Preface

Welcome to the second edition of Digital Media Primer. This book continues with the spirit of its first edition. It emphasizes both conceptual and production aspects of digital media. It adopts a conceptual approach and relates to digital media software applications. The coverage of software applications intends to show students a general picture of how the concepts are translated into the common commands found in software applications. Therefore, whenever possible, multiple software applications are used as examples. The intent is not about training of software application skills or providing a survey of these software applications. Digital media software applications of the same medium share common commands and features, which are based on the same technical concepts and principles. The differences may be that these concepts and principles are presented in the software applications using slightly different command names and user interfaces. It is the author’s assumption that if the student understands the underlying concepts and principles and then sees examples of how they are actually translated into the commands or options found in application programs, the student can apply the knowledge to quickly pick up similar software applications and the ever-changing new versions of these software applications.

What’s New in This Edition?

The main motivation of the new edition is to update the materials with new technology and to expand the content to allow more different paths through this book for a wide range of digital media courses.

All of the chapters are revised, but the significant changes in this edition fall into three categories. One is the expansion of the multimedia authoring to a full introductory computer programming course in the context of game programming. Game programming is becoming one of the popular themes that many instructors have started considering for introductory computer programming courses. Chapters 8 through 11 cover about half a semester’s worth of materials of a full introductory computer programming course. The new object-oriented programming (OOP) chapters provide the materials for the second half of such courses. This revision allows the book to be used for a full introductory computer programming course in addition to digital media courses.

The second category of changes is the inclusion of a chapter on HTML5 video and audio. This is motivated by the fact that the Web is a common distribution method for digital media. In particular, HTML5 video and audio are emerging popular formats for sharing video and audio on the Web. In order to provide a foundation for learning HTML5, a chapter on HTML basics is also added.
The third category of changes is the revision of the video chapters to shift the focus from standard-definition video to high-definition video. At the time of writing the first edition, standard-definition video was the most available format and high-definition video cameras and editing software were limited. Now, with more video cameras and editing tools available for high-definition video, the video chapters are revised to put more focus on high-definition video.

Specifically, the new content and updates in this edition include:

- A new chapter introducing OOP in the context of game programming (Chapter 12)
- A new chapter on inheritance and polymorphism (Chapter 13)
- A new chapter on HTML basics (Chapter 14) to provide a foundation of HTML for the new HTML5 chapter to build upon
- A new chapter on HTML5 video and audio (Chapter 15) to cover structure, syntax, and semantics of HTML5, and to show how to share video and audio on the Web using HTML5
- Revised Chapter 6 (video concepts) to include more information on high-definition video
- Revised Chapter 7 (video production) to include updates on digital video cameras, examples of high-definition video editing tools, and examples of video effects
- Addition of a section on multitrack basics in the audio chapter (Chapter 5) to provide more information on working with multitrack sessions
- Replacement of the references to the Digital Art Module with the actual examples and explanations from the Digital Art Module
- New screenshots of the latest digital media software applications

Coordinating Coursework with This Text

This book is written for introductory courses in digital media. It is for introductory students from all disciplines who are interested in learning the foundational scientific concepts and basic techniques in digital media production. There is no specific prerequisite to use this book. The courses in which this textbook will be useful include:

- Non-major introductory computer science courses that adopt a digital media theme, integrating both scientific concepts and hands-on production aspects of digital images, video, and audio, and giving students exposure to basic computer programming through animation and game programming
- Introductory computer programming courses that adopt the theme of game programming with Flash ActionScript
- Introductory digital art courses intended to help students harness the digital media tools by learning the underlying scientific concepts, thereby achieving intended artistic results and improving confidence to experiment with creative uses of such tools
- Introductory media production courses that introduce students to a solid technical foundation of digital video and audio

After completing this book, students will understand the underlying concepts of computer terms common to digital media and be able to connect these concepts with the tools and techniques of digital media application programs. The connection between scientific concepts and applications will help students make educated decisions, rather than relying
on defaults or recipes, in using tools and techniques in application programs. In addition, the approach of this book intends to instill in students the ability and confidence to explore and teach themselves new application programs. After completing Chapters 1 through 7, students will be able to create and edit digital images, audio, and video. After completing Chapter 8, students will get an introduction on working with Flash and be able to create basic Flash animation. Building upon the knowledge of Flash, students will also learn basic computer programming concepts (procedural programming) with Flash ActionScript in the context of game programming (Chapters 9–11). Students may also continue on to the advanced topics of computer programming covered in Chapters 12 and 13—OOP, inheritance, and polymorphism. Chapter 14 covers HTML basics to prepare students with a sufficient foundation to build upon in learning how to add HTML5 video and audio to Web pages. In addition, students will learn the structure, syntax, and semantics of HTML5, as well as HTML5 video and audio, in Chapter 15. After completing Chapter 15, students will be able to construct a basic HTML5 document and embed video and audio on a Web page using the HTML5 video and audio tags.

