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Graphics and Computers

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CHAPTER 1

Graphics and Computers Overview:

INTRODUCTION

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The field of computer graphics, the word "model" refer to geometric model or mathematical model. Geometric model a model something we plan to have in a picture: you can make model of a house, a car, or an air plane. Geometric model enhanced various attributes that describe the color or texture reflectance of materials involved in the model. Staring from and creating such model called modeling' and geometric – plus-other information description result is call model.

A mathematical model is model of physical or computation process. Also have models of objects move and models of things the image-acquisition process in a digital camera. It provide predictive and correct mathematical model of phenomenon or they may be physically based, derived from principles, or empirical or phenomenological, observation or even intuition.

(John & Morgan, 2014)

An Introduction to Computer Graphics

Computer graphics is art and science of communicating visual via computer's display and interaction devices. Visual of communication usually in computer-to-human direction, human-to-computer direction being mediated by keyboard, mouse, game controller joystick, or touch-sensitive overlay. Visual data starting to flow back to computer, interfaces based on computer vision algorithms applied video or depth-camera input. For computer-to-user direction, the user of communications are human, and that humans perceive imagery are design of graphics programs. Computer graphics disciplinary field in mathematics, physics, human perception, human-computer interaction, graphic design, engineering, all play important roles. Physics use to model light and perform animation. Mathematics use to describe shape. Engineering use to optimizing allocation of bandwidth, processor and memory time. Graphic design and art combine human-computer interaction make computer-to-human direction of communication most effective.

Definition of computer graphics state refers taking model of object in a scene "geometric things in the scene and description how they reflect light" and model of light emitted into scene "mathematical description sources light energy, direction of radiation, distribution of light wavelengths" representation of particular *view* of scene (light arriving at imaginary eye or camera in scene). This view, one say that graphics is just glorified multiplication: One multiplies incoming light the reflective of objects in the computer light leaving object' surfaces and repeats process (treating surfaces as new light sources recursively invoking the light transport operation), all light eventually reaches the camera. Computer vision amounts to *factoring* – a view of scene, the computer vision system is change determining illumination or the scene's contents

(which graphics system then “multiply” together reproduce the same image). The truth, vision system cannot solve problem stated and typically works assumptions about scene, or lighting, or both may have multiple views scene from different cameras, or multiple views from single camera at different times.

Graphics far richer than generalized multiplication process render view, vision is richer than factorization. Graphics in methods for creating geometric models, methods representing surface reflectance (subsurface reflectance, and reflectance participating media as fog and smoke). Animation of scenes by physical law, the control of animation, interaction virtual objects, invention nonphotorealistic representations, in recent years. Fields computer graphics and computer vision growing increasingly to each other. Example the camera takes multiple photos of single scene, from various images, one use computer vision techniques determine contours and estimate basic properties for object scene. Can used to create nonphotorealistic of scene in Figure 1.1.

Figure 1.1 Nonphotorealistic camera create artistic scene applying computer vision techniques

There more to graphics than realistic image capture and rendering. Animation and interaction, are also important. Computer graphics provides higher-level view subject, gold of teaching ideas that remain long after implementations no longer important.

The World of Computer Graphics

Computer graphics dominated by SIGGRAPH, Association Computing Machinery's Special Interest Group on Computer Graphics and Interactive Techniques; annual SIGGRAPH conference premier venue presentation new in Computer graphics, and large commercial trade show and several conferences in the areas. SIGGRAPH proceeding published by ACM, most important reference works a practitioner in the field have. Recent years been published and issue ACM Transactions in Graphics.

Computer graphics an industry, has impact the areas of television, film, games, and Advertising. It changed information in, architecture, medicine, network operation, industrial process control, and our day to day lives see weather maps or information visualizations. The graphical user interface (GUI) on computers, telephones, automobile dashboards and home electronics devices ell enabled by computer graphics.

Current and Future Application Areas

Computer graphics shifted from novelty to everyday phenomenon. Even handheld digital games parents give children keep them occupied at airport, graphical displays and interfaces. This two phenomena: First visual perception power, and visual communication rapid, designers of devices all kinds want to use it, second, manufacture computer-based devices decreasing rapidly.

