **Chapter 10, "Lighting and Timelines (The Dark Side of QC)."** This chapter introduces the topic of lighting, including all settings that a computer light has but the light in your room doesn't. Experimentation with light, its positioning and its strength, and getting other controller objects involved are encouraged. Those readers who are used to normal editing and motion graphics packages will be happy to find out how Quartz Composer's timelines work.
- **Chapter 11, "Replication/Iteration (The Bomb)."** Why have just one interesting interactive object when you can have hundreds? One of the great things about Quartz Composer is that once you have created a single object, you can make hundreds without any of that boring copy-and-paste nonsense!

Part II: Quartz Ninja

- **Chapter 12, "Modeling Complex Environments (3D Cities)."** In this chapter, we take a lot of what you have learned through the earlier chapters and use it to create an awesome audio reactive city scene. Readers learn how to turn cubes into buildings, to create floors, and to create more complex camera moves.
- **Chapter 13, "Create a Cocoa App (Send Quartz to Your Friends)."** Apple makes it easy for amateurs to create native applications that can manipulate Quartz Composer compositions. This chapter covers the basics of using Xcode and guides you all the way through publishing an application.
- **Chapter 14, "Create a Screensaver."** Building on the earlier discussions of LFO and interpolation, this chapter uses patch time and random output to demonstrate longer-term, more gradually developing patches. It also explains how to wrap up and install patches as screensavers.
- **Chapter 15, "Secret Patches, Core Image Filters, and GLSL (Pushing the Boundaries)."** Quartz provides a rich feature set and many objects for

developing stunning compositions. Beyond its own capabilities, many interesting and exciting possibilities are provided by third-party plugins, access to the shader language GLSL, Core Image filters, and OpenCL. This chapter introduces the plugins included with Quartz Composer, including how to install them, how to access Kineme's work, and how to make your own Core Image filter.

Tutorial Videos and DVD Resources

With the book comes a great DVD, complete with a video tutorial for each chapter. The book and tutorials work together, so you can see exactly how to accomplish the more tricky bits covered in the book. The DVD also includes sample projects for each chapter, as well as some images we refer to in the chapters. Enjoy!

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This book has been a lot of fun to write and simply would not have happened without a lot of time, effort, and help from these fantastic people:

- Our first editor at Addison-Wesley, Chuck Toporek, and his superstar assistant, Romny French. Chuck found our online video tutorials and made this all happen. Chuck and Romny were succeeded by editor Trina MacDonald and assistant Olivia Basegio, who helped us make it over the finish line. Without everyone's support, guidance, and encouragement, we would never have been able to become authors.
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About the Authors

Graham Robinson runs Shakinda Productions in Belfast, Ireland, specializing in innovative projection design and interactive visual systems creation. He believes that technology allows us to create art that can inspire humanity and transform society, and has performed audio-visual sets as VJ Shakinda worldwide.

Surya Buchwald runs MMMLabs in Portland, Oregon, creating interactive experiences for Nike, Intel, Scion, and others. He traverses the globe as the VJ for The Glitch Mob, bringing the Quartz Composer magic to fans all over. He also creates interactive video instruments and performs with them as Momo the Monster.

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Chapter 1

What Is Quartz Composer and Why Should I Learn It?

Welcome to the first chapter! Are you ready to discover a whole new world? This chapter introduces Quartz Composer, explains how it differs from other applications you may have used before, and describes the many different end products you can create with it. We'll explain just how flexible it is and why you should always experiment, experiment, experiment!

Terms

The following terms are used throughout this book:

- QC: Quartz Composer.
- Patch: the basic building blocks of QC. Each little box in the editor is a patch.
- Composition: any saved QC file but normally a collection of patches you arrange to do something.
- Noodle: the flexible lines that connect patches, created by clicking and dragging from a patch output or double-clicking on the patch output and then moving the mouse. Officially these lines are called "patchcords"—but that's a bit boring so we'll call them noodles.

Play Video Introduction to Quartz Composer

Still not really sure what Quartz Composer is? Quartz Composer (QC) is a node-based graphical programming language. If that sounds complex, it simply means that you will be connecting boxes with squiggly lines instead of editing a timeline or using a drawing tool (see Figure 1.1). QC allows you to build up things—for example, you can take a QuickTime video, pass it through a filter, combine it with shapes, and display that on the screen. It takes some getting used to, but between reading this book and viewing its DVD, you'll be a QC ninja in no time.

