

intel® McGraw-Hill

Now Covers  
Windows and OS/2!

# Multimedia Applications Development

Using Indeo™ Video and DVI® Technology

SECOND EDITION



MARK J.  
BUNZEL

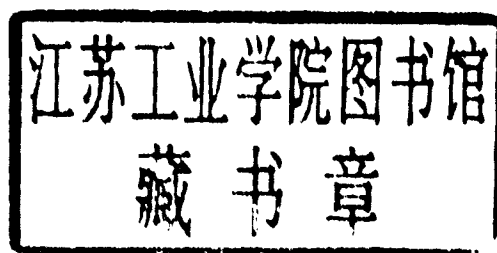
SANDRA K.  
MORRIS

---

# Multimedia Applications Development

Using Indeo™ Video and DVI® Technology

Mark J. Bunzel  
Sandra K. Morris



Second Edition

McGraw-Hill, Inc.

New York San Francisco Washington, D.C. Auckland Bogotá  
Caracas Lisbon London Madrid Mexico City Milan  
Montreal New Delhi San Juan Singapore  
Sydney Tokyo Toronto

## Library of Congress Cataloging-in-Publication Data

Bunzel, Mark J.

Multimedia applications development : using Indeo video and DVI technology / Mark J. Bunzel, Sandra K. Morris. — 2nd ed.

p. cm. — (Intel/McGraw-Hill series)

Includes bibliographical references (p. ) and index.

ISBN 0-07-043300-3 — ISBN 0-07-043301-1 (pbk.)

1. Interactive video—Computer programs. 2. Digital television.

3. Computer software—Development. I. Morris, Sandra K.

II. Title. III. Series.

TK6687.B86 1994

006.6—dc20

93-23188

CIP

Copyright © 1994, 1992 by McGraw-Hill, Inc. All rights reserved. Printed in the United States of America. Except as permitted under the United States Copyright Act of 1976, no part of this publication may be reproduced or distributed in any form or by any means, or stored in a data base or retrieval system, without the prior written permission of the publisher.

International Edition 0-07-113220-1 Exclusive rights by McGraw-Hill Book Co. - Singapore for manufacture and export. This book cannot be re-exported from the country to which it is consigned by McGraw-Hill. Not for resale in Australia, Canada, Europe, Japan, the United Kingdom, and the United States of America. Export sales may be made only by, or with the expressed consent, of the Publisher.

1 2 3 4 5 6 7 8 9 0 DOC / DOC 9 9 8 7 6 5 4 3

ISBN 0-07-043300-3 (HC)

ISBN 0-07-043301-1 (PBK)

*The sponsoring editor for this book was Daniel A. Gonneau,*

*and the production supervisor was Pamela A. Pelton.*

*It was set in Century Schoolbook by North Market Street Graphics.*

*Printed and bound by R. R. Donnelley & Sons Company.*

Intel, DVI, FaxBACK and i750 are registered trademarks of Intel Corporation; Indeo, Intel386, Intel486, i386, i486, ActionMedia and PRO750 are trademarks of Intel Corporation; UNIX is a registered trademark of UNIX System Laboratories; Macintosh is a registered trademark of Apple Computer, Inc.; PC AT, Infowindow, OS/2, PS/2 and Presentation Manager are registered trademarks of IBM Corporation; Micro Channel is a trademark of IBM Corporation; MS-DOS, PowerPoint, and Word are registered trademarks of Microsoft Corporation; Windows, WindowsNT, and Excel are trademarks of Microsoft Corporation; Betacam and VIEW are trademarks of Sony Corporation; Targa is a registered trademark of Truevision, Inc.; Authology is a registered trademark of American Training International, Inc.; Lumena and MEDIAscript are trademarks of Network Technology Corporation; Hyper ties is a trademark of Cognetics Corporation; NetWare is a trademark of NOVELL Corporation; Harvard Graphics is a registered trademark of Software Publishing Corporation.