Graphics become more prevalent, expectation of user have risen. Video games display millions polygons person, special effects films are so good they're no longer

distinguishable from non-computer-generated material. Example digital cameras and digital video cameras has huge stream of **pixels** (individual items array dots constitutes image) to processed, tools processing them fast evolving. The increased power computers allowed possibility enriched of graphics. Digital photography, sophisticated scanners (Figure 1.2), other tools, no longer explicitly create models of object been shown:

Figure 1.2. Scanner projects on model rotated on turntable. Camera records pattern in many positions determines object's shape.

One can scan object directly, or ignore object and use digital images of it proxy for thing itself. With enriched data streams, extracting more and more information on data—using computer vision, begun influence possible applications of graphics. Camera-based

tracking technology lets body pose or gestures control games and other applications Figure 1.3.

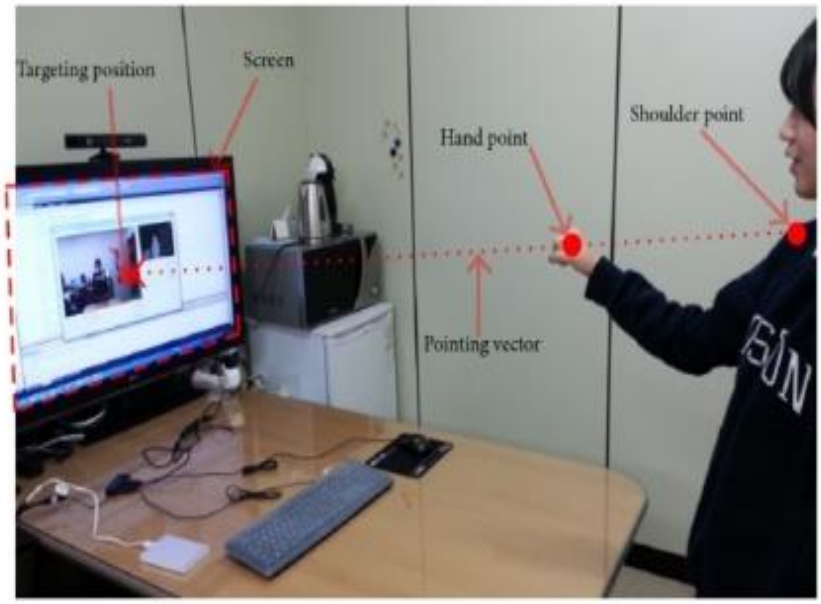


Figure 1.3. Interface allow user's position, to adjust view of data by body with or without mouse or keyboard.

Graphics has impact on entertainment industry, influence in the area of engineering, science, "computer-aided design and manufacturing" , desktop publishing, medicine, website design, information handling, communication, analysis and more continues grow daily. New interaction ranging large to small factors virtual reality, room – size displays (Figure 1.4) displays containing in font of user's eyes, multi-touch devices, large multi-touch table and laptops (Figure 1.5) and smartphone with new opportunities for greater impact.

Graphic applications you have in mind applications like video games, which we'll call these **display pixels** distinguish them from other users of term "pixel," resources are processor time, memory, and bandwidth with **rendering** – causing object or images to appear on display. There a wide range of application types, with own set requirements

Figure 1.4 Below

Figure 1.4 displays font of user's eyes, multi-touch devices, and large multi-touch table

Figure 1.5. Below

Figure 1.5 displays large multi-touch smartphone or laptop

(John & Morgan, 2014)

and critical resources. A performance measure to keep in mind, is **primitives per second,** a **primitive** is building block to the application; arcade – like video game it be textured polygons, with a fluid-flow-visualization system short colored arrows. Number of primitives displayed per second, product number of primitive displayed per frame (displayed image) and number of frames displayed per second. Some applications choose to display primitives per frame, to do so need to reduces frame rate; or aiming smoothness in animation, you can higher frame rates, also can reduce number of primitives displayed per frame.

