

# Computer Graphics Curricula in the Visual Arts

Dena Elisabeth Eber

Bowling Green State University

Bowling Green, Ohio, USA

deber@christo.bgsu.edu

## Abstract

*Computers have recently emerged as commonplace on the scene in a record number of university art departments. This rapid change has created the need for new curriculum in the computer art discipline. In designing these courses I see three ideas that are paramount to any computer graphics curriculum in the visual arts. First, the courses and course work should focus on individual expression and creativity, second, the instruction should include an awareness of the “wow” factor, and third, the courses should include a balance of computer art, traditional art, computer science, and academics such as theory, art history, and criticism.*

**Keywords:** *computer graphics curriculum, visual arts, higher education*

## 1. Introduction

Against many odds and tight budgets, computers have recently emerged as commonplace on the scene in a record number of traditional college and university art departments. As part of this rapid change, artists are not only using computers as an extension of many traditional art practices, but they are also using them as a medium to create unique digital art forms. From imaging, digital painting, and 3D modeling, to interactivity, video, and 3D animation, graphics technologies give artists the power to use the computer as an expressive art form, thus forging new educational and aesthetic concerns in curricula for computer graphics educators. This paper will address a subset of these concerns in a general way with the intention of highlighting areas that individual programs and researchers can further expand.

### 1.1. Scope of Paper

This paper will articulate some curricular issues related to teaching computer graphics in the visual arts at the higher education level. The 1990 *Guidelines for Curricula in Computer Graphics in the Visual Arts*, also known as *The Dream Curriculum*, addresses similar issues, however some have changed and others have emerged since its publication [7]. I will touch on a small number of

the emergent and dated topics. Other areas of art such as music and theater may also be affected by the changes in computer graphics, but these domains are not covered in this paper. Also of great importance but outside the scope of this paper is computer graphics in kindergarten through twelfth grade (K-12). This document is concerned with curricula for students at the college level who have chosen computer graphics as a field of study and as a career in the visual arts.

Curriculum for computer graphics is quite broad with applications ranging from graphics and textile design to studio art. This paper is modeled after a studio art approach, however, it also encompasses the commercial arts such as graphics design, interior design, textile design, architecture, interior, industrial and packaging design. Both the studio artist and the commercial artist focus on expression through visual media, however, the key difference is the application of that focus. In graphics design and commercial arts, the focus is on a client or a customer and the goal is to use personal creativity to visually express, design, or illustrate a product or idea. In studio art, the focus is most often on the artist's personal expression, creativity, or idea through visual media.

The suggestions in this paper do not go into enough detail to differentiate the nuances between these two general approaches, especially as the line between them becomes more and more indistinguishable. However, it is my intention to highlight that I am writing from a studio art frame of reference and to leave the application of my suggestions up to the reader.

### 1.2. What is Art?

*Art is a human activity consisting in this, that one man [or woman] consciously by means of certain external signs, hands on to others feelings he [or she] has lived through, and that others are infected by these feelings and also experience them.*

Tolstoy, from *What is Art?*, 1897

A work of art, according to Tolstoy [8], is sincere, and it transmits information, feelings, and experiences through lines, colors, sound, or words. Actualization of the elements embedded in the imagery start with the creator, the creative process, and the ability to see and to know through that seeing. The work may take varied forms, but to be art, the object, idea, or presentation goes beyond the physical and contains some aspect of human experience. Art may be created with any tool, as long as the artist can use that tool to put some of their true self into the art.

A common approach to teaching studio art is to stress expression of the individual, a focus that goes far beyond the tool or medium. Artists have always used technology and many have learned to express themselves in a way that emphasizes the message, not the medium. There are many other dissenting views of media, some of which are based on Marshall McLuhan's idea of electronic media, that the medium is the message [6]. Bits that underlie the varied digital representations are all the same, thus setting expressive boundaries upon artists [4].

The balancing of the message and the medium in digital technologies is similar to a problem that artists have always had when working with new media of the time, however, digital technologies add a new twist. Computer hardware and software technologies are being replaced at the rate of every eighteen months, if not faster. Rising beyond the medium takes time, but an ever-changing paintbrush that is highly technological hinders the time artists have with it. New tools require them to re-learn a skill set, which in turn, forces them to constantly shift between artistic expression and skill acquisition, two different ways of thinking. Teaching computer graphics in an art setting demands finding a delicate equilibrium between artistic expression and technological proficiency, something the curriculum must address.