Information contained in this work has been obtained by McGraw-Hill, Inc., from sources believed to be reliable. However, neither McGraw-Hill nor its authors guarantee the accuracy or completeness of any information published herein, and neither McGraw-Hill nor its authors shall be responsible for any errors, omissions, or damages arising out of use of this information. This work is published with the understanding that McGraw-Hill and its authors are supplying information but are not attempting to render engineering or other professional services. If such services are required, the assistance of an appropriate professional should be sought.

## Other Books in the Intel/McGraw-Hill Series

---

EDELHART • *Intel's Official Guide to 386™ Computing*  
GUREWICH • *Communication Systems: Practical Guide to Intel's  
Connectivity Design*  
LUTHER • *Digital Video in the PC Environment, 2nd edition*  
MARGULIS • *i860 Microprocessor Architecture*  
RAGSDALE • *Parallel Programming*  
VICKERY • *Real Time and Systems Programming*  
YUEN • *Intel's SL Architecture: Designing Portable Applications*  
RAO • *Multilevel Interconnect Technology*

*To order, or to receive additional information on these or  
any other McGraw-Hill titles, please call 1-800-822-8158  
in the United States. In other countries, please contact  
your local McGraw-Hill office.*

**MH93**

---

# Foreword

The marriage of computing power and television is one of the most important developments of the technology revolution. It has the potential to strike a balance between lethargic “couch-potato” television watching and the frantic interactivity of computer games and applications. Somewhere between beer and caffeine, there’s a middle ground.

Computers are powerful productivity tools, but tools alone are boring, especially if a lot of expertise is needed to operate them. The old joke about how computers are hard to understand goes, “What’s the difference between a computer salesman and a used car salesman? The used car salesman *knows* he’s lying.”

Television is easy to use and quite attractive, even addictive, but offers little more than a barrage of sensory stimulation. In a *Calvin and Hobbes* cartoon, Calvin bows before his television, saying, “O great altar of passive entertainment, bestow upon me thy discordant images at such speed as to render linear thought impossible!”

Computers are hard to use, but becoming easier through well-thought-out interfaces. Television is easy to use, but becoming harder through the rise of cable, satellites, and the incomprehensible seven-day, 14-event VCR timer (and computer people thought the “C>” prompt was hard!).

Today, with tools such as Intel’s DVI technology, people like you are marrying television’s uncanny ability to attract and hold our attention with the computer’s ability to start and stop at will, or to switch among a variety of media. The time is right.

As a motivator and attention-getter, television has been a fabulous tool for advertising over the last 30 years. But television’s success is wearing out. Our attention is drifting, partly because more channels are available, but more likely because we’re reaching the limits of sensory stimulation. Scene changes in television commercials can’t become much shorter without passing the boundary of human perception. Something new is needed. It’s not High-Definition Television (HDTV), which is just bigger, sharper lights and noise. Bigger, stupid televisions would be a Band-Aid. Smarter televisions are the next step.

While television has been an obvious influence on life in the past 30 years, computers have been an equally powerful, though much less visible, shaper of the recent decades. The plummeting cost of information management has led to an amazing variety of products and services that depend on data processing.

People are overwhelmed by the flood of publications, phone calls, television stations, direct mail, videotapes, conferences, and other goods and services screaming for attention—virtually all of them managed by, and many produced by, computers.

## GAINING CONTROL

Despite the impact of television and computers—certainly the most profound technological influences in today's world—the average person has had little control of either one. *Programming*, which means something different in television and computing, has been out of the reach of the ordinary person.

The computer's ability to handle a variety of media—text, graphics, audio, video, paper, and telecommunications—offers a myriad of new opportunities to create products that allow ordinary people to cope with the sensory and factual deluges that threaten to overwhelm us. It won't happen overnight. The cost of these systems means that business will be the first to adopt them. There are four major applications in which interactive multimedia technologies will gain ground: learning, persuasion, documentation, and visualization.

