Computer Graphics and Multimedia

Applications, Problems and Solutions

John DiMarco

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Preface

Making sense of the extensive disciplines and sub-topics within computer graphics and multimedia is a lifelong challenge. No one can be versed in all areas at once due to the vast amounts of information that exists on all the subject areas and due to the dynamic nature of technology. Inevitably, we specialize. Programmers create programs and artists create art. Computer scientists are programmers and artists use computers to paint digitally and perform graphic design. That's the way it is today, is that not accurate? Nothing could be further from the truth. In 1919, Bauhaus pioneer Wassily Kandinsky stated, "And so the arts are encroaching upon one another, and from a proper use of this encroachment will rise the art that is truly monumental" (Packer, xv, 2001). The emergence art that is truly monumental has not yet been seen. The same can be said of technology and science. Of course, time is marked by influential events that shape the history of the discipline, but one monumental event ultimately replaces another. Looking back is essential to growth, but looking forward to "the next big thing" is the prominent response to success. What has emerged on a superficial level is an artistic and technical society that has ingrained disciplinary boundaries that often characterize researchers, scholars, and artists as one-dimensional practitioners that do not stray from their grass roots. This notion has been changed with the growth of digital technology. Technology has promoted interdisciplinary collaboration to become an integral part of mainstream educational practice. Academic programs that institute interdisciplinary projects and exploration have begun to nurture a movement in collaboration that is genuine, exciting, and boundless. This can be seen in distance education trends, interdisciplinary degree programs growth,

and the transformation of working individually on a project or being part of a specialized team. In academia, this collaborative approach is born from the need for every scholar to define new applications for development within their specialization. Secondly, the interdisciplinary approach fosters a new multitude of problems that incite exploration of multidimensional and often multidisciplinary solutions.

US VS. THEM

Although collaboration is the goal, often artists and programmers stray from each other's tools, techniques, and processes. Therefore, the debate begins. Here is an example of a typical artist vs. techie debate; What is better to use in web design, HTML hand coding, or WYSIWYG software such as Macromedia Dreamweaver? Is HTML hand coding better than writing the code transparently within an intuitive user interface? Does it truly matter? The result is the same — a web page. Why the debate? Well, we all want to think that our discipline and approach is a better solution. One main cause for tech vs. art is the natural inclination of the masses to view technology as simply a term for computers and peripherals. When in fact, the Greek word *technikos* means **of art**. The word technical is also defined as: *of or relating to technique*. In addition, the word also carries the meaning: *having special knowledge of a mechanical or scientific subject*. Technology is defined by Merriam Webster as: *a manner of accomplishing a task using technical methods or knowledge*. If the word technology is so scientific, where did it find its way into art? Billy Kluver, a Swedish-born engineer in the late 1950s became a chief catalyst for the art and technology movement in the 1960s. Kulver was a pioneering proponent in the marriage between art and technology. Inspired by Aristotle's notion of Techne — in which there was no differentiation between the practice of art and science. Kluver was a crucial conduit in interdisciplinary collaboration between artists and scientists. In a 1996 essay titled, "The Great Northwestern Power Failure," Kluver states, "The artists work is like that of a scientist. It is an investigation which may or may not yield meaningful results; in many cases we only know many years later." Kluver was a visionary who understood the value of technology as a gathering force in collaboration, not a obstacle. The work Kluver accomplished with Robert Rauschenberg in their founded group Experiments in Art and Technology (E.A.T.) was critical to today's interdisciplinary collaborations. E.A.T. encouraged artists and engineers in interdisciplinary technology-based art projects (Packer, 2001).

SHARING WORDS

Highly shared words throughout many disciplines, computer graphics and multimedia have become foundations for scholars to explore within their own contexts. The terms are found universally throughout many disciplines that bear no resemblance to each other in purpose, process, and output. It is appropriate that the digital scholar is to understand, embrace, and explore the countless tributaries of opportunity that exist within computer graphics and multimedia. Within concentration areas, there exists a mountain of terms that has an immeasurable amount of specialization and hybrids. Each one is important in the unique function of a particular problem. Engagement of unknown areas is critical to developing a true meaning for the word technology.