## **2. A General Approach**

### **2.1. Philosophical underpinnings**

No matter the focus of a digital art program, be it a specialization within a traditional university art department, an extension of an established studio area, a commercial major, or other related areas, the curriculum must balance digital technology with other concerns. I see three ideas that are paramount to any computer graphics curriculum in the visual arts:

- 1) The courses and course work should focus on individual expression and creativity,
- 2) The instruction should include an awareness of the "wow" factor
- 3) The courses should include a balance of computer art, traditional art, computer science, and academics such as theory, art history, and criticism.

For students to make expressive art, they must pay attention to the message it portrays. This means that instructors need to make a pedagogical shift from technique oriented curricular goals to exercises that limit the tool set and leave room for experimentation, play, and theme based works. The tool set should be expanded only after students address content and show a level of comfort with the medium. In this way the digital techniques will be one important concern, among others. Further, the students then have time to figure out what they want to express, thus shaping the medium rather than the medium shaping them. The critiques and assignments should focus around an idea, which stimulates self reflection and critical thinking. The premise of this approach is if an instructor stimulates critical reflection and dialogue within and between the students, then they will have a better understanding of how to shape digital media to express their ideas. This will in turn dramatically improve the outcome of their work [3].

Related to individual expression is an awareness of the "wow" factor, a condition that is especially abundant when working with digital media. This characteristic takes many forms, but in most cases it is a desire on the part of the student to create works solely for the application of a cliché or often overused special effect. Not only does this kind of work look canned or have an "off-the shelf" aesthetic, but it lacks personal expression and creativity and shifts the focus away from critical reflection and back to surface level technique. It is for this reason that instructors must point out the "wow" factor and de-emphasize it.

Beyond cliché and content, it is my view that the curriculum should include art theory, criticism, and history at least within the studio courses, but most preferably in addition to them. Not only does this help artists identify their work with other art in computer graphics and traditional media, but it helps them critique it and understand how their ideas can expand on those of others. Schools such as Keel University stress a 50/50 split between studio and theory, which provides the student with discourse and data to situate their work in the digital and art world [2].

Keel University also requires the computer graphics student to work in another studio area such as photography, print, painting, or sculpture. This allows students to see different approaches to expression that computer graphics can extend. It is my view that this approach also helps the student understand and contextualize their work with digital media, a new and multifaceted medium.

Not only should the curriculum address computer art, other studio art areas, and theory, but it should also introduce the student to programming. *The Dream Curriculum* [7] points out that teaching artists how to program is a controversial notion. At the time it was written, artists who wanted to use three dimensional (3D) imagery and other image effects in their work had to write many of their own programs. Since then, powerful image processing and 3D modeling packages have been written and the artist no longer has to, but often still does, program.

Also since *The Dream Curriculum*, use of the world wide web (WWW) has emerged and many other kinds of scriptable interactive packages have become available. There will be times when most artists will need to write scripts, however what kind, in what language and for what purpose will prove to be dynamic. Underlying any specific programming application is the basic understanding of programming logic, data structures, functions, input and output, and variables. At minimum, artists should understand these ideas in whatever flavor is available, such as C or visual basic. This should be a class most preferably in computer science because the cross disciplinary setting gives both artists and computer scientists each a taste of the other discipline and how people in that field think. This setting is increasingly important as industry heads towards interdisciplinary art and science teams.

Some artists may choose to go beyond the basic programming level and make it a larger part of how they create art. Some artists and educators believe that programming is one way to break the “pre-set” or “off-the-shelf” aesthetic that makes some work appear unoriginal [4]. It is my view that this approach will work for some, but not all. Programming requires a technical, spatial, and linear way of thinking, which some artists employ in addition to non-linear and emergent approaches. However, there are many art students who do not think in this way and have talents or intelligences in many other styles such as personal or bodily-kinesthetic forms [1]. These methods and more can be integral to making successful works of digital art.