## LEARNING

The power of interactive video training and education is already known, especially when it is impractical for logistical, cost, safety, or other reasons to have a “live” teacher. Interactive video proceeds at the students' pace. It is always available, flexible to the student's schedule. It can simulate dangerous or expensive procedures such as aircraft operations and complex manufacturing equipment.

Yet this is only the start. The computer's ability to *manage* audiovisual resources is much more important than its ability to substitute for the teacher. There are numerous failures of interactive video in classrooms, simply because instead of helping the teacher do his or her job better, the courseware tried to impose its own curriculum, trying to replace the teacher.

The same tools that allow the teacher to manage audiovisual information, in the hands of students can bring them into the modern world of audiovisual communications as *author*, instead of remaining simply couch-potato recipients. With luck, this means that they will

be far more aware and critical of the tricks and techniques that the electronic media employ to persuade and shape opinions.

## **PERSUASION**

The power of audiovisual information to persuade (motivate, sell, indoctrinate—choose your word) is being put to work in sales and marketing, proposal preparation, and other persuasive business applications.

There's been limited success with kiosks and other multimedia productions that attempt to take over the sales representative's job. But the same lesson learned by education applies to sales and marketing—instead of trying to replace the salespeople, the best applications help them do their job better. The software teaches them about the products and helps them manage information so that they can serve customers better. In an age of increasingly customized products, interactive technology offers a way to cope with the overwhelming number of choices available.

At a personal communications level, even simple voice annotation of computer documents can become a powerful tool to put the right "spin" on them.

For example, thousands of computerized spreadsheets are sent from place to place every day, containing proposals, budgets, business plans, operating results, and so forth. They're boring. Worse, the people who send them really have no good way to draw attention to key points. Pages of text, explaining the numbers, may accompany the spreadsheets, but anyone who thinks those really have an impact probably also thinks that people actually read software manuals. They don't.

Voice annotation, ideally combined with software that records the screen image, lets the sender attach significance to certain parts, much better than is possible with text annotation. That's a huge step in communications. It's not simply that the computer can combine text, graphics, and voice—television alone can do that. The point is that the computer can switch instantly from one to the other. The receiver of the annotated spreadsheet can listen to the comments if he or she wishes, or ignore them and examine the spreadsheet itself in detail.

## **DOCUMENTATION**

The complexity of high-technology products is so great that they require enormous amounts of reference material for maintenance and repair. Nowhere is this more obvious than in the Defense Depart-

ment. The amount of paper aboard a large naval vessel is so heavy that it affects the ship's speed and handling. There are so many manuals for a modern military airplane that mechanics can't possibly take all of them along, so they have to make many trips back and forth to the hangar—or worse, they work from memory and make mistakes. There are similar problems in the private sector.

Highly regulated industries, such as utilities and those that handle hazardous materials, have a nightmarish logistical problem of keeping employees up-to-date on the information necessary to operate legally, safely, and efficiently.

These industries are prime candidates for electronic documentation.

The computer's ability to simulate can make electronic documents far more useful than their paper counterparts. Already, manuals exist that adapt themselves to the technician's experience. A novice receives detailed instructions; the expert only has to look at the outline.

Animation is a great improvement over the incomprehensible "exploded diagrams" found in many technical manuals. Likewise, the computer's ability to reproduce other sights and sounds can be used in diagnosis. "Does the engine sound like this?" "Does the semiconductor wafer have discoloration like this?"

## **VISUALIZATIONS**

Scientists and engineers increasingly use visualization to understand how objects that are too small, too big, or nonexistent might look. Computers can model everything from atoms to the universe, yielding new insights into the workings of all sorts of things.

Further, computers can show what an unbuilt building or next year's automobile design will look like. It is becoming easier and easier to create artificial environments that are much easier to construct and change than the real thing. Models of buildings allow architects to take their clients on a tour, or show a city planning commission just how the skyline and shadows will change.