Digital media classes may be taught from different disciplinary perspectives, and the background of students taking digital media classes are also diverse. There are many paths through this book for a digital media course. Thus, this book covers more than a semester’s worth of materials. For some courses, this book may offer more technical background than the course’s expectations. The role of the instructor is integral in deciding the best path through this book for the course. For example, not all the topics in Chapter 1 have to be the first week’s lectures; they could be in the middle or end of the semester as the instructor sees fit. Listed in Table 1 are several suggested treatments employing this book and the three-book digital media series.

The first edition of this book serves as the primer of a three-book digital media series. The other two books in the series, which allow further specialization at the advanced, discipline-specific level, are:


All three books maintain the same number of parallel chapters—one on background, two on each of the image, audio, and video, and several on multimedia/Web authoring. The second edition of this book preserves the structure of the parallel chapters, allowing students to easily look up relevant information across perspectives.

The three-book series allows flexibility for different courses with respect to the breadth (the number of media) and depth (depth in the direction of art or computer science perspective) of the course content. You can pick and choose to add the computer science or digital art components, depending on the depth of the art or computer science components you want to incorporate into the course.

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1Also by this author.
2By Jennifer J. Burg.
<table>
<thead>
<tr>
<th>Suggested Treatments Employing This Book and the Series</th>
<th>Suggested Chapter Coverage</th>
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| A course that covers the breadth of all three media: images, audio, and video | - Chapters 1–7 (this book)  
- Chapters 14–15 (this book) |
| A course that covers only one medium | - Chapter 1 (this book)  
- Two chapters of the medium (this book)  
- Chapters 14–15 if the medium is video or audio  
- Chapter 1 (either the Art or CS book)  
- Two chapters of the medium (either the Art or CS book)  
For example, for a course that focuses on digital images from the art perspective, you could cover Primer Chapters 1, 2, 3, and Art Module Chapters 1, 2, 3. |
| A course that covers multimedia authoring or basic programming through animation and games | - Chapters 1–3 (this book)  
- Chapters 8–11 (this book) |
| An introduction to computer programming in the context of game programming | - Chapters 8–13 (this book)  
- Chapters 1–3 (this book) if time allows |
| A course that focuses on concepts with minimal hands-on practice | Concept chapters:  
- Chapters 1, 2, 4, 6 (this book)  
- Chapters 1, 2, 4, 6 (either the Art or CS book) |
| A course that focuses on hands-on practice | - Chapters 1, 3, 5, 7, 14, 15 (this book)  
- Chapters 1, 3, 5, 7 (either the Art or CS book)  
- The concepts chapters (Chapters 2, 4, and 6) are highly recommended. If it is not possible to go over the concepts in class, refer students to self-study these concepts chapters. You may want to assign the end-of-chapter review questions to ensure they understand the concepts. |

**Text Organization**

This book follows the organization of its first edition. The digital media curriculum is organized around a core concept of digital media: the digitization process—sampling and quantization (Figure 1). For example, the **sampling** process gives rise to the image resolution in digital images and the sampling rate in digital audio. The **quantization** process gives rise to the color depth in digital images and the bit depth in digital audio. Digital video also deals with frame size, which relates to image resolution. This way, students learn about image resolution, audio sampling rate, color depth, audio bit depth, and video frame size from the same central concepts applied in different contexts, rather than as separate bits and pieces of factual information for different media. The core concept of digitization also helps students understand the nature of digital media—their limitations and uses.

Each of the image, audio, and video topics consists of two chapters: one on concepts and the second one on application of the concepts and the production of the media.

Chapter 1: Background

Chapter 2: Digital Image (concepts)
Chapter 3: Digital Image (application and production)

Chapter 4: Digital Audio (concepts)
Chapter 5: Digital Audio (application and production)

Chapter 6: Digital Video (concepts)
Chapter 7: Digital Video (application and production)

Chapter 8: Multimedia Authoring and Animation


Chapter 14: HTML Basics
Chapter 15: HTML5 Video and Audio

The scientific concepts and technical information are discussed in the concepts chapters (Chapters 2, 4, 6). The applications of the concepts and the general techniques and tools of application programs are discussed in the production chapters (Chapters 3, 5, and 7). For example, Chapter 2 explains the concept of resolution of images. Correspondingly, Chapter 3 discusses how to estimate the scanning resolution and printing resolution. The determination of the scanning and printing resolution is an application of the concept of resolution.
For the multimedia authoring chapters, Chapter 8 introduces the basics of animation and working with Adobe Flash. Chapter 9 provides an overview on programming fundamentals that are common to most programming languages. Chapter 10 discusses some specific aspects in programming with Flash ActionScript. Chapter 11 introduces computer programming basics and explains how to add interactivity. Chapter 12 introduces object-oriented programming, and Chapter 13 discusses inheritance and polymorphism. The lab exercises are designed around programming computer games.

