

Technologies and Means of Processing Graphic Information

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Annotation: The spread of computer graphics began with printing. But soon she escaped from the cramped premises of printing houses into the scope of wide application. Computer games, scientific graphics and films have gained immense popularity. This article provides information on graphic data processing technologies and tools.

Keywords: raster graphics, vector graphics, fractal graphics, 3D graphics, Adobe Photoshop, MS Paint.

Introduction. The spread of computer graphics began with printing. But soon she escaped from the cramped premises of printing houses into the scope of wide application. Computer games, scientific graphics and films have gained immense popularity. Now, not a single science fiction film, not a single computer game can do without developed and sophisticated graphics. The images are so real that it is hard to believe that all this was created on a computer. The most powerful machines and the most talented teams of mathematicians, programmers and designers are working on it. No business report is complete without a computer presentation.

From a simple enumeration of applications, it can be seen that the concept of "computer graphics" is quite extensive - from algorithms that draw fancy patterns on the screen, to powerful 3D graphics packages and programs that mimic the classic artist's tools. That is, computer graphics is not a simple drawing using a computer, but is a rather complex, which can be conditionally divided into several areas:

- two-dimensional graphics;
- polygraphy;
- web design;
- multimedia;
- 3D graphics and computer animation;
- video editing;
- CAD and business graphics.

The fields of application of computer graphics are extremely diverse. Each of its sections has its own distinctive features and subtleties of "technological production". Each of them has its own software, which includes a variety of special programs (graphic editors). Regardless of the area of use, each graphic editor must have:

- ✓ drawing tools on the computer;
- ✓ library of ready images;
- ✓ set of fonts;
- ✓ set of special effects;
- ✓ as well as being compatible with other graphic programs.

Many PC users associate the concept of computer graphics with programs designed to edit two-dimensional digital images. This software can be divided into three groups according to the principle of operation and functionality:

- raster graphics;
- vector graphics;
- fractal graphics;

The most widely represented in computer graphics are the first two types of programs: raster and vector. And fractal graphics, like vector graphics, are calculated and occupy an intermediate position between vector and raster. In addition, fractal patterns are often used as beautiful fractal fills in raster and vector graphics editors. Two-dimensional, or 2D graphics, is the basis of all computer graphics (including 3D graphics). No computer artist-designer can fruitfully work on their projects without understanding the basic concepts of two-dimensional graphics.

Raster graphics - Most image editing programs are raster programs. In them, the image is formed from a lattice of tiny squares called pixels. Because each pixel on a computer screen is mapped to a specific location on the screen, programs that create an image in this way are called bitmap or bitmap programs. The lattice (or matrix) formed by pixels is called a raster. Therefore, bitmapped programs are also called raster programs.

How is a digital image created? Many imaging programs allow the user to select the desired electronic brush, color, and paint. Sometimes the end result is indistinguishable from traditional painting, but, in general, the capabilities of a computer are much wider than traditional ones.

Discussion. Most traditional images are first entered into a computer using a scanner or digital camera. Using a scanner, you can digitize a slide, transparencies, and photograph by converting the image into digital data. The technique of scanning an image with subsequent color correction and retouching operations is most often used in printed computer products, primarily when creating advertisements and magazine covers. The computer can change the color of your hair or eyes, retouch a mole on your cheek, change the color or background of your photo, and remove all flaws and defects. To attract the attention of viewers, computer artists often add special effects to photographs in magazines and advertisements, creating complex collages.

The process of digitizing an image with a digital camera is simple - a person simply points the camera at the subject and presses the shutter button. The image is instantly digitized and stored in a memory device inside the camera. You don't have to buy and develop film - it just doesn't exist. Instead of displaying the image on slides or printing photographs, it is downloaded to the computer via a cable line. When an image appears on a computer screen, you can change its colors, retouch, and twist-twist, bend, distort to create special effects in image editing programs.

Raster programs are designed primarily for image editing, providing the ability to color correct, retouch, and create special effects based on digital images. Using imaging software, you can create collages, vignettes, photomontages, and prepare color images for printing. Today, image editing programs are used in the production of almost all printed images that require photography. They are used to erase wrinkles from the faces of fashion models, to give bright colors to cloudy and gloomy days, and to change the general mood through special lighting effects. They are also widely used by media producers to create text and background effects and to change the number of colors in an image.

Vector graphics - An image created in vector programs is based on mathematical formulas, not pixel coordinates. The curves and straight lines that form the basis of such images are called vectors. Since mathematical formulas are used when specifying objects on the screen, individual elements of the image created in vector programs can

be easily moved, enlarged or reduced without showing the “step effect”. So, to move an object, just drag it with the mouse. The computer automatically recalculates its size and new location.

Since the image is created mathematically in this case, vector programs are usually used when clean lines are needed. They are often used to create logos, plotter fonts, and various drawings.

When you output an image created in a vector program, its quality does not depend on the original resolution of the image, but on the resolution of the output device. Because image quality is not based on resolution, an image created with vector programs tends to have fewer files than those created with bitmap programs. In vector programs, there are no problems with fonts either - large font arrays do not form huge files.

Fractal graphics - Fractal graphics (FG), like vector graphics, are calculated, but differ from it in that no objects are stored in the computer's memory. The image is built according to the equation, so you don't need to store anything other than the formula. By changing the coefficients in the equation, you can get a completely different picture.

