# Creative graphics in education

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**Abstract:** The paper deals with creative graphics supported by computers. The first part shows briefly the relationship between the art and computers. It describes why artists started to work with computers and what techniques and tools supported by a computer power are accessible for them. The second part of the paper discusses the proposal of the Creative-graphics course curriculum. The course is designed primarily for students of the new founded faculty at Technical University of Brno (Czech republic) — Faculty of visual arts (founded in 1992).

**Key words:** machine aesthetics, computer art, computer creative graphics

## 1. Introduction

Computer graphics is one of the most exciting branches of the computer science, and it promises to be even more exciting in the future. Potentialities of computer graphics has increased considerably over the last few years. The technological improvements in a computer industry brought to the end users more powerful machines with bigger storage capacities and with better graphic output and input devices. They were necessary conditions for the new breakthrough in computer graphics.

A few years ago, computer graphics was considered to be a special application of computers. The situation has changed. Computer graphics is a part of computer science now. Computer graphics is also an essential part of new application programs, and it plays an important role in the area of human-machine interface. The graphical form of computed results occurs as frequently as the numeric representation. Image processing has become widely used in diverse scientific applications of computers.

Hardware as well as software systems have been adapted to users. The user merely makes selection decisions based on menus. The formal, mathematically-oriented background of computer graphics is hidden from the end users thus making the working environment user friendly. The programs are oriented to users who has no computer-science knowledge. The method thus applied is that of trial and error — a mode of operation well adjusted to the processes of human thinking and creating.

## 2. Art and Computers

A person who is not a scientist, but who is seriously-interested visual worker, can find suitable tools that usually meet their needs. Artists can find tools that help them to express their ideas using tools that remind natural tools like pens, brushes, etc. Moreover, they can use new tools that have no counterparts in the real world. New efects that are based on some kind of processing (that requires a computer) give the artists new dimensions allowing them to express better their ideas.

Let us note that both art and science rely on technique; the difference between them is in the degree of contact with psyche. Computer art refers to a narrow creative activity connected with fine art. The term *computer art* is used for works created with an aid of computer-based tools and methods for the purpose of fulfilling an aesthetic needs of the creator as well as of the public). We need extended designation for our purposes. A computer artist, an illustrator, or a graphic designer are named visual workers, and artifacts they produce can be named as computer creative graphics.

The history of computer creative graphics is almost as old as computers are, but some new applications of computer graphics made it popular:

- Design (patterns on textile, industrial products, in architecture and others);
- Picture processing (an extension of special photograph effects);
- Animation (computer games, educational purposes, movies, advertising);
- Visualization (a visual simulation of natural phenomena);
- Experimental aesthetics (computer is used as a tool for experimenting with and studying of human processes of perception);
- Multimedia (computer graphics is used together with other media as music and video).

The future of creative graphics is not based on usage of a computer for simulation of what can be produced better with other, conventional media. Computer technology should be (and is expected to be) used for creation of images that cannot be made using other techniques. Most visual workers tend to look at the computer technology as on a tool, while some artists view it as a new medium that helps them to expres their ideas better.

## 3. Computer Creative Graphics – the curriculum proposal

The following part of the paper shows the curriculum proposal of the course of Computer Creative Graphics. The course is held at the new founded Faculty of visual arts (1992) at Technical University of Brno (Czech republic), and it was designed to meet the needs of the faculty.

The curriculum is an application oriented one. In other words, it was designed by the Department of Computer Science and Informatics of the Faculty of Electrical

Engineering and Informatics because of the experience with a computer environment and applications. On the other hand, the cooperation with the Faculty of visual arts and the contact with its students give to the curriculum the artist influence. Both sides enrich the curriculum, because both sides are deeply experienced in completely different areas, and they do not know very much about the problems and potentialities in the working area of the other side.

Designing the curriculum, we did not adopted any existing teaching model from other schools because we did not find any similar curriculum that fit into our plans. The curriculum design is bases on our own experience. The course is designed with respect to different interests of students of arts (in comparison with students of Computer Science).

### The course topics

The course topics, as presented, are based on our first decisions and feelings of how such a course should look like. The curriculum is further developped according to feedback from students, according to ideas from the Faculty of visual arts, and it will also be following new potentialities given us by access to the new technology. Final section summarizes the first experience.

