

# Overview of computer Graphics

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**Abstract** - To review what a metaball is, and how to render them; and to describe a new optimization I've made for rendering metaballs. For complex scenes, it can render hundreds of times faster, though I'm certain others have discovered this trick as well. It does very slightly change the characteristic shape of the blobs, but there is no loss in image quality whatsoever.

## INTRODUCTION

Computer graphics deals with generating images with the aid of computers. Today, computer graphics is a core technology in digital photography, film, video games, cell phone and computer display, and many specialized applications. A great deal of specialized hardware and software has been developed, with the displays of most devices being driven by computer graphics hardware. It is a vast and recently developed area of computer science. The phrase was coined in 1960 by computer graphics researchers Verne Hudson and William Fetter of Boeing. It is often abbreviated as CG, or typically in the context of film as computer generated imagery (CGI). The non-artistic aspects of computer graphics are the subject of computer science research.

Some topics in computer graphics include user interface design, sprite graphics, rendering, ray tracing, geometry processing, computer animation, vector graphics, 3D modeling, shaders, GPU design, implicit surfaces, visualization, scientific computing, image processing, computational photography, scientific visualization, computational geometry and computer vision, among others. The overall methodology depends heavily on the underlying sciences of geometry, optics, physics, and perception.

Computer graphics is responsible for displaying art and image data effectively and meaningfully to the consumer. It is also used for processing image data received from the physical world, such as photo and video content. Computer graphics development has had a significant impact on many types of media and has revolutionized animation, movies, advertising, video games, in general.

## OVERVIEW

The term computer graphics has been used in a broad sense to describe "almost everything on computers that is not text or sound". Typically, the term computer graphics refers to several different things:

the representation and manipulation of image data by a computer the various technologies used to create and manipulate images methods for digitally synthesizing and manipulating visual content, see study of computer graphics

Today, computer graphics is widespread. Such imagery is found in and on television, newspapers, weather reports, and in a variety of medical investigations and surgical procedures. A well-constructed graph can present complex statistics in a form that is easier to understand and interpret. In the media "such graphs are used to illustrate papers, reports, theses", and other presentation material.

Many tools have been developed to visualize data. Computer-generated imagery can be categorized into several different types: two dimensional (2D), three dimensional (3D), and animated graphics. As technology has improved, 3D computer graphics have become more common, but 2D computer graphics are still widely used. Computer graphics has emerged as a sub-field of computer science which studies methods for digitally synthesizing and manipulating visual content. Over the past decade, other specialized fields have been developed like information visualization, and scientific visualization more concerned with "the visualization of three dimensional phenomena (architectural, meteorological, medical, biological, etc.), where the emphasis is on realistic renderings of volumes, surfaces, illumination sources, and so forth, perhaps with a dynamic (time) component.

## HISTORY

1950: The first graphic images are created by Ben Laposky using an oscilloscope to generate waveform artwork produced by manipulating the analogy electronic beams. 1951: Designed to support military preparedness, Jay Forrester and Robert Everett of the Massachusetts Institute of

Technology (MIT) produce the Whirlwind, a mainframe computer with a CRT to plot blips representing incoming aircrafts based on radar-gathered data.

1955: Direct descendant of the Whirlwind, the SAGE (Semi-Automatic Ground Equipment) air defense system is designed by Bert Sutherland at MIT. It uses simple vector graphics to display on analog CRTs radar images with a wireframe outline of the region being scanned, as well as the first light pen as an input device that operators would use to pinpoint planes flying over regions of the United States. It becomes a key part of the US missile defense system.

1959: General Motors and IBM develop “DAC-1” (Design Augmented by Computers), the first industrial CAD system (Computer-Aided Design) used to help engineers design cars. It allows a user to rotate and view a simple drawings.

1960: The term “computer graphics” is coined by William A. Fetter at Boeing to describe the new design methods for his human factors cockpit simulations. Two years later, he will create the “First Man” digital human for cockpit studies.

1961: Spacewar, the first video game, is developed by MIT student Steve Russell for the DEC PDP-1 minicomputer.

1963: Larry Roberts develops the first effective hidden-line removal algorithm, the precursor to various subsequent hidden-line and hidden-surface algorithms.

1965: The digital line drawing algorithm for raster devices developed in 1962 by Jack Bresenham at IBM is published.

1966: Ivan Sutherland creates the first head-mounted display, the Sword of Damocles, which displays separate wireframe images, allowing depth perception.

1967: MIT’s Center for Advanced Visual Studies is founded by Gyorgy Kepes.

1968: Dave Evans joins the computer science department at the University of Utah and forms a

CG group. Sutherland also joins the University of Utah.

1968: Frustrated by the lack of graphics hardware available, Evans & Sutherland then found their own company.

1968: Arthur Appel at IBM introduces ray-casting, a pre-cursor to ray-tracing which combines a hidden-surface and shadow algorithm.

1971: Gouraud shading is developed by Utah student Henri Gouraud. By interpolating intensity, visual improvements over flat shading may be achieved at a marginal cost.

1973: The entertainment feature film Westworld makes the first use of 2D animation, while 3D wireframe CGI will first be used 3 years later in its sequel Futureworld.

1974: Wolfgang Strasser in his dissertation describes the Z-Buffer, together with Jose Encarnacao he can be seen as the fathers of CG in Germany

1974: Utah student Edwin (Ed) Catmull (now president of Walt Disney Animation Studios) develops both the Z-buffer hidden-surface algorithm as well as texture mapping.