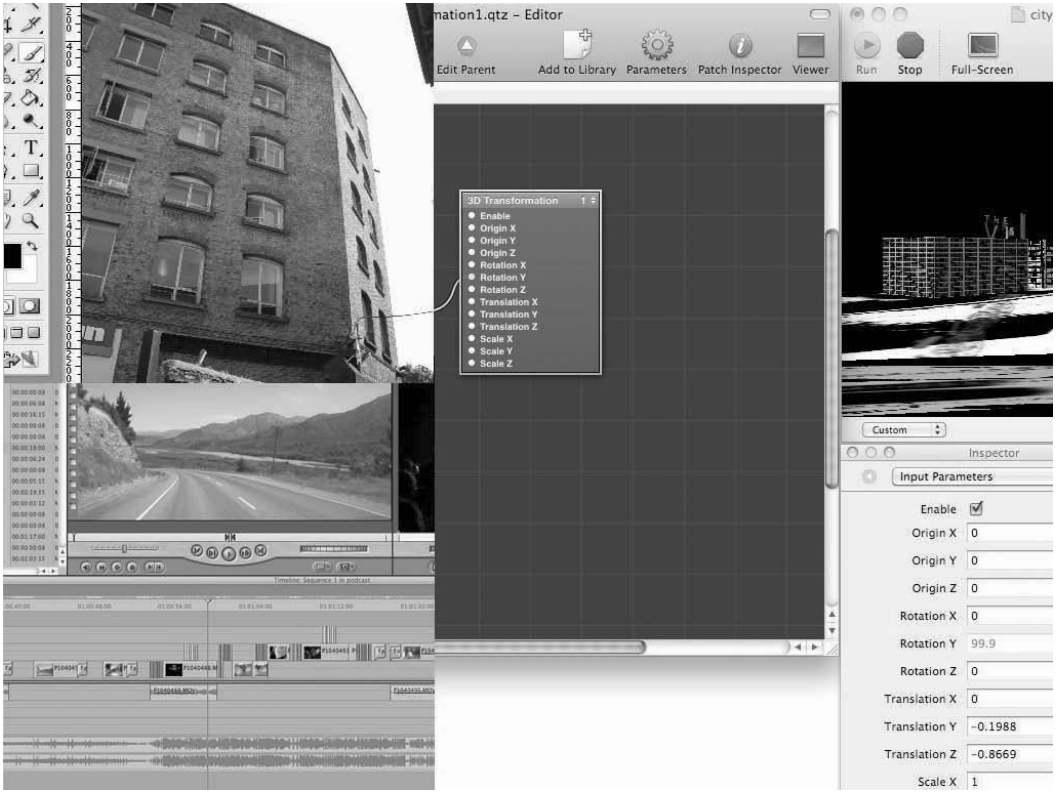

Figure 1.1 Quartz Composer interface versus Photoshop and Final Cut Pro

Play the video titled "Introduction to Quartz Composer."

If you haven't done so already, pop in the DVD and check out a few examples to see what's possible with Quartz Composer.

At this stage, if you haven't already set up Quartz Composer, you need to get it on your machine. This is a painless process, but it will involve digging out your original Mac install disks, (or rocking over to Mac dev at `http://developer.apple.com`, setting up an account, and downloading the installer).

Installing and Setting Up Quartz Composer

 Play the video titled "Installing and Setting Up Quartz Composer."

Follow these steps to install Quartz Composer:

1. Grab your Snow Leopard or Leopard Install DVD and stick it in your Mac.
2. Browse to Optional Installs > XcodeTools and double-click `XcodeTools.mpkg`.
3. Step through the installer and restart your machine.
4. Quartz Composer is now installed to Macintosh HD > Developer > Applications > Quartz Composer. If you drag the icon to your dock, it will add a launch shortcut.

Alternatively, if you are running Mac OSX Lion, follow these steps:

1. Open the App Store.
2. Search for "Xcode."
3. Download and step through the installer.
4. Quartz Composer is now installed to Macintosh HD > Developer > Applications > Quartz Composer. If you drag the icon to your dock, it will add a launch shortcut.

Congratulations, you are ready to rock!

Outputs

There are many different ways to output your QC productions (or "compositions," as we'll call them). Most simply, you can share them as Quartz composition files (extension `.qtz`), which means other people will be able to see exactly how you made your composition and add their own ideas to it—a great choice for collaboration. If you save a Quartz composition to `~/Library/Screen Savers` or the `/Library/Screen Savers` folder, it's ready to be a screensaver and will appear in your Screen Saver Preference Panel (see Figure 1.2).

If you want to include your composition in a webpage or dashboard widget (which load via the same WebKit plugin), use the `<embed>` tag. (For more information, go to `http://developer.apple.com/documentation/GraphicsImaging/Conceptual/QuartzComposer/qc_webkit/chapter_8_section_1.html#//apple_ref/doc/uid/TP40001357-CH3-SW6`.)