## **THE FUTURE**

As an interactive video producer, you are at the forefront of an evolution in computing. You're also on the leading edge of a revolution in communications.

There are many mysteries about interactive multimedia. Although we can see that these tools and products will appeal to many people for many purposes, we know very little about how to create them so



that they truly are useful to a wide range of people. The controls that work for cable television, VCRs, word processors, databases, and spreadsheets will only work for the evolutionary applications, not the revolution.

The rise of information-rich software is the revolution. The merger of audiovisual data with computer programming demands new human-computer interfaces, if this revolution is to grow beyond the minority that is turned on by raw technology.

You can make that happen by learning everything you can about the things that do and don't work. You can make it happen by subjecting your creating to testing by real people. Test, test, and test more—there are many dead ends still to be discovered.

The long-term promise of this new kind of communication is to create new communities. Businesses already have demonstrated the power of electronic mail and teleconferencing and other computer-mediated communications to help them run more efficiently, to allow large numbers of widely dispersed people to work together.

Less expensive and easier-to-learn versions of similar tools can help address enormous social problems. Good communications can reduce the need for travel. Parents can work at home part of the day, to be home when their children arrive. Educational software and links among parents and teachers can allow parents to become more involved in their children's education.

Your work today is setting the stage.

NICK ARNETT

*President*

*Multimedia Computing Corporation*

*Santa Clara, California*

---

# Preface

The steps of multimedia application development are very similar to any major project. There is a planning stage, a production stage, and a final stage where products are made ready to deliver to a client or to the public. The complexity and requirements of each of these stages is dependent on the particular project. You would not attempt to design an office complex, or take over the controls of an airplane, or even to bake a cake from scratch, unless you had some interest, knowledge, and understanding of the scope of what you were about to do. The goal of this book is to provide you with enough information about the production of a multimedia application that you can begin to develop your own multimedia products.

If you have produced media before, the information here will help you to understand what is different and unique about production for all-digital multimedia; if you have worked on software projects before, you will gain insight into the special requirements of audio, video, and still-image production. The complete novice will find this book a place to begin to learn what is required to begin, and how to put a multimedia team together.

The information here is presented in three parts that correspond to the three stages of project, or product, development—planning, production, and the final stage of releasing a product. Throughout the book, you will find production tips and techniques that have been used by other multimedia developers. The orientation of the authors is multimedia production. Each chapter is presented from the viewpoint of a producer, and is written so that a wide audience will be able to understand and apply the ideas and facts presented.

The first section of the book is dedicated to the project planning stage. In Chapter 1, you read about multimedia in general, and multimedia applications that are in use today. Chapter 2 is an introduction to the DVI hardware and software including Indeo™ video technology and the basic technical concepts of video compression and decompression.

Next, Chapter 3 provides more detail on the key production steps for developing multimedia software applications. In Chapter 4, you

will find information on the people, resources, and talents you may want to tap in multimedia production. Chapter 5 provides more detail about the application development workstation for applications using Indeo™ video, including the hardware and peripherals needed to complete the workstation.

The last two chapters of Section 1 share “tools of the trade” for project planning, and will spell out ways that you can use popular software products to help you control budgets and time lines of the project. Creative tools will also be unveiled to help you document the project with storyboards and scripts.

Section 2 of the book is a more detailed treatment of production. After a more in-depth look at the theory of digital motion video compression and decompression and image formats, each media element is covered in detail. Information on audio production, video production, still-image digitizing, and compression are all presented. Tips, shortcuts, and features of Intel’s video technology hardware and software for Indeo™ video are covered in this section.

Particular tips on creating graphics and on integrating visual material, such as motion video, stills, and VGA graphics for multimedia, are provided in Chapter 9. Chapter 10 is totally dedicated to still images as a media element in multimedia applications, while Chapter 11 is devoted to motion video and the special production techniques to keep in mind while producing video for the all-digital environment. Audio production is covered in Chapter 12. Chapter 13, the last in Section 2, is an overview of programming and authoring for Indeo™ technology. These chapters will help you to decide how you design a production that will result in a successful application.