1. The simplest fractal object is a fractal triangle. Construct an equilateral triangle with side a . Divide each of its sides into 3 segments. On the middle segment of the side, build an equilateral triangle with a side equal to $1/3$ of the side of the original triangle, and on other segments, build equilateral triangles with a side equal to $1/9a$. With the resulting triangles, repeat the same operations. Triangles of subsequent generations inherit the properties of their parent structures. This is how a fractal figure is born.

2. The process of inheritance can be continued indefinitely. Taking such an infinite fractal object and examining it with a magnifying glass or a microscope, one can find in it more and more details that repeat the properties of the original structure.

3. Many objects of animate and inanimate nature have fractal properties. An ordinary snowflake magnified many times over turns out to be a fractal object. Fractal algorithms underlie the growth of crystals and plants.

In separate branches of trees, purely mathematical methods can trace the properties of the entire tree. And if you put a branch in water, then soon you can get a seedling, which will eventually develop into a full-fledged tree. The ability of a FG to simulate images of wildlife in a computational way is often used to automatically generate unusual illustrations.

3D graphics - Three-dimensional graphics has found wide application in such areas as scientific calculations, engineering design, computer modeling of physical objects. As an example, consider the most complex version of three-dimensional modeling - the creation of a moving image of a real physical body. In a simplified form, spatial modeling of an object requires:

- to design and create a virtual framework ("skeleton") of an object that most fully corresponds to its real form;
- design and create virtual materials similar to real ones in terms of physical visualization properties;
- assign materials to different parts of the object's surface;
- set the physical parameters of the space in which the object will operate - set the lighting, gravity, atmosphere properties, properties of interacting objects and surfaces;
- set the trajectory of movement of objects;
- calculate the resulting sequence of frames;
- apply surface effects to the final animation clip.

It is necessary to determine the composition of hardware and software for creating and processing graphic images (drawings, diagrams, photographs, etc.). Hardware includes mainly:

- ✓ monitor and video card that supports graphic display mode;
- ✓ video adapters (video accelerators);
- ✓ 3D accelerators;
- ✓ manipulators "mouse";
- ✓ scanners;
- ✓ digitizers;
- ✓ printers and plotters (plotters).

Software tools include:

- programs for two-dimensional computer painting - graphic editors designed to create and process planar (two-dimensional) static images (Painter, Adobe PhotoShop, Picture Man, etc.);
- means of business graphics;
- computer graphics packages for printing - allow you to supplement the text with illustrations of different formats, create page designs and print printed products with high quality;
- presentation packages used as a means of creating a variety of slides to accompany reports, speeches, promotions;
- 2D animation programs used to create dynamic images and special effects in movies (Animator Pro, Power Animator, etc.);
- programs for two-dimensional and three-dimensional modeling used for design and engineering developments (AutoCAD, Sketch!, Ray Dream Designer, AutoStudio, etc.);
- 3D animation packages used to create commercials, music videos and movies (3D Studio, Power Animator, Truespace, etc.);
- programs for scientific visualization (Surfer, Grapher, PV-Wave, Data Visualizer, etc.).

Consider some computer graphics programs:

MS Paint - The Microsoft Paint bitmap editor is a standard operating system application. One of the main advantages of MS Paint is its accessibility and compactness. Despite this, it contains the core tools that are part of almost all modern graphics packages, and familiarity with its tools allows you to more effectively master more powerful graphics tools.

Graphic editor: MS Paint is designed to create, modify and view drawings. With the help of OLE technology, the image created in it can be inserted into any other document or used as a desktop background. With certain drawing skills, the MS Paint editor allows you to prepare quite decent drawings for multimedia presentations. It can also be used to view and edit photos taken with a digital camera or scanner.

Like most popular programs, MS Paint contains an extensive help system that is similar to most Windows applications. The user interface of the MS Paint editor is extremely simple and focused on intuitive use. Most users start working with the editor right away without any familiarity with its capabilities.

Adobe Photoshop is an unsurpassed digitized image editor, recognized by all as a standard. The main working qualities of Adobe Photoshop:

- Ability to create a multilayer image. Moreover, each illustration element can be saved in its own, separate layer, which can be edited separately, moved relative to other layers, etc. The final image can be saved both in its original, "multi-layered" form, or you can merge all the layers into one by converting the finished image into one of the standard formats.
- Improved tools for working with text. Starting with the sixth version of the program, you can add text inserts to any part of the image, "stuffing" the text directly on top of the picture.
- About 100 different filters and special effects.
- Several dozen tools for drawing, cutting out the contours of the image.
- The richest possibilities of combining images, working with textures.
- Ability to work with dozens of popular graphic formats.
- File format.
- Possibility of multi-stage cancellation of the changes made.

Conclusion. However, a good set of editing tools alone doesn't give Photoshop the edge it has today. Another thing is that all these tools are implemented not at the amateur level, but at the professional level. Working with flowers is the quality that elevates him to a truly unattainable height. Adobe Photoshop is equipped with tools for the finest adjustment of the colors of the scanned image, and the parameters of each color or hue in the picture can be adjusted separately. Special effects modules are another trump card of Adobe Photoshop. There are hundreds of these modules - from simple ones that sharpen images to very exotic ones that allow you to create three-dimensional volumetric objects from two-dimensional photos, simulate the effects of explosions, cigarette smoke, etc.

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