#### Topic 1.1

A computer in the graphics designer's atelier; computer graphics and its contemporary potentials; a brief history of the Computer Art in the world and in the Czech lands:

- Presentation of computers as of a computer graphics tool; slide show (the classic one) of some results from the world – what is computer graphics good for (differences between Creative Graphics, Computer Art, CAD);
- A discussion about the course and about relations with other courses.

#### Topic 1.2

An interactive work with computer: principles, examples. Description of simple painting programs and their usage (MS-PaintBrush and similar):

- Interactive work with lines;
- Letters and text;
- Area filling with colour or pattern;
- Modifications of the shape and position of elements;
- Cut and paste functions;
- A picture as a combination of basic elements and operations applied to them or to areas of the picture;
- Printing the picture on a computer printer;
- Storing the picture in a graphical-format file;

Notice: Individual projects of students will be discussed and analyzed at the end of the topic.

**Topic 1.3**

Students will obtain basic information about working with a computer. The explanation is based on their own experience from the work described in previous topics. The object is to give the student an abstract notion of graphical operations, tools, and also of computer commands, memory, files. The knowledge level must be sufficient only for understanding the situation when they start to work with professional systems:

- Basic principles of generating and displaying the picture on the screen;
- A personal computer and its operating system;
- Input and output devices for graphics;
- An application program, a computer library with functions for graphics, an application oriented software system for graphics;

Notice: Some parts of the topic are expected to be mastered during the previous topic in the *learning-by-example* process.

**Topic 1.4**

The topic is focused on *noninteractive* graphics. Simple programming language (for example a subset of commands of GW Basic) is used for creation of line-art pictures:

- Programs for plotting of mathematical functions that are interesting from an aesthetic point of view;
- Programs that utilize a random-number generator;
- Programs that utilize repeated transformations of a motif;
- Programs that generates patterns, symbols, and other graphical structures;
- Combinatoric algorithms;
- Programs for generating of sequences of shape changes of planar objects (effects like *blending* and *in-between*;
- A simple animation of planar objects.

Notice: The topic is based on the narrow cooperation of students with a teacher-programmer. Some programs are only presented, some are created by students. Students obtain skeletons of programs, and they modify them following teacher's advices. No previous programming skills are required. Conclusions and the students' works are discussed in the end of the topic.

**Topic 1.5**

Fractal graphics – principles, slides with results, a practical usage of demonstration programs.

- Space filling curves;
- IFS fractals (IFS stands for Iteration Function Systems);
- Graphtals;
- Mandelbrot's and Julia's fractals;
- Random fractals.

Notice: The topic consists of passive demonstration of results as well as the active work of students. A cooperation with a teacher-programmer is necessary. Students' works are discussed in the end of the topic.

**Topic 2.1**

Professional software package for applied graphics (illustration programs): the purpose, principles, tools and their usage.

- Basic tasks — tools, operating modes, simplest objects and their attributes;
- Extended tasks — drawing techniques (they are different in comparison with the classical ones), usage of layers, grouping, transformations, alignment, special atributes of objects. Working with text objects and with compositions of objects;
- Special effects;
- Printing in colors: principles, contemporary computer hardware, color separations.

Notice: The software package CorelDRAW is planned to be used. The system will be also confronted with others to show the students similarities, differeces, and the development of features of such packages. As in the previous topics, students will be given further general information about computers. The topic is closed by discussion and analysis of the students' semestral works. They will be evaluated with the help of atelier teachers (they are specialized in classical graphics).

**Topic 2.2**

Text editors: principles, usage. Students will get acquainted with simple, WordStar-like editor for creation of documents. They will use it for writing texts. The knowledge will help them to understand problems of combination of text and graphics. It is also the first step towards professional *DeskTop Publishing* systems.

**Topic 3.1**

The topic focuses on *Image Processing*. Basic procedures of transforming of a real-scene into a computer format are explained including its further processing. Both black-and-white and color pictures are mentioned.

- Problems related to halftones and dithering;
- Scanning of pictures and tuning the gray-scale and color pictures;
- Special techniques related to photography — transformations, filters;

- Combined techniques — photography combined with generated objects (text, patterns, vector images, etc.);
- Hardware and software for scanning the real pictures;
- A description and usage of software systems for digitized photography processing.