For these students, intuitive software provides the tools they need to make rich and expressive works of art. There is a lot that focused and creative students can do with a pre-programmed digital paint brush.

I believe that the learning objectives for students in computer graphics and the visual arts should include not only technical proficiency, but also an understanding of the significance of their work and how they can manipulate the medium to express their message. They can accomplish this through a curriculum balanced in complimentary areas as well through instructors that stress ideas as well as technique.

## 2.2. Foundations Core

A common approach to university level art programs is to begin with what is called a foundations core, or a set of classes that address basic art principles. Many programs break this up into the two dimensional (2D) and three dimensional (3D) areas. 2D course work often includes drawing, composition, color theory, figure drawing, and painting, while 3D course work focuses on different forms of sculpture. Some programs are also incorporating sections that cover the concept of time, performance, criticism, theory in contemporary art, interactivity, and installation art. The computer in foundations is threefold, it can be used as an educational tool to teach concepts such as color theory, it can be taught as an extension of other media such as printmaking or painting, or it can be addressed as a medium in and of itself.

It is my view that computer graphics as an art medium should in some way be part of the foundations core. It is important that students using all media understand the role that computer graphics plays in their art making, be it directly or indirectly. In other words, it is meaningful for all artists to have an understanding of digital media as a basic core requirement, much like drawing is treated as a core for all art students, which brings up another point of contention.

Converse to the argument that non-computer art students should be exposed to digital media is the argument that computer art students should take drawing. Since *The Dream Curriculum* was written, computer art has become a commonplace major or specialization. As a result of this change, may contend that not all the standard core requirements apply to computer art majors. It is my view that drawing and other basic core requirements are absolutely essential for computer graphics majors.

Recall I stated that art is about seeing and core requirements, if nothing else, help students learn to see.

Others say that drawing helps those in computer graphics, a discipline that stresses vertical thinking, to solve problems in a lateral way [5]. Vertical thinking is characterized by a stepwise logical process, while lateral thinking is a non-linear process. A vertical approach to finding a solution might be to search one entire plane of solutions when in fact the solution is on another search plane. The lateral approach will throw the search into a new space at which time vertical thinking may take over. Most people can think in both ways and according to some, drawing is one way to exercise lateral thinking in computer graphics, which is otherwise a vertical discipline.

In designing the core curriculum, I think one very important and often overlooked notion, especially for computer art majors, is that of time, or 4D. 2D or 3D computer animation, digital video, and interactive works of art such as WWW pieces or virtual environments (VE) all require an understanding of how ideas unfold, change, and take shape over time. Whether it is dealt with in a separate course or addressed in a section of a universal art core class, the concept of 4D should be included because it is basic to many computer graphic art forms.

### 2.3. Enter Computer Graphics

Whether computer graphics is part of the core curriculum or not, computer art majors must begin work in their discipline at some time. A point of contention is when to start computer art majors in computer art classes. In some programs, computer art majors begin work with computer graphics at the upper-class level, only after the core classes are complete. In a four year program, this means that they do not start with computer graphics until the end of their sophomore or the beginning of their junior year.

I believe that computer graphics majors in the arts must start on the computer as soon as they can, preferably in their first year. The first course should be a sampling of the computer art focus areas offered at the institution. From this course, the ones that follow should be a higher competency level in a particular focus area. See table 1 in section 3 for some of these areas.

As I have already mentioned, art is a form of expression and it is up to the artist to learn how to

shape the medium to do so. This takes time, much more than two final years of college can provide. Further, the students need to be aware of the capabilities that the computer graphics medium provides while they form their artistic ideas.

### 3. Beyond the Core: Focus Areas in Computer Art

*The Dream Curriculum* mentions that art educators need to decide if computer graphics will be a support area for other media or a major unto itself. Since 1990, it is more common to find a computer art major or specialization in an art program than a computer lab which supports other disciplines. It is for this reason that the following suggestions are intended for computer art majors. I did not indicate competency levels or what courses should come in what order following the core classes. That, I believe, should be tailored to individual programs and resources. However, I feel students should have some understanding about *the still* and *time* before they can fully grasp the potential of interactivity.