Finally, Section 3 is dedicated to the final steps of getting your title ready for distribution. If you are preparing your title for CD-ROM or other magnetic media, including distribution on a Local Area Network, you will find the necessary information in Chapter 15. This section will also give you some tips about how to test your application, ways to store and distribute production among team members, resources about copyright law, and information about the future that you may want to keep in mind as you develop applications today.

In total, our goal is to provide you with a valuable resource to jump into the exciting world of multimedia production. There are many valuable lessons in these pages, and we are pleased to be able to share them with you. We hope to lead you down the path far enough that you can uncover more ideas and experiences as producers. Good luck!

MARK J. BUNZEL  
SANDRA K. MORRIS

---

# Acknowledgments

Preparing and writing a book is an ambitious undertaking, especially when you hold a full-time job. We would like to thank Sandra's husband Bill and our families for their patience and support during the weekends and evenings this book came together. To our children, Gordon and Garrett, as you grow up we hope the information contained in this book will inspire multimedia applications you can learn from and enjoy. When this happens, our goals for this book will have been met.

There are many people at Intel who have been extremely supportive and contributed directly and indirectly to the writing of this book. We would like to thank Rick Stauffer, Al Korenjak, and Scott Darling for reviewing portions of the book, and Karen Andring for her excellent copy editing and suggestions in the first edition. Mike Keith and Rick Yeomans helped to confirm technical details. A special thanks to Kevin O'Connell for his extensive technical review. Many other members of the Intel team have also contributed to the knowledge and techniques described in this book.

The staff at Avtex Research has been an enormous help in assembling the content and developing many of the production methods described throughout the book. Special thanks go to Leslie Service, Debra Lyons, Ken Wiens, Lisa Ramirez, Derek Wade, Eric Hards, Laura Phillips, Natalie Brunello, and Karen Moultrup for their help in assembling this material.

Many of the application screen designs used as examples in this book are the creative work of Nancy White. The cover design and artwork was created by Chad Little of Tracer in Phoenix, Arizona. David O'Dell, Cory Law, and Scott Luebke of Intel's Corporate Graphics department created the illustrations used throughout the book.

We would also like to thank Janet Brownstone of Intel, and Dan Gonneau of McGraw-Hill who encouraged us and have helped to keep the book production on schedule.

There are a number of other important contributors who have also helped us to learn more about the technology and who influenced the preparation of this book. We thank you for your contributions and look forward to your sharing with us in the success of the multimedia industry.

MARK J. BUNZEL  
SANDRA K. MORRIS

---

# Contents

List of Figures	ix
Foreword by <i>Nick Arnett</i>	xiii
Preface	xix
Acknowledgments	xxi

## Section 1 Project Planning

<b>Chapter 1. Multimedia Basics</b>	<b>3</b>
The Media Revolution	3
What Is a Multimedia Application?	5
Multimedia Software Development	6
Multimedia Applications Today	13
The Key Ingredient—Creativity	17
 <b>Chapter 2. Multimedia Technology—An Overview for Developers</b>	 <b>19</b>
Multimedia Basics—DVI Technology	20
What Is DVI Technology?	21
Multimedia Technology Summary	35
 <b>Chapter 3. Steps to Producing a Multimedia Application</b>	 <b>37</b>
The Production Stage	39
Software for Production—Indeo Video Capture	41
Programming Your Application	44
The Last Steps	46
Our Example	46
Success as a Multimedia Developer	50
 <b>Chapter 4. Staffing and Skills for Multimedia Production</b>	 <b>51</b>
The Production Staff—Tasks and Skills Required	52
Summary	66