Features in the Textbook

There are several pedagogic elements used in the book:

- **Key terms**: Key terms are boldfaced. When a key term appears at several places in the text, the term is usually boldfaced where its definition is given.
- **Learning aids**: There are several types of learning aids accompanying this text (see the subsequent subsection.) They are integral to the text and noted in the text in blue boxes. A title and a brief description are given for each learning aid. The learning aids can be found on the accompanying Web site of this text.
- **Boxed materials**: They intend to expand the discussion and explanation of the concept or terminology relevant to the current part of the text. The materials may be branched off from the main flow of the text. Thus, they are separated from the main text to avoid diversion from the flow of thoughts.
- **Margin notes**: They are generally used for a brief explanation of terminology, or for referring to the chapter that covers the basics that are needed for the current part of the text.
- **Self-test questions**: These questions are found in the text of some chapters. The answers are provided at the end of the question or the bottom of the page. These questions, unlike the end-of-chapter review questions, intend to provide the students an instant review of the topics. These topics are a little too involved to wait for the end-of-chapter review questions.
- **Summary**: Each chapter concludes with a summary of key concepts.
- **End-of-chapter review questions**: These are multiple-choice and short-answer questions to reinforce the retrieval of the learned foundational knowledge. They are to ensure that the student reaches the same level of competence of foundational knowledge.
- **Exploring the applications**: At the end of a production chapter, there is a list of suggested commonly used features and functionalities for the students to look up and explore in application programs. The goal is to help students to learn how to explore application programs in terms of tasks and then apply the basic concepts they have learned in the textbook. By taking this approach, the student is not tied to learning a particular software package or version.

Student Learning Aids and Supplementary Materials

For access to the Learning Aids and Supplementary Materials, please go to http://www.pearsonhighered.com/digitalmedia.

There are several types of online learning aids accompanying this text. They appear in blue boxes with a small icon (_HELLO_ or _FILM_STRIP_) followed by a title and a brief description. The computer mouse icon indicates that the learning aid is interactive or has a hands-on component. These include interactive tutorials and demonstrations, labs, and worksheets. The filmstrip icon means that the learning aid is a movie (for example, the screen-captured movies that show how to use a tool in an application program), video files that demonstrate the effect of different compression settings, or supplementary reading materials.

• \textbf{Tutorials} \\
  The tutorials are used for various purposes: \\
  • Conceptual: To explain concepts, such as sampling and quantizing \\
  • Software tool how-to’s: Short screen-captured movies showing how-to’s of application programs \\
  • Example files: Files that you can download to open and see how they work \\
  • Visualization: To help visualize difficult concepts \\
  • Explanation of terminology \\
  • Step-by-step guide to solve a problem: such as Chapter 1’s binary-decimal conversion \\

  All of the tutorials can be used as outside class review by students. Some of the tutorials can be used by the instructor as interactive animated presentations during lecture—for example: Chapter 1’s “Converting Analog to Digital—Sampling and Quantizing”, Chapter 2’s “Sampling and Quantizing in Digital Images”, Chapter 3’s “Understanding and Applying Histograms”, and Chapter 4’s “Sound as a Pressure Wave” and “Sampling and Quantizing in Digital Audio”.

• \textbf{Demonstrations:} For example: audio files that let you hear how different sampling rates and bit depths affect the audio quality, or video files that let you see how different compression settings affect the visual quality.

• \textbf{Worksheets:} Worksheets are question-based PDF files that can be downloaded and printed out. They require more thinking than the end-of-chapter review questions. Some may require exploration or experimentation to discover answers. The syntax review worksheets in the programming chapters are intended to help students to summarize the syntax and practice writing code, which are important to success in an introductory programming course.

  My game programming class surveys showed that students unanimously found the syntax review worksheets very helpful and that they used their graded worksheets for studying. Some students even suggested having more review worksheets on topics that were not included in the worksheets. However, it was also a common response that the syntax review worksheets were boring. Therefore, if the syntax review worksheets were made optional, students very likely will not complete the worksheets that are beneficial to their learning. I found that it worked well to make the syntax review worksheets part of the homework assignments. I also advised students to keep the graded worksheets for use as syntax references in the lab and for studying for tests and the final exam. The intention of the syntax review worksheets is to help students create their own study aids and notes. Therefore, it would be best to help them to complete the worksheets correctly as much as possible.