The purpose of the following list is to highlight areas or directions that programs can follow in computer graphics. I chose to break this expansive discipline into four major areas; the still, time based works, interactive works, and computer graphics with other media. This same list could be viewed in many other ways, such as 2D, 3D, and time. The four suggested areas are not mutually exclusive, as many crossover in inextricable ways. Table 1 is a list of the four areas and some topics that fall within each.

The Still	Time	Interactive	Cross Computer Art
2D Imaging/Digital Paint	2D animation	Web based art	Digital Photography
3D modeling	3D animation	Interactive CDs	Printmaking & Computer
Installation or Sculpture	Digital video	Interactive installations	Fibers & Computer
Algorithmic	Digital Performance	Virtual Environments	Drawing/Painting & Computer

Table 1. Some suggested areas of focus in computer graphics for the visual arts.

### 3.1. The Still

The still is a form of computer art that does not include time and can range from a print of a digitally manipulated photographic image to an installation or a sculpture. The still can be wholly generated on the screen, such as a digital painting or a 3D model, or can include scanned or acquired imagery or algorithms. Especially at issue with the still is "objecthood," or the still as a physical material, such as a print rather than an image on a screen. "Objecthood" is not a concern within the scope of this paper, however it is one that should be addressed in the course work.

The still is often thought of as a 2D or 3D image, however I have included installation and sculptural works because they deal with a single instance of time. An understanding of 4D is so crucial to some areas in computer art that I used it as an organizing factor that surmounts the difference between imagery and sculpture. A digital installation could be time based, especially if it includes digital video, but the sculpture I refer to in the still category is one that deals with a single instance in time. This includes anything from the latest resin based stereolithographic sculpture to still images that have been realized in some sculptural form such as digital images wrapped around a cube.

### 3.2. Time

It is one thing to understand how the composition of a single image works formally and expressively, but it is quite another issue to understand how that aesthetic changes over time. What is important for expression when the viewer cannot contemplate each frame? How do ideas change as the still image moves? How does time factor into the overall success of the art? These questions and more are ones that time based course work must address.

Courses in this area include 2D and 3D animation, digital video, and performance using computer graphics technologies. Students who focus in this area should take support courses in theater, film, and drama.

### 3.3. Interactive Works

Since *The Dream Curriculum* the notion of interactivity has grown profoundly more complex, especially in light of developments such as the WWW and multi-user installations. These courses include web based art, interactive CDs, interactive installations, and VEs.

Students who work with interactivity use both time and imagery as well as human response. This course work should include an understanding of human computer interface design as well as concepts such as the aesthetic experience for viewers as they unfold layers of the work.

### 3.4. Computer Graphics and other Media

The ways in which computer art crosses into other art areas is abundant and numbers far beyond the four that I have listed. Computer graphics as an extension of other media is helping artists approach their studio area in a new way by enlarging the scope of artistic possibilities. For example a painter can scan a slide of her painting, manipulate it, reproduce it as an Iris print, then transfer it to wet plaster to create a sculpture with a fresco aesthetic. This process surpasses the act of painting and perhaps defies a label, but it is a unique process made possible by computer graphics. It is this type of thing that would fall within the Computer graphics and other media focus area.

In addition to computer art, students in this area should have an equally strong focus in at least one other studio area.

## 4. Conclusion

In a time when our culture is becoming much more visually literate, those who create visual media must pay more attention to clear, meaningful, and sophisticated messages in their work. Visual media for the sake of effect stops at the surface of the work, and the audience is lost after the initial "wow." This is much like movies that sport fascinating special effects but fall short of a meaningful story line. On the other hand, movies that weave monumental visual effects into purposeful narratives are the works of art that will be significant in years to come. This means that the curriculum that educates some of the artists who will make these films must address technical proficiency along with creativity and meaningful expression.

To this end I have highlighted a few concerns in core curriculum, listed some computer art focus areas, and suggested key issues to address in the general approach to designing curriculum for computer graphics in the visual arts. These are only suggestions and individual programs and goals should be the ultimate guiding force.

My hope with this document is to continue the dialogue about curriculum so computer graphics

educators in the visual arts can address it in a meaningful and vital way.

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