User-Interface Considerations

The change in computer graphics the past 30 years appear to be improvement in visual fidelity both static and dynamic images, most important the new **interactivity** of day to day computer graphics. We **interact** with pictures, instead looking at them. Today with user interfaces (UIs) are increasingly important.

The field user interfaces evolved in its right and can no longer considered tiny portion of computer graphics, two remain closely integrated. The state of commercial desktop UIs not drastically changed from research systems a generation ago. Input to computer primarily through mouse and keyboard, with a mouse is just to clicking on buttons, pointing to text or images, or selecting menu items. The point-and-click WIMP (icon, windows, menus, and pointers) interface dominated for past 30 years, high-quality and well-designed interface are rare, and interface design. Touch-based interfaces are step forward, some still mimic the WIMP interface various ways. User demand and sophistication, interface design significant part of development almost any application.

Interface is important, reason bean is economics. In 1960, computers took up large rooms or small building; cost millions of dollars and shared by multiple users, each with small salary. By 2000, computers were small and costs a fraction of salary of people

using them. Figure 1.6 shows trend dimensionless ration ratio salary a user the cost of computer used. 1960 was critical computer be used efficiently at all times, users obliged to lots of things to make that happen, 2000 situation entirely reversed.

Figure 1.6 below

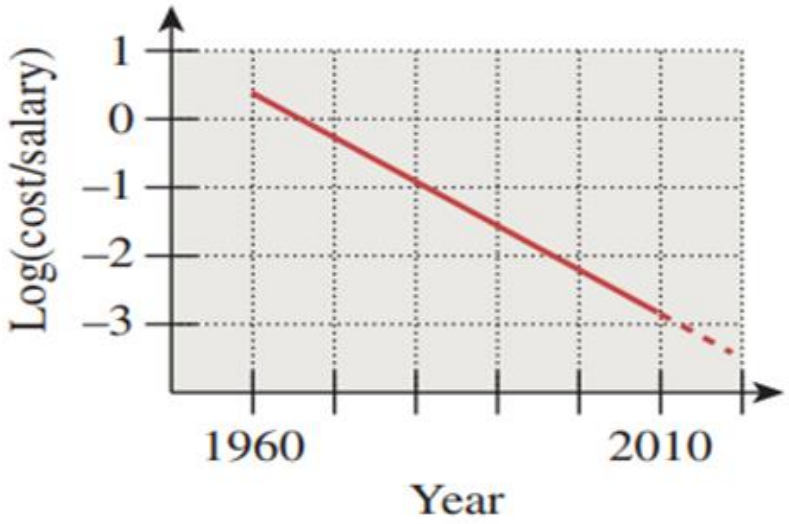


Figure 1.6 log ratio between cost of computer and salary of person using the computer.

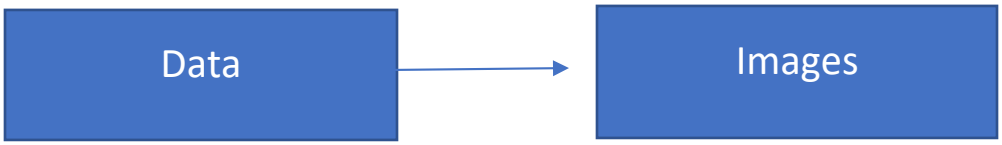
The UI is where user time consumed, with large and slow running programs: once program running, he or she can do other things. The users should concentrate more on interface and interaction.

Issues that affect UI design? Some are related psychology, perception, and human factors. You can use color in your UI; another make sure UI works color deficient users as well. You can have all menu items present; another to group them so typical user fined what he or she looking for and make select it easily: Menu items should be organize, each item large to make selection easy. The UI whatever device it is: smartphone, desktop machine, PDA, or video game it should easy for user to use.

(John & Morgan, 2014)

Data and Image

Computer graphics is fundamental guide ultimately is of transforming data into images:



Result is computer graphics commonly defined group of methods and techniques transforming data into images displayed it as graphic device.

The fundamental problem computer graphics as framework, we take the problems and develop theory and mathematical models to solve each of them. Understanding and solving subproblems allow us obtain solutions to the main problems.

