

# Digital Media Curriculum Development Project

Yue-Ling Wong  
Computer Science Department  
Art Department  
Wake Forest University  
USA  
ylwong@wfu.edu

Jennifer B. Burg  
Computer Science Department  
Wake Forest University  
USA  
burg@wfu.edu

**Abstract:** This paper presents and discusses an interdisciplinary digital media curriculum project that is currently under development. The material, designed for students of either computer science or art, contains a core curriculum necessary for both groups of students, presented in an integrated, modular approach. The curriculum consists of three modules: a primer, a CS advanced module and an art advanced module. The material covers topics on image processing, digital audio, digital video, and multimedia authoring. It will be delivered in an electronic format (Web, CD-ROM, and e-books) with interactive multimedia tutorials, visual aids, and worksheet exercises.

## Introduction

With the rise of student interest and the prevalence of multimedia in widely ranging work environments, there is a need for a digital media curriculum that addresses both the technical and the aesthetic elements of multimedia creation, and a need for a curriculum that balances hands-on experience with fundamental concepts that remain constant beyond fast-changing multimedia development tools. In response to such needs, we are developing material aimed at students who wish to study digital media from the perspective of a computer scientist, those who wish to study it from the perspective of an artist, and those who wish to study it from both perspectives.

Digital media is a relatively new discipline, and its academic home varies from one university to the next. Some schools have independent digital media or multimedia programs. Others offer the program under various departments, such as computer science, art, or communication. Due to the subject's highly interdisciplinary nature, the curriculum emphasis varies from one department to another.

What is needed is curriculum material that finds the common ground of all approaches to digital media, and then moves from there to more advanced focus on other discipline-specific topics. The most adept and successful digital media professionals will be those who combine expertise in software tools (*application*) with understanding of the science and mathematics upon which the tools are built (*theory*) and adaptability to rapidly evolving technology. Students need to sharpen their sense of aesthetics and design as well as develop their skills in efficient, user-directed implementation. Good curriculum material should pull these interdisciplinary elements together in a coherent and organized manner, with an emphasis on the concepts and skills that will remain relevant beyond the ever-changing versions of software tools.

## Approaches

Our digital media curriculum project is under development as a proof-of-concept project under a National Science Foundation grant. Our main approach to curriculum development is based on modularity and incorporation of interactive learning aids such as computer-based tutorials, demos, exercises, and worksheets.

The modularity of the curriculum material allows students and instructors of various digital media programs at different schools to pick and choose from our material to match their program's emphasis. Interactive

learning aids allow students to visualize difficult concepts, get instant feedback, and create hands-on solutions to problems that make theory come alive.

## Integrated Interdisciplinary Course Material – Primer, CS Module, and Art Module

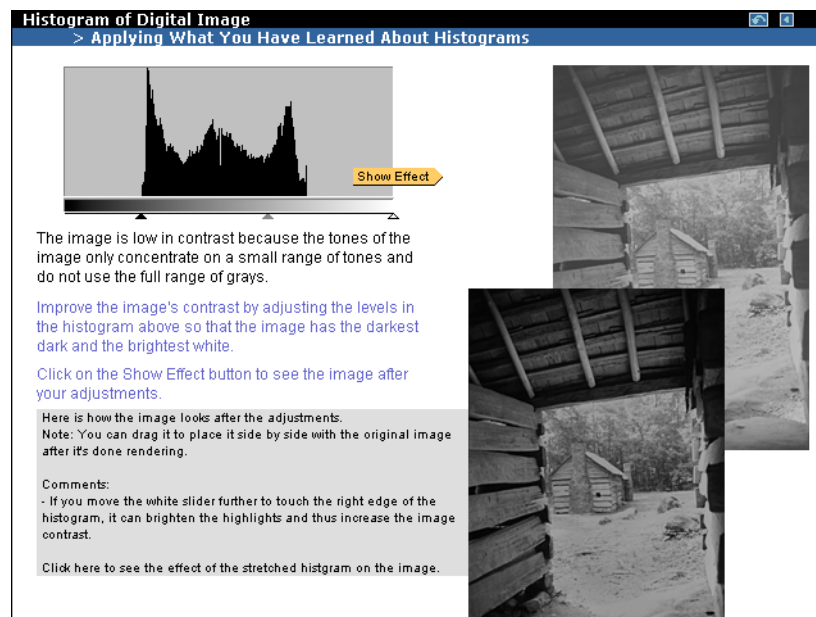
The challenge in coordinating a digital media program between computer science and art is showing students the relationship between the science and the art while taking them to a level appropriate for their major. Our grant-supported curriculum development project is premised on the idea that the study of digital media – whether it is looked at from a computer scientist's or from an artist's perspective – is based upon a central body of information. There are certain fundamentals that students from either camp must understand. We call this basic body of knowledge the digital media "Primer." Branching from the Primer in either direction are the "advanced modules" in computer science and art. For computer science, the advanced module ensures that the digital media course goes beyond application programming. The advanced Art Module, on the other hand, delves into graphic design, aesthetics, human perception, and technical fundamentals behind common art techniques and concepts.