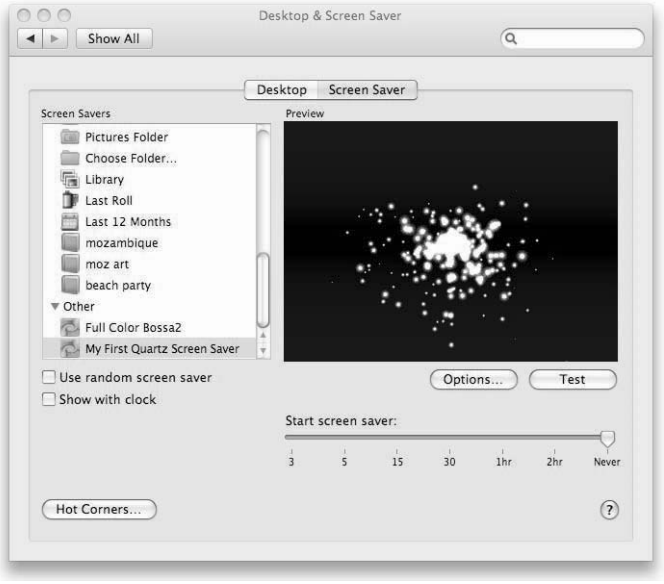

Figure 1.2 Quartz composition as a screensaver

Alternatively, you can export the composition as a QuickTime movie of a specified length and resolution. This method means that anyone with QuickTime installed can watch your composition and, if they have the QuickTime player version 7 or higher, will be able to see any interactive elements of your composition. Once you have the composition formatted as a movie, you can upload it to YouTube or load it into Final Cut, Video Jockey software, or other programs, just like any other movie file.

Not enough for you? Using Cocoa, it's simple to create an application that runs your composition. (See Chapter 13.)

Getting even geekier, you can "publish" certain controls of your compositions so they can be bound with an interface builder to create interfaces for other programs you may have written (`http://vidvox.net/wiki/index.php/QuartzComposer_Adding_a_published_input`). The publishing process can also be used in a specific Video Jockey setup with VDMX to create some very powerful live performance experiences.

Surely that's enough—but wait, there's more! Using a QCRenderer class, you can run a QC file in any OpenGL context. If you're not sure what an OpenGL context is, don't panic. . . . I'm covering all the bases here just to show you just how many different ways there are to output your creations from QC.

Flexibility

As you can see, there are many, many different ways to put your QC files to work—but that's only half the story. The range of what you can put in a Quartz composition is also formidable.

QC has an impressive range of filters that come from the core image library. You can have a lot of fun just putting photos, videos, or Photoshop files through a couple of filters. QC can also combine images using 31 different blending modes, some of which Photoshop users will recognize—Add, Alpha, Multiply, and so on—and some they won't—Luminescence Premultiply, anyone?

As well as being a great compositor of images and movies, QC loves live data streams, including audio being picked up by a microphone, RSS feeds from the Internet, MIDI and OSC data from other programs, JavaScript patches within a composition, and data from the ambient light and motion sensors from a MacBook Pro. All of these data streams can be manipulated and represented in incredible visualizations.

Three-dimensional environments can be created; 3D objects loaded, lit, textured, and animated; and camera moves animated on timelines. Lots of smooth and simple controller patches are also built into QC, which allow complex and organic movements to be created simply and quickly.

The possibilities are endless.

Experimentation

This is where you come in: Experiment, experiment, experiment. It is impossible for us, as authors, to highlight all of the possibilities provided by QC. To get the most from QC, you need to take the initiative and play around. Anywhere you see an input to a patch, think, "What could I connect to that?" The beauty of QC is that it's live, so once you have that thought, just noodle out from the closest patch and find out what happens. Then try another hole, a different value, or another controller. Keep going until your composition looks nothing like what it was when you started!

We are expecting some awesome results from you, our apprentices, so in preparation, we created a special site for your creations at `http://www.iloveqc.org`. As soon as you have something that looks a bit different, get your experiments online and let everyone else enjoy them. Share your compositions, learn from others' work, and collaborate. Let the QC explosion begin!

Summary

In this chapter we covered what Quartz Composer is, how to install it, and which kinds of wonderful things you can do with it. We also introduced experimentation as one of the key concepts to help you learn QC: Play around as much as possible and have fun!

Challenges

This chapter described how to install Quartz Composer, so why not start it up and play with some of the templates? If you get stuck, don't worry; just head to Chapter 2, where we will explain how to get started.

Index

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Y

Z