Line between open and solved problems is blurry in applied mathematics. In mathematics, new solutions solved problem not necessarily amount innovation contributing scientific progress. Applied mathematics, different solutions to same problem generally follow the use of new models, and greatly preferable from viewpoint practical applications.

Data, Images, and Computer Graphics

The goal computer graphics has been allow visualization of information. There no limitation on source and nature of such information, today computer graphics applications virtually all fields of human activity: design and research every sort, finance, medicine, entertainment list go on or endless. The variety of applications, the conceptual core shared techniques and methods, usefully grouped into sub disciplines, based on nature of inputs and outputs (see Figure 1.7.) Below.

(Jonas & Luiz)

1 **Geometric modeling** treats problem describing and geometric data on the Computer.

Figure 1.7 below

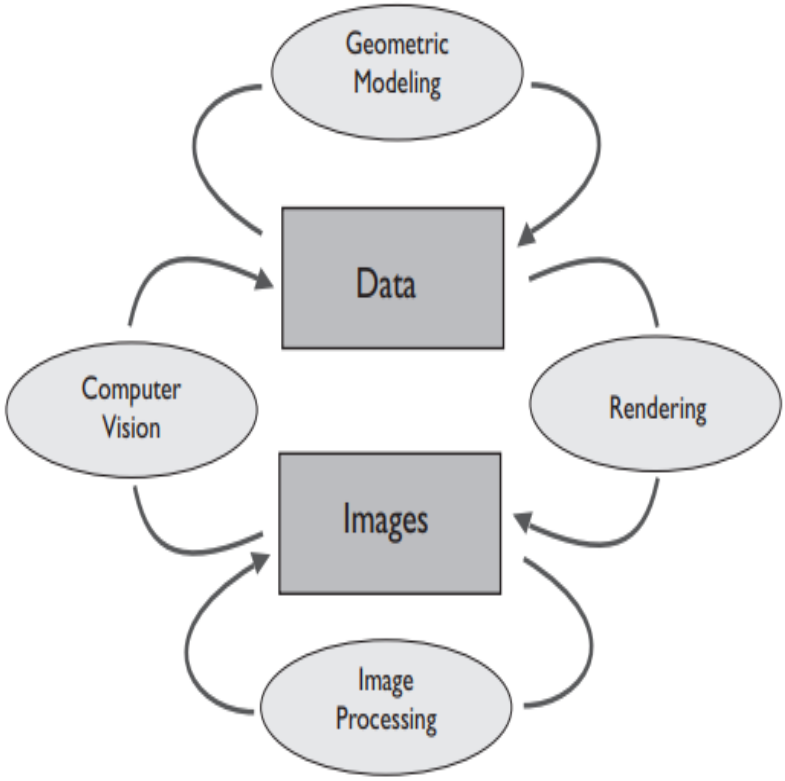


Figure 1.7. Four broadest sub disciplines of computer graphics.

2 **Image synthesis, also known as rendering**, involves manipulating data generated by geometric modeling system obtain image that can displayed on graphics output device like monitor or printer.

3 **In image processing**, the input itself an image, modified some way; output is the processed image. Examples colorizing, enhancing details, or combining images, in processing performed on image from a satellite.

4 **Image analysis,** known as **computer vision,** has goal of extracting geometrical,

topological, and physical information the objects depicted an image. Such techniques are important, example, robotics – allowing robots to "see" -- applications real and synthetic scenes must be combined. Thus, rendering focuses on generation of images, computer vision treats problem of interpreting them.

Motion

Once add time dimension to computer graphics, things more interesting. Figure 1.8 indicate the analogous conceptual sub disciplines account the time evolution of and image.