BOOK ORGANIZATION

This book has a diverse authorship that spans several disciplines, countries, and levels. Specifically, three main areas are focused on. Section I is *Digital Design*. Chapters in this section explore topics within digital design education, production, culture, and techniques. Section II is *Computer Science*. Chapters in this section provide extensive insight into computer science research topics including 4d visualization, virtual environments, graph aesthetics, and video indexing. Section III is *Multimedia and New Media*. This section contains chapters that cross boundaries between digital design and computer science. However, because the chapters engage multiple media and integrate interactivity in the discussion, they are classified as multimedia or new media chapters within this text. The topic areas include Macromedia Flash programming, digital asset alignment and management, analysis of digital audio, and machine vision in the arts. This diverse array of art, technology, and science all come together to make up a small piece of the vast subject we know as computer graphics and multimedia. One major goal of this text is to enable the reader to open their minds to the extensive journeys that can be taken exploring merely one specialization in computer graphics and multimedia. This book also hopes to encourage artists to understand and embrace collaboration in science and technology. And to encourage scientists, engineers, and techies to open the doors to collaborative interdisciplinary projects allowing scientists and artists to come together as hybrid technologists who share the same vision and principles towards problem solving, but do not share the same educational, experiential, and technical backgrounds.

There are 12 chapters in this book. They are fairly divided between digital design, computer science, and multimedia/new media. Here is a brief description of each chapter's significance.

Section One: Digital Design

Chapter One, *Teaching Computer Graphics and Multimedia: A Practical Overview*, analyzes and identifies problems and solutions facing the digital teaching professional. The text develops a dialogue for new and existing instructors to understand and utilize in their digital teaching. The principles behind the chapter guide the reader into a practical understanding of rudimentary pitfalls, successful strategies, technology issues, and communication techniques that are imperative to teaching digital subject matter.

Chapter Two, *Digital Prepress: Issues and Solutions for the Preparation of Print Media*, addresses the changes that have occurred in the print design industry as a result of the digital revolution. The text focuses on print media and its preparation in the world of digital technology. This chapter highlights common problems and concerns that are present in the design, production, and output of print media.

Chapter Three, *Screenspace*, the author takes a fascinating journey through Tokyo landscape to uncover the Screenspace and Cellspace that has engulfed the lives of the Japanese. Fully interactive cellphones and jumbo LED displays have become commonplace in urban life. This chapter crosses boundaries into multimedia and ultimately describes the technical, virtual, and digital re-design of a living environment and culture as a result of integrating technology into everyday life. This text also places the screen into the true context it occupies in real life.

Chapter Four, *How to Use Photoshop to Improve the Gestalt of an Image*, develops an understanding of visual communication through images. The chapter discusses the composition of forms within the image having a structure, or Gestalt to carry the content through the end-user's perception process to a state of understanding. Discussions are included on the use of Adobe Photoshop for cleaning up distracting visual trash such as dust, hair, scratches or unwanted objects. Systematic directions and examples explain the entire process.

Section Two: Computer Science

Chapter Five, *Adaptive Narrative Virtual Environments*, will explore the technologies and issues surrounding Adaptive Presentation Management for Narrative Virtual Environments. Discussion will also examine the subject in a broader context, with regards to plans for enhancements and future systems in order to make VE technology more accessible to a wider range of applications in areas such as education and training, visualization, and communication, and even to enable new types of entertainment and games. Some

of the burden of managing the presentation should be lifted from the designer and the user, and placed on the computer.

Chapter Six, *Isoluminance Contours: A Fast, Simple Model for 4D Animated Visualization*, presents important background information on 4d visualization. The chapter highlights the Isoluminance Contour Model that not only provides a quick and easy method for generating images, but also dramatically reduces the amount of work required by traditional computer graphics methods. This chapter introduces the ICM for visualization, chronicles successful research findings and presents tangible results.

Chapter Seven, *Content-Based Video Indexing and Retrieval*, presents recent advances in digital video compression and networks. Content based video retrieval systems are reviewed and a new framework called *ClassView* is proposed to make some advancement towards more efficient content-based video retrieval. The chapter highlights several advances in video retrieval. The proposed framework includes efficient video content analysis, a hierarchical representation scheme, and a video database indexing structure.

Chapter Eight, *Evaluating Graph Drawing Aesthetics: Defining and Exploring a New Empirical Research Area*, describes a long-term project to investigate the validity of the design principles on which many automatic graph layout algorithms are based, not from the perspective of computational efficiency, but from the perspective of human comprehension. The chapter summarizes all the empirical work the author has done on the effectiveness of 2D graph drawing aesthetics. It also describes the process of initiating a new experimental research area, and of developing a framework for empirical studies within the area, with specific reference to the experimental methodology and statistical analysis issues involved.