The material of all three modules covers topics on image processing, digital video, digital audio, and multimedia authoring.

## Learning Aids

Interactive demonstrations, exercises, and visual aids as well as worksheets are an important element of our curriculum material. For the Primer, we attempt to make the exercises intuitive and base them on simple real-world experiences, concepts, and analogies. The demos in the CS Module, on the other hand, are more mathematical and analytical in nature. Examples from the first two sections – Background and Digital Image Processing – serve to illustrate this approach.

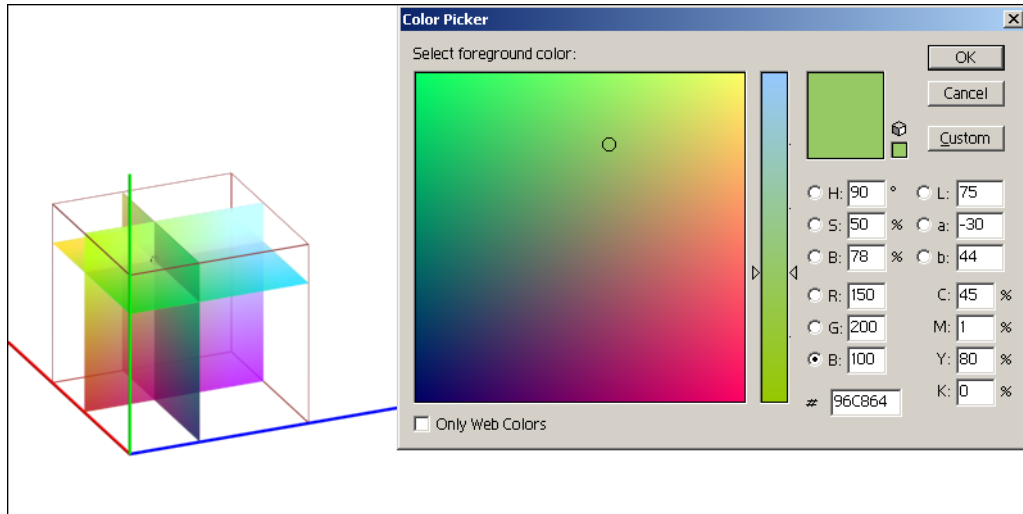
In the Primer, the concept of sampling and quantization in the digitization process is illustrated by means of an interactive demo that allows the student to monitor a puppy's growth rate by weighing the puppy on an analog scale. An online tutorial teaches concepts of histograms. At the end of the tutorial, there are online exercises that test the student's understanding of the subject by having them to interpret and stretch histograms. (Figure 1)