  Some students may come to your office to ask questions on homework. However, many students may not be willing to do so. I have found that a short in-class Q&A section right before the students turn in the worksheets provides a good opportunity for offering such help. During the Q&A section, students are encouraged to ask questions that they have been stuck on and to discuss their thoughts on the answers. They are allowed to make corrections before they turn in the worksheets. Being able to make corrections before turning in the worksheets is an incentive for students to ask questions. It is also as if they are grading their own homework. This provides an opportunity for students to take a critical look at their code answers. While they are asking homework questions in class, they more likely also ask you
to clarify some lecture materials, in which case you will get student feedback on the lecture materials and be able to clarify any misunderstandings that were usually the root of the homework problems.

- **Labs:** These are lab manuals, with instructions to edit or create digital media files. They are designed to provide hands-on opportunities to process and manipulate digital images, sound, and video. The labs for multimedia authoring include creating animation in Adobe Flash and programming games in ActionScript. In developing the labs, I tried to emphasize the tasks rather than giving command-by-command, recipe-type instructions. For the computer programming chapters (Chapters 8–13), labs are an important component. From my experience, for a 3-credit course (three 50-minute lectures per week) plus a lab section (1.5 hours per week), it worked well to turn one of the lecture periods into an extra lab period. A lab briefing that gives students a big picture of the steps and demonstrates how the final product should look and work is also important.

Worksheets and labs are different. Worksheets are question-based homework intended to help students review and summarize a topic at a time. Labs are hands-on instruction-based activities that create or modify media files. Labs provide opportunities for students to apply multiple learned concepts and techniques in practice.

**eText with Online Learning Aids**

I encourage you to explore the eText with online learning aids and supplementary materials that are noted in the text. These materials can be accessed through the publisher’s Companion Website for this text at http://www.pearsonhighered.com/digitalmedia. You will need to redeem the access code provided at the front of your new textbook. Some learning aids require Shockwave plug-in, some require Flash player, some require QuickTime player, and some require JavaScript enabled. For those who have trouble getting Shockwave plug-in installed on the lab computers, the Shockwave supplementary materials are now also available as standalone .exe (Windows) and .app (Mac OS) files. The file format and requirements of each of these learning aids are noted with its link on the Companion Website.

**Instructor Resources**

Protected instructor resources are available on the Pearson Instructor Resource Center (IRC). Please contact your local Pearson sales representative to gain access to this site. Instructors will find the following support material on the IRC:

- Lecture PowerPoint slides
- Answers to the end-of-chapter questions
- Answers to the worksheets
- Completed lab files

**Software Tools for Practice and Labs**

Although this book’s approach of teaching media production application tools emphasizes identifying tasks and tries not to tie to any particular software, it is inevitable that you must select some representative application programs to demonstrate the tools and techniques in the text and in the practice exercises, such as labs and worksheets. Table 2 lists the different application programs used as examples in this book. The application programs that appear the most in the text, tutorials, labs, and worksheets are in bold.
Acknowledgments

The materials have been class-tested and I would like to thank our students who provided us feedback to help us improve the text and its organization for the series. I would also like to thank the pre-revision reviewers of this book for their valuable comments and suggestions: Christopher T. Jennings of Metropolitan State College of Denver, J. Bryan Pittard of University of Central Florida, and Jonathan Ross of Asheville-Buncombe Technical Community College.

There would not have been a second edition without the first edition to serve as a basis. Thus, my thanks again go to the professors who participated in pilot-testing of the first edition of the three-book series: Julie Carrington of Rollins College, Kristian Damkjer of University of Florida, Ian Douglas of Florida State University, Edward A. Fox of Virginia Polytechnic Institute and State University, Martha Garrett of Bishop McGuinness High School (North Carolina), Kim Nelson of University of Windsor (Ontario, Canada), Naomi Spellman of The University of California San Diego and San Diego State University, Christopher Stein of Borough of Manhattan Community College, and Mark Watanabe of Keaau High School (Hawaii).

I would also like to thank my student assistants, who helped in developing and suggesting some of the learning aids, and my former students who let me include their class work as demonstrations and chapter openers in the book: Cory Bullock, Kevin Crace, Emma Edgar, Gretchen Edwards, Robert May, Lindsay Ryerse, Caldwell Tanner, and Daniel Verwholt.

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<thead>
<tr>
<th>Media Topic</th>
<th>Application Programs Used as Examples in the Text</th>
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<tbody>
<tr>
<td>Digital Image</td>
<td>Adobe Photoshop, Adobe Illustrator</td>
</tr>
<tr>
<td>Digital Audio</td>
<td>Adobe Audition, Audacity, Apple Garage Band, Sony Sound Forge, SONAR, Sony ACID Pro</td>
</tr>
<tr>
<td>Digital Video</td>
<td>Adobe Premiere Pro, Apple Final Cut Pro, Sony Vegas, Adobe Encore DVD, Sony DVD Architect</td>
</tr>
<tr>
<td>Multimedia Authoring and Introduction to Computer Programming in the Context of Game Programming</td>
<td>Adobe Flash</td>
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