Section Three: Multimedia/New Media

Chapter Nine, *Client and Server Side Programming Concepts Incorporating Macromedia Flash*, explains that the motion graphics and authoring package is more than a graphic arts program. This application allows the designer to create a true and unique graphical user interface (GUI). This GUI can be precisely programmed to support end user interactivity. Flash is not limited to the World Wide Web, however, it has found tremendous treatment in this arena. The general perspective of this chapter is to discuss Macromedia Flash as a tool for the delivery of multimedia content via the World Wide Web. In addition, object oriented programming and server-side scripting will also be addressed within and related to the context of this application. Short tutorials will reinforce the subject matter. These will enhance the reader's un-

derstanding in gaining a deeper perspective of Flash. This chapter will also address Flash's place in the many avenues and perplexities of web applications.

Chapter Ten, *Everything That Can Communicate Will: Aspects of Digital Asset Alignment and Management*, deals with the concept of aligning and managing digital assets as a reaction to the evolution of digital production and digital networks. This chapter highlights digital asset management as it relates to value and importance in the roles of digital liquidity, digital continuity, and digital viability.

Chapter Eleven, *Analysis of Musical Content in Digital Audio*, discusses how automatic analysis of digital audio with musical content is a difficult but important task for various applications in computer music, audio compression and music information retrieval. This chapter contains a brief review of audio analysis as it relates to music, followed by three case studies of recently developed systems that analyze specific aspects of music.

Chapter Twelve, *Certain Aspects of Machine Vision in the Arts*, attempts to consider the consequences of machine vision technologies for the role of the image in the visual arts. After a short introduction to the topic, the text gives a practical overview of image processing techniques that are relevant in surveillance, installation and information art practice. Example work by practitioners in the field contextualizes these more technical descriptions and shows how computational approaches to digital imagery can radically expand the use of the image in the arts.

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SECTION I

DIGITAL DESIGN

Chapter I

Teaching Computer Graphics and Multimedia:
A Practical Overview

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ABSTRACT

This chapter defines and examines situations, problems, and processes faced by teachers of technology. Based on experience teaching at three colleges with different economic, academic, ethnic, and financial attributes, this chapter provides stable and practical approaches to solving common issues. Each school environment and student population presents different technical and interpersonal challenges. Real experiences involving set up of college laboratories, development of digital curriculum, and creation of accredited programs are highlighted and transferred into tangible strategies. If you are new to teaching digital subjects, this text may help you get started. If you are an experienced teacher, this may bring you a new strategy or perspective. Ultimately, this chapter aims to assist

student teachers, experienced teachers, artists, information technologists, and computer scientists in becoming stronger in transferring knowledge and skills in the digital realm. In addition, the chapter hopes to invite scholars and educators to explore teaching computer graphics and multimedia within the context of their own disciplines.

INTRODUCTION

The teaching of technological output requires every student to get value from his or her experiences within the laboratory environment. The coursework and laboratory work that challenges a student should simulate real conditions. Course problems should present both conceptual and technical challenges to students. As a digital design professor, I feel that all "digital teachers" have a great responsibility to students. We must transfer knowledge and skills at the highest levels. We must be thorough in our approaches and precise in our criticisms. We teach what we know and must know what we teach. We must teach using real-world materials and techniques. Although we may have varied control over curriculum directions, we do have control over our success or over that of our students. We must encourage participation, communication, responsiveness, and critical thinking about design and final output. We must always encourage and never insult. We must facilitate practice — and plenty of it. We must be lifetime learners. We must have a personal technology budget. We must be empathetic toward the problems of the individuals we teach. We must take responsibility for the success of the students in our courses. We must care and commit to excellence.

MOTIVATION AND CONFIDENCE
Clear Your Mind and Prepare for Intense Mental Challenges Ahead

Go into the teaching environment with a clear head and focus on the task at hand. It is nearly impossible to communicate effectively when you have worries or problems on your mind. You can use concentrated breathing right before class to free your mind and body of negative energy. Here's how:
1. Sit down (preferably on the floor or on a comfortable chair)
2. Raise your arms and breath deeply with big inhales and exhales for seven to 10 repetitions

3.   Concentrate on only your breathing, repeat raising your arms, and take five deep breaths
4.   Relax your mind and empty it of all thoughts
5.   Get up slowly and focus on the task at hand
6.   Review and talk out your lesson outline before leaving the house
7.   Arrive at class a few minutes early — rushing will raise stress levels

Remember that teaching computer classes is a mental workout. It makes your mind move rapidly through a barrage of material. It requires you to take information and present it in a hierarchical structure. That requires clear thinking! Here are some tips to help build confidence and success.

Walk Around the Class Frequently

If possible, make it a point to stand briefly near each student. Doing this generates attentiveness and immediately revives a bored student. Mobility keeps people awake!