Figure 1.8

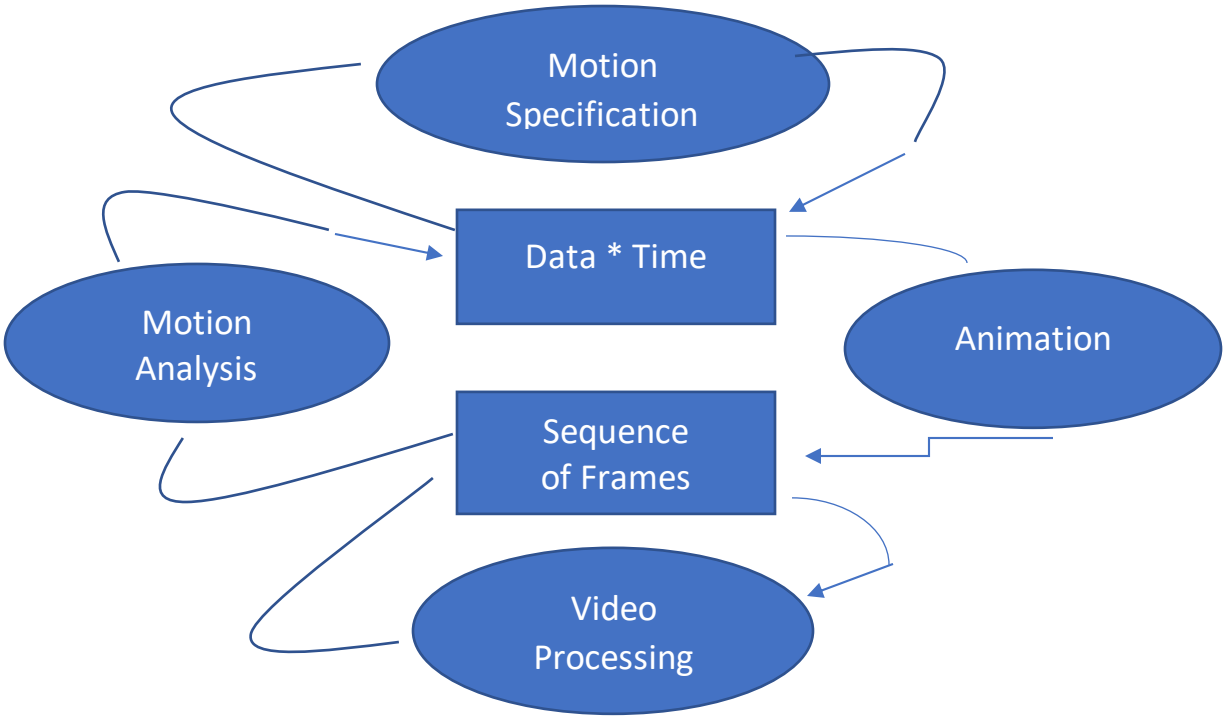


Figure 1.8 Subdisciplines computer graphics, applied to systems in motion.

* **Motion modeling or specification deals** with modeling and description moving objects in scene. Both motion itself and elements such path specification, merging and splitting objects, appearance changes.

* **Motion visualization or animation** translates object and scene description into sequence of frames (images), known as **Video**. Video can stored a variety formats subsequent visualization.

* **Video processing** is manipulation of animation sequence.

* **Motion analysis** is part image analysis deal with obtaining information on dynamic scene from sequence of images depict it.

Graphics Objects

The four part scheme area of computer graphics, drawing diagram to Figures 1.7 and 1.8. This process can be introduce broader concepts that allow merge these diagrams a more unified view computer graphics. **A graphics object.** Once done the four broad realms in last two diagrams: modeling, rendering, processing, and analysis. Notion of graphics object, must broad enough to include geometric model, images, animation video, etc

(Jonas & Luiz)

Introduction to User Interfaces

User interface one of important parts of any program it is only connection between system and user. There has been two different ways communicate with the interfaces; either typing commands in character based interfaces (CBI) or pointing and clicking object in GUI. User interfaces and different types of interfaces, starting with CBI and two dimensional (2D) GUIs.

Character-Based Interfaces

This screen display a CBI represented an array of boxes, each hold one character. A

CBI only display characters. The users interact with system by typing commands on a Keyboard Figure 1.9. below.