1974: Alexander (Alex) Schure, founder of the New York Institute of Technology (NYIT), creates a new Computer Graphics Lab, naming Ed Catmull director. Joined by Alvy Ray Smith and others, the team develops interest in producing what could have been the first feature-length CG film, The Works, but it was never completed.

1975: Utah student Bui Tuong Phong develops a specular illumination model. He also introduces the interpolation of normals for shading, now known as Phong shading.

#### Advantages of Computer Graphics

Computer graphics offers us the tool to create not only real-world objects but also objects that are abstract in nature such as 4D mathematical models. There are many application and advantages of computer graphics in real world. Some of the main advantages of computer graphics are mentioned below-

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### Communication

The high-quality graphic displays help us to easily communicate with the computer systems. For example, the graphical user interface is the medium of communication between the user and the computer. It utilizes bit mapping and a mouse which enables us to interact with the computer graphics that are displayed on the computer screen.

### Animation

There is a plethora of software that enables us to create animations with computer graphics. These animations are used for a wide variety of purposes such as for understanding, entertainment, business, etc.

### Control animation

The control animation is one of the aspects of computer graphics that allow a user to control fine details that are present in the animation. These control animation aspects can be speed, the geometric relationship between objects, the total scene in view, a portion of the view, etc. The computer graphics enables the user to control all these fine details in animation.

### Motion dynamics

With the help of computer graphics, we can also control the motion dynamics of the graphics. With the motion dynamics, the user can move the object with respect to the stationary object, also the user can make the object stationary with respect to some moving object. For example, the 360 views in Google Maps, which enables the user to take a 360 view of the environment on the device. In this case, the environment is moving with respect to the stationary user. Also, there can be cases where both the user and the object moving.

### Update dynamics

The computer graphics also offers the facility of update dynamic. The update dynamics can be used to change the shape, size, color, or other properties of the object.

### Virtualization

With the help of computer graphics, the user can create virtual 2D as well as 3D objects. The augmented reality and virtual reality are the concepts that are gaining popularity and this is all possible due to the discipline of computer graphics. We can create objects that are not present in the real world but with the help of the right hardware and software, the object can be virtualized to be displayed either overlapping with the environment of the world or completely overtaking the environment.

### Disadvantages of Computer Graphics

#### 1. Cost

Graphics cards generally expensive depending on the model. Higher the price, grater the performance of card will be. Even some laptops with dedicated graphics cards are more costly than integrated graphics.

#### 2. Speed

Whenever there is high resolution and colors, there is always a performance effect. This is because the system needs to deal with more information's. Due to this, the texts and icons can appear much smaller.

#### 3.Overheating

As mentioned earlier graphics card consume more power. Hence, enormous amount of heat is generated which overheats the gpu. However, for countering this most of the graphics cards comes with 1-3 fans. These fans can cool down the gpu to some extent.

#### 4. Weight

Computers, particularly laptops become bulkier and heavy if it is having a dedicated graphics. It is almost impossible to find ultra-thin laptops today with powerful graphics card.

#### 5. Power Consumption

A Graphics card consume more power than any other device on your computer. It throughout does many processing and calculations which requires lots of power. Therefore, it draws more power from the Power Supply Unit.

### Application of Computer Graphics

1. Education and Training: Computer-generated model of the physical, financial and economic

system is often used as educational aids. Model of physical systems, physiological system, population trends or equipment can help trainees to understand the operation of the system.

For some training applications, particular systems are designed. For example, Flight Simulator.

**Flight Simulator:** It helps in giving training to the pilots of airplanes. These pilots spend much of their training not in a real aircraft but on the ground at the controls of a Flight Simulator.

**Advantages:**

Fuel Saving

Safety

Ability to familiarize the training with a large number of the world's airports.

2. **Use in Biology:** Molecular biologist can display a picture of molecules and gain insight into their structure with the help of computer graphics.

3. **Computer-Generated Maps:** Town planners and transportation engineers can use computer-generated maps which display data useful to them in their planning work.

4. **Architect:** Architect can explore an alternative solution to design problems at an interactive graphics terminal. In this way, they can test many more solutions that would not be possible without the computer.

5. **Presentation Graphics:** Example of presentation Graphics are bar charts, line graphs, pie charts and other displays showing relationships between multiple parameters. Presentation Graphics is commonly used to summarize

Financial Reports

Statistical Reports

Mathematical Reports

Scientific Reports

Economic Data for research reports

Managerial Reports

Consumer Information Bulletins

And other types of reports

6. **Computer Art:** Computer Graphics are also used in the field of commercial arts. It is used to generate television and advertising commercial.

7. **Entertainment:** Computer Graphics are now commonly used in making motion pictures, music videos and television shows.

8. **Visualization:** It is used for visualization of scientists, engineers, medical personnel, business analysts for the study of a large amount of information.

9. **Educational Software:** Computer Graphics is used in the development of educational software for making computer-aided instruction.

10. **Printing Technology:** Computer Graphics is used for printing technology and textile design

## CONCLUSION

Graphic Design for the marketplace is a every growing and broadening field. With this expanding field comes a need to understand even more what make you, a designer, successful. Ethnography without a doubt is useful and necessary for graphic design because it provides vital information about who the designer should be/will be aiming their advertisement at and with that information, how they will appeal to that audience. Without that information, a designer cannot be successful in designing a visual object, advertisement, or campaign that draws in a consumer. One of design's main goals is to grab someone's attention who usually would not give your product a second glance. With knowledge of a culture, a person's way of living, history, etc, that goal is attainable.