Notice: The topic can be presented depending on the level of students and on the accessible technology (computer, software, input and output devices). It can be presented only as a demonstration as well as a complete mastering of some systems. The software packages CorelDRAW (PhotoPaint) and PhotoStyler are planned to be used in the course.

**Topic 3.2**

The topic is focused on *DeskTop Publishing systems*. Students of the course are designers, and they are trainded in typesetting theory. The topic should help them to get acquainted with software DTP systems for personal computers (Ventura Publisher, PageMaker, Word, etc.).

Notice: The topic can be demonstrated only, or it can be covered in details including the mastering of some DTP system.

**Topic 4.1**

Computer graphics for modelling of volumes and 3D scenes — basic tasks.

- Ways of creating of 3D objects on a computer;
- Transformations of 3D objects;
- Projections (mainly the perspective projection).

Notice: The topic covers only fundamental principles necessary for understanding how special program systems work.

**Topic 4.2**

A computer animation:

- Principles of an animation of 2D scene (an *animated film*);
- Principles of an animation of 3D scene (a *realistic scene*).

Notice: The topic covers only fundamental principles necessary for understanding special program systems.

**Topic 4.3**

The topic focuses on a special software for a computer animation. Principles, functions, and usage of such systems is demonstrated. For example Autodesk Animator is planned to be used for the demonstration purpose. Depending on situation, the topic can also cover the problem in details — including mastering of some animation program.

**Topic 5.1**

Computer graphics for modelling of volumes and 3D scenes — tasks dealing with natural ligh in the scenes:

- A scene illumination, optical properties of surfaces;
- A continuous (natural) shading;
- Modern methods of determining the illumination (*ray tracing*, etc.);
- Modelling of complex (natural) surfaces and structures;
- Principles of 3D scene animation.

Notice: The topic covers only fundamental principles necessary for understanding special program systems.

**Topic 5.2**

Special software for 3D graphics — principles, functions, usage:

- 3D-Studio and Autodesk Animator Professional — static tasks;
- 3D-Studio and Autodesk Animator Professional — dynamic tasks (animated 3D scene).

Notice: Software systems mentioned in topics 4.3 and 5.2 are installed and used at Technical University of Brno.

**Topic 6.1**

Multimedia — modern software and hardware tools for integrating of dynamic digitized pictures and of a sound on computers:

- Conception, main problems, hardware and software support;
- Getting acquainted with systems accessible at the university.

Notice: The topic can be demonstrated only, or it can be covered in details including the mastering of some system.

## Remarks

The course is designed so that no previous experience with computers is required at the beginning. The curriculum consists of topics which describe new tools for people interested in the graphic design and computer graphics. The computer knowledge is absorbed by students gradually and only in the level that is necessary for work with software packages and for understanding basic principles of computer graphics. The course covers the area of the creative activity in the art supported by computers. The curriculum reflects the trends in developped countries. Such a comprehensive course is not held at other universities in the Czech lands, yet.

The length of the course is planned for three years (6 semesters; one semester is equal to 15 weeks). Lessons are given every week — two units of lecture and from 4 to 6 units of exercises (one unit is equal to 45 minutes). The course start in the third semester.

## 4. Conclusion: First impressions

Our first impression is that students of art-oriented studying programs are interested in the subject. They accept the new knowledge quickly without prejudices.

As other young people, the students of arts like to play with new and interesting tools. They accept easily things that, from the first point of view, have nothing to do with technology. Graphical user interface, as MS-Windows or similar is, seems to be natural for them. However, in comparison with more technically oriented students, they do not want to accept other kind of interface. Talking about the topic 1.4—noninteractive graphics—they like the results, but they are not willing to use some noninteractive tools like programming languages even if the skeletons of programs for graphics are prepared for them (GW-Basic).

The first works of art-oriented students are much better than results of people who are only interested in computers. As people with the feeling for art, they are able to create surprising results even with very primitive software tools.

The students often like to use tools that are closer to the painting by hand. For example, they like to use scanner and real charts to obtain a background texture of a created picture.

Further experience from first two semesters of teaching and selected works of students will be presented at the conference.

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