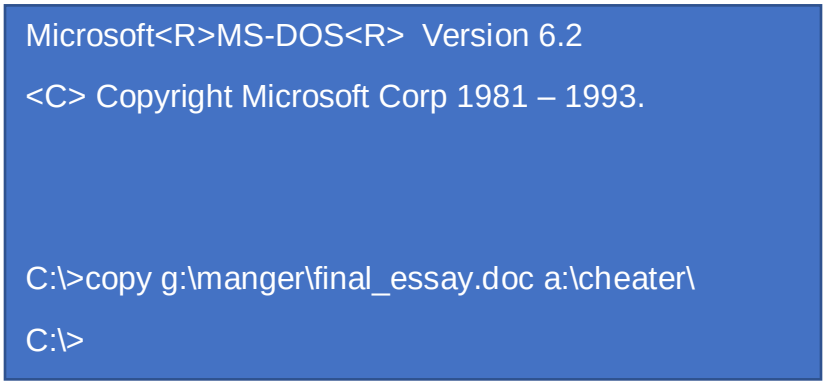


Figure 1.9 Character Based Interface.

The input device on small computer systems is keyboard. Characters are typed, stored in memory and copied to output device, display screen.

CBIs are often difficult for novice to learn and remember it essential for users to learn the syntax. Once learned the CBI it flexible and powerful for advance users. Training is necessary, error messages can be difficult understand.

The character-based interfaces have features of GUIs, like menus. Other character–based interfaces include drawing simple objects, but not capable of representing complicated objects e.g. curves; sometime called graphical character based user interfaces separate them from true GUIs.

2D Graphical User Interfaces

Fundamental GUIs screen divided a grid of picture elements (pixels), turning the pixels on or off pictures be formed {Davis 1991].

Character Based Interfaces, GUIs uses keyboard as input device and display as output

device. The mouse a small device move cursor to present position and make it easy with computer system.

GUIs features windows, icons, menus, and pointers. Window make possible divide the screen in different areas use each for different tasks. The window contain icon, are small pictures of objects representing commands, files or windows. Menus a collection commands and objects where user select and execute a choice. Pointer a symbol appears on display screen, you move to select and execute objects and commands.

GUIs includes standard formats representing text and graphics, making it possible different programs using GUIs share data.

The GUIs reduce mental effort interact with programs. Instead remembering sequences complex command languages, users learn how to interact with simulated word objects, e.g. icon and menus [Preece 1994].

Desktop Metaphor

One famous of first graphical user interfaces called Star user interface designed by Xerox Corporation's Palo Alto Research Centre in 1970s. The early 1980s that development of Apple Lisa and Macintosh made graphical user interface popular

Star interface based on physical office and designed more like physical world already familiar to users. Interface metaphor was create electronic counterparts physical objects in an office. This representing office objects, papers, folders, filing cabinets and trashcans, on the screen. Organizing metaphor presented on screen of a desktop, resembling top of office desk.

The principles that developed the Star computer in included direct manipulation, What

You See Is What You Get (WYSIWYG), consistency of commands. Direct manipulation a communication style objects represented on screen and manipulated by user in analogues how user work with real objects. WYSIWYG is represent user's model in form that can displayed. Example document displayed on screen, look in printed form.

3D Graphical User Interfaces

The "3D interface" describe wide variety of interface for displaying and interacting with 3D objects. True 3D interfaces with all components in 3D environment, interfaces today referred to 3D GUIs almost exclusively "hybrids" between 2D and 3D interfaces. We refer to "hybrid" interfaces as 3D GUIs.

The early days 3D computing users of 3D graphics were groups of engineers and scientists (i.e. experts) they have access to expensive super computers and workstations. Today, growth platform-level support real time-time 3D graphics increased adding to dimensionality of GUIs. User group grown from exclusive group of expert users, to diverse group like researchers and practitioners in such area as CAD/CAM, medicine, engineering, etc. One way to design the user interface that makes it possible users engage natural skills navigating and orientating themselves with applications. The Virtual Reality (VR), known as Virtual Environment (VE), an attempt to accomplish this. It a field coupled to 3D GUIs.

CONCLUSION

The graphical user interface (GUI), is ways of making users programs easier to use an exciting. You can add different components like ‘widgets’ on your interface, many different ways information can entered to the program and displayed as output.
You can person to push button, displaying text, or let them choose option from menu.

(Martin & Laura, 2020)

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