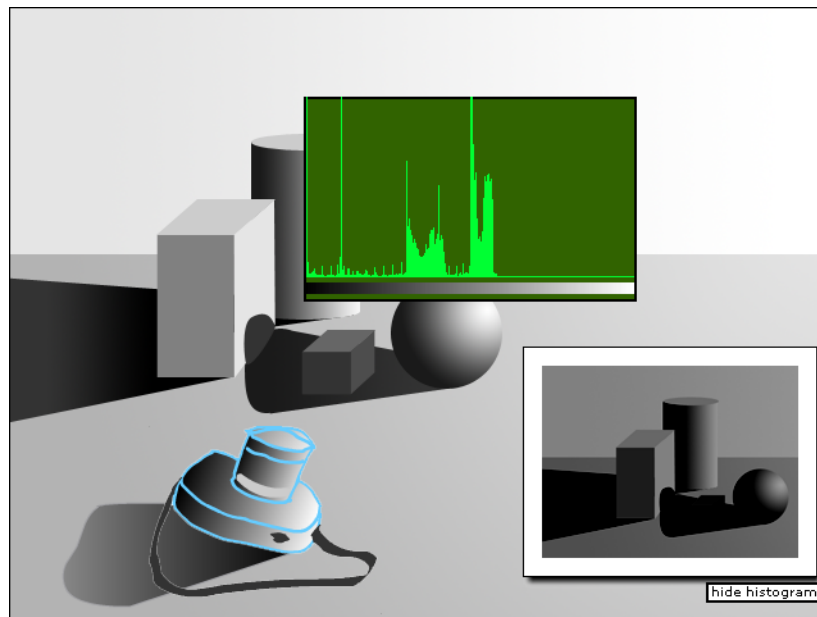
**Figure 1:** A screenshot of a primer module interactive tutorial. This online tutorial teaches concepts of histograms. At the end of the tutorial, there are online exercises that test the student's understanding of histograms with instant feedback.

In the CS Module, interactive demos are particularly useful in explaining the geometric representation of color spaces. One demo allows the students to take slices through the RGB color cube and to see what colors lie on various horizontal or vertical planes. (Figure 2) Another demo shows the students the distortion of the RGB color cube into the HSV hexacone, thus letting them visualize the algorithmic transformation in a color space. These demos can be viewed at <http://www.wfu.edu/~ylwong/digitalmedia> along with the text-based curriculum material.

In the Art Module, the material is geared towards the science that underlies artistic techniques or concepts that art students commonly apply in creating artwork. For example, an interactive demo emulates spot metering in photography and relates the metering concepts to histograms. (Figure 3) Again, in relating RGB color space to color selection during the creative process, another interactive exercise, called "Color Appraisal Fair," tests the student's eye for color and trains them to be able to tell the approximate RGB values for a given color. In another example in the Art Module, inkjet printing and color mixing are related to pointillism.



**Figure 2:** A screenshot of a CS Module interactive demonstration. This demo allows the students to take slices through the RGB color cube and to see what colors lie on various horizontal or vertical planes. Putting the common color picker found in most digital imaging applications side by side with the RGB color cube allows the students to make a connection between application and theory.



**Figure 3:** A screenshot of an Art Module interactive demonstration. This example emulates spot metering in photography and relates the metering concepts to histograms.

### **Distribution and Delivery of Materials**

The obvious and natural medium for this course material is electronic. The modules are being created in a Web-based format, and will be also produced as an e-book version. The material is available at <http://www.wfu.edu/~ylwong/digitalmedia>. To disseminate our material to a wider population, we are also contacting publishers to publish our material in the traditional textbook format.

### **Evaluation and Future Work**

The curriculum material is currently being used with computer science and art students at Wake Forest University. The first year of the grant program entailed gathering baseline information using existing traditional curriculum material. Baseline data was gathered through questionnaires measuring the students' incoming knowledge and periodic tests in the Digital Media/Digital Art/Digital Imaging courses measuring their mastery of concepts and skills. In the spring of 2003, part of the new course material is being used.

When all of the curriculum material has been completed, computer science students in the Digital Media course and art students in Digital Art will be required to read and master the material in the Primer. From the Primer, all students will have access to the advanced modules. The CS module will be required for students in the computer science Digital Media course, but they will also be able to consult the advanced Art Module, and vice versa for the art students. The course material is essentially Web-based but will also be developed as a traditional text-based publication as well as in e-book format, as described above. The material is available at <http://www.wfu.edu/~ylwong/digitalmedia>.

Additional topics such as Web page authoring, Web site management, and computer animation will be considered when we expand our digital media curriculum in the future.

By finding the common ground in the study of digital media that is shared by both technical and artistic perspectives, and by using coherently interrelated course material, it is possible to incorporate a well-integrated and rigorous digital media track into existing computer science and art departments without complicated curriculum revision or new degree programs. Because of the modularity of our material and its integration of technical and artistic information, our curriculum material can be used in schools with full-fledged independent digital media programs, or in schools where digital media is woven into other academic disciplines.

### **Acknowledgement**

This material is based on work supported by the National Science Foundation under Grant No. 0127280.