<b>Chapter 5. Multimedia Hardware: Selection of the Delivery and Production Environment</b>	<b>69</b>
The Base Multimedia Development System	69
Other Data Storage Options	74
Local Area Networks	76
Potential Hardware Conflicts	77
Image Capture Subsystem	77
Computer Graphics Subsystem	80
Audio Production Subsystem	80
Motion-Video Capture	83
Software Environment for Multimedia Application Development	83
Application Development and Production Tools	85
Multimedia Delivery System	88
Where Do I Find Everything I Need?	91
<b>Chapter 6. Managing Multimedia Application Development</b>	<b>93</b>
Project Management for Multimedia	93
The Question of Budget	94
Project Time Line	103
The Product Proposal: Treatment, Budget, and Time Line	109
<b>Chapter 7. The Blueprints of Production: Flowcharts, Storyboards, and Scripts</b>	<b>111</b>
Design Documents	112
Content and Creativity—Maintaining Flexibility	123
 <b>Section 2 Production</b>	
<b>Chapter 8. How Multimedia Technology Works</b>	<b>127</b>
Displaying Still Images	127
Displaying Digital Motion Video in a Multimedia System	132
Image Compression and the Multimedia Producer	137
<b>Chapter 9. Designing Your Applications: Graphic Design for Multimedia Applications</b>	<b>139</b>
Elements of the Design Process	142
Text as Part of the Graphic Design	145
Fonts Dynamically Displayed	147
Still Images as a Design Element	148
<b>Chapter 10. Capturing Still Images</b>	<b>155</b>
Using Still Images in an Application	155
Capturing Still Images	155
Choosing the Still Images Format	158
Still Image Capture	163
Image Size, Memory, and Load Times	164
Budget, Production Time Lines, and Still Images	165

<b>Chapter 11. Producing Full-Motion Video for Multimedia Applications</b>	<b>167</b>
Production Planning	169
How to Order Compression of PLV Motion Video	176
Production Tools for Your Motion Video Files	177
<b>Chapter 12. Creating Multimedia Soundtracks</b>	<b>183</b>
Elements in a Soundtrack	183
How Does the Process of Soundtrack Production Begin?	187
Digitizing Audio	191
<b>Chapter 13. Bringing Your Application Together with Programming or Authoring</b>	<b>195</b>
Authoring	197
Selecting the Right Programming or Authoring Environment for an Application	204
The Process of Authoring or Programming	206
The Programmer as Team Member	208

### **Section 3    Getting Your Application Ready for Distribution**

<b>Chapter 14. Testing Your Application</b>	<b>211</b>
Develop an Application Test Plan	211
Functional Tests	212
Installation Procedures	214
Random Testing	215
Alpha Testing	216
Beta Testing	217
Once You Have Completed Testing—The Real Beta Begins	217
<b>Chapter 15. Distributing Your Multimedia Application</b>	<b>219</b>
CD-ROM	220
Writable CD-ROM Recorders	222
WORM or Erasable Drives	222
Local Area Networks	223
Archive Streamer Tape Backup System	224
DAT Tape	224
Removable Cartridge Systems	224
Floppy Disks	225
Efficient Transportation of Large Files Is a Reality	225
<b>Chapter 16. Copyright and the Multimedia Producer</b>	<b>227</b>
What Is a Copyright?	227
Budgeting the Acquisition of Media	229
How to Acquire Rights to Media	230
Copyright Violations	231
Resources for Copyright Protection	232



<b>Chapter 17. The Future of Video and its Applications</b>	<b>233</b>
<b>Compression and Standards</b>	<b>234</b>
<b>Powerful New Programmable Processors</b>	<b>235</b>
<b>Advancement in LANs to Transport Multimedia Data</b>	<b>236</b>
<b>Something Is Missing</b>	<b>237</b>
<b>Appendix A. Additional Reading</b>	<b>239</b>
<b>Appendix B. Resources for Multimedia Production</b>	<b>243</b>
<b>Appendix C. Getting More Information</b>	<b>251</b>
<b>Glossary</b>	<b>255</b>
<b>Index</b>	<b>259</b>