It is essential to engage students freely and often. It induces interactive communication and results in illustrating your teaching style as a "hands-on" approach. Stay in tune with student work to nurture revision and improvement. Take pride in the project's success: the student is a product of your guidance and cultivation.

How do you stay mobile? Wear comfortable shoes — you will be on your feet. And make a 10-minute rule. If you are seated for 10 minutes or more, get up and walk around. It will keep you sharp and the class listening and alert.

Avoid Frustration

Frustration is one of the biggest obstacles for computer teachers. You must be able to reverse negative student attitudes. You must be able to deal with people who, at first, do not get it. No matter how much you repeat, they do not understand and cannot execute. Try to refrain from berating foolish questions. Be critical, but kind. Become the nicest person you can be — then get even nicer. Being friendly results in relaxation and comfort for the student. Be friendly, but firm. Expect results and anticipate initial failure. Be ready to console and control the negative situation. This is extremely important in the arts where creativity must flow freely. Whoever said "patience is a virtue" never taught computer-based coursework. Do not crack under pressure. Being a computer teacher requires the patience of a saint. Why? Because every time you have a class that exceeds one person, you have students who have different

levels of knowledge and skills with computers. Unless you are teaching an introductory course in computer basics with a room full of blank slates, you will have some students who are more knowledgeable than others. Students may walk into class who have never have touched a computer. In that same class, there may be students who have used computers at home, at school, at work, or in prior training and coursework. You may have a disruptive student or an extra-experienced one who wants to stump the teacher with outlandish or unrelated personal equipment questions that cause class flow to be halted. In the classroom, your brain will be torn in many directions. Do not give up. Stay with it.

Remember Who Controls the Class — You Do!

You control the class, the class does not control you. Therefore, you should set a pace appropriate for your teaching speed — not appropriate to the levels of one or two students. Do not try to cover an abundance of material to satisfy one advanced student. You will end up losing the rest of the class. Let the student explore advanced techniques on their own time or during individualized help sessions with you. Do not lower the goals of the class to cater to one student. We work in a competitive world where computer art and multimedia may not be for every student. Let students understand the responsibilities involved in learning. Both the teacher and student are responsible for success. Without mutual effort, respect, and extensive communication learning will be retarded. Allow a lagging student to work under less intensive criteria; in an academic setting, however, grade accordingly. Sometimes it is best to allow an advanced student to explore new concepts and techniques. Encourage the right students to accelerate or to slow down while keeping the entire class working on the same project at the same pace. This seems like an impossible equilibrium, but try to achieve it. This helps when demonstrating techniques. It helps eliminate premature and old questions.

STUDENT INTERACTION
Motivate Students by Relating Hard Work to Tangible Reward, Not to Academic Failure

Be a coach. Install a winning attitude in every student! Make your class a win-win situation for all students. Let them know that the efforts they put in during class sessions will reap rewards later in their careers. Equate effort to success. Learning computer graphics and multimedia requires a concerted

effort toward success. This must include diligent work inside and outside of the classroom and the computer lab. It requires a commitment to lifelong learning and the expansion of skills that occur regularly throughout one's career. Students have to buy into the fact that you are not just their teacher, but also an expert and a valuable resource for them. They have to trust your abilities and they have to share a common goal with you — their success. I believe that a teacher on the college level should try to avoid threatening students with bad grades; rather, make students aware that their grades rely upon success in the course and the projects assigned. Students' success is directly related to effort inside and outside the classroom. Here is my philosophy — I share these thoughts with my students on the first day of each new course:

> *To learn our craft, we must practice. Practice takes the form of projects. Projects must be completed to succeed in the courses. Completed, well-done projects in our portfolios and backgrounds help us get new projects and jobs. Projects portray our skills, abilities, and experiences. Make your portfolio scream of completed projects and you will succeed in getting the opportunities you want.*

Determine "Can't Do Students" from "Won't Do Students"

Throughout my career, different types of students have challenged me in valuable ways. I have had to learn how to guide them to meeting goals. I categorize notably challenging students in two ways: "can't do students" and "won't do students".

The reasons behind both types of students may be abundant. However, I have found that there are general consistencies between each type. Determining student type and motivation will help you in your goals to help these students succeed in the course, and inevitably to build confidence, skills, knowledge, and work.

"Can't Do Students"
- May have personal problems that are affecting class involvement (missing class for work or illness)
- May not have the time to devote to practice and/or to continued learning
- May not have the resources (lacking a computer at home or the proper software)
- May lack prerequisite skills
- May have a learning disability