

# **Virtual Reality and Augmented Reality**

August 16, 2022

What is Computer Graphics?

# Computer Graphics

The term Computer Graphics roughly refers to the field of study that deals with the display mechanism (Hardware and Software) of a Computer.

# Computer Graphics

In the early days, for most of us, computer meant what we got to see on the "MONITOR" (of a Desktop/Laptop)

# Computer Graphics

- For younger generation, PC/Laptop no longer the only 'COMPUTER'
  - replaced by a plethora of devices.
- These devices come in various shapes and sizes with varying degrees of functionality.
- For example: Smartphones, tablets (or tabs), wearable computers (smart watch, smart glass), even televisions (smart TVs).
- Made possible with rapid technological change, including display technology: CRT replaced by LCD, plasma panel, light-emitting diode (LED), organic light-emitting diode (OLED), thin-film transistor (TFT).

# Computer Graphics

Regardless of the state-of-the-art technology in computing, the idea of a computer is shaped primarily by what we got to see on the display.

# Computer Graphics

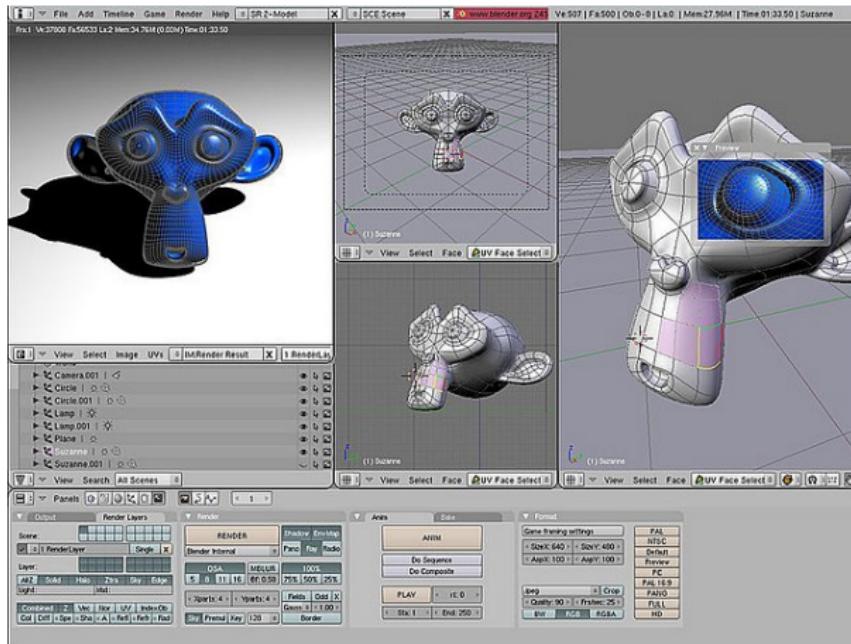
It is important to know components of a computing system that give rise to this perception - the display hardware and the associated software and algorithms.

# What is Computer Graphics

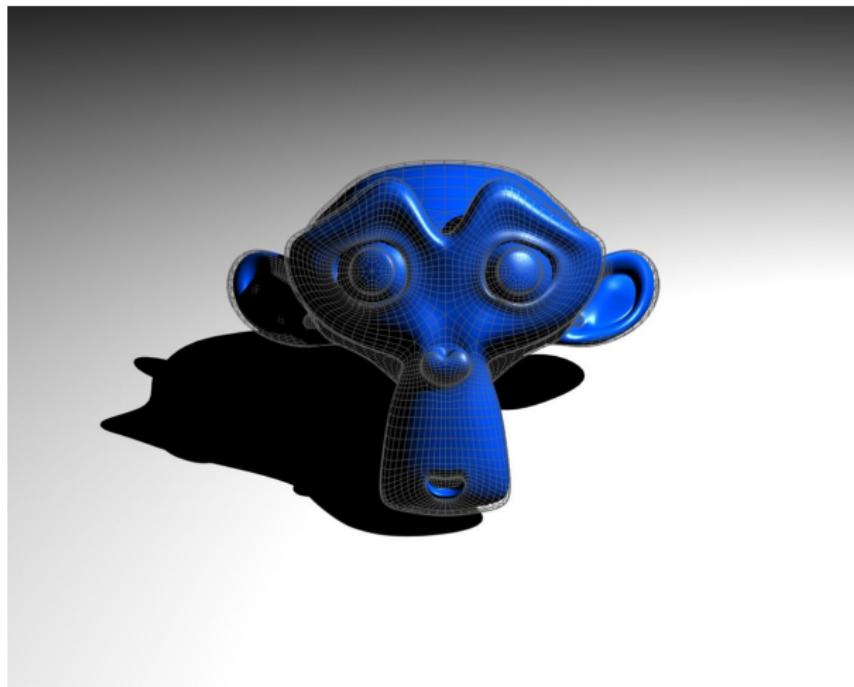
Anything to do with visual representations on a computer

- Modelling
- Rendering
- Also animation - dynamics of moving objects

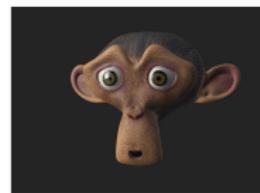
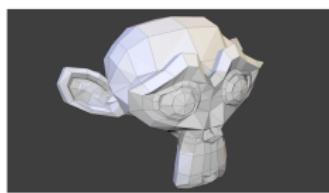
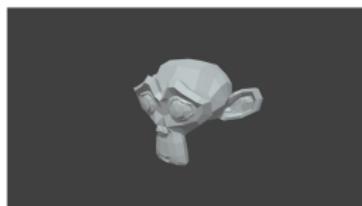
# Modelling



# Rendering



# Animation



# Computer Graphics

What We Do With Computers?

# What We Do With Computers?

Lot of things!!!

# What We Do With Computers?

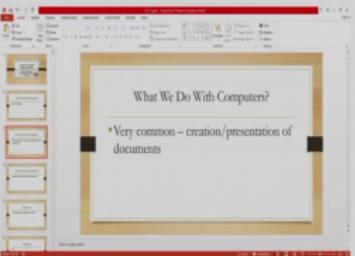
## Example 1 (Document Processing)

- Creation/Presentation of Documents

# What We Do With Computers?

Example 1 (Document Processing)

- Primary components are the (alphanumeric) characters
- Entered using a keyboard



The image shows a screenshot of a Microsoft Word document. The title of the document is "What We Do With Computers?". Below the title, there is a bulleted list: "Very common – creation/presentation of documents". The Word interface is visible, including the ribbon menu at the top and the preview pane on the left.

- There are other equally important components
- Such as, the menu option that we see here on the top side of the screen
- We also have the preview slides on the left part which is another important component

# What We Do With Computers?

Example – 2 (CAD Interface)



# What We Do With Computers?

## Example – 2 (CAD Interface)

- How it helps
  - An engineer can specify properties of individual components and try to assemble them *virtually* on the computer screen, to check if there is any problem in the specifications.
  - Saves time, effort, and cost, as no need to develop physical prototype and perform checks

# What We Do With Computers?

Example – 3 (Visualization)



DNA visualization

# What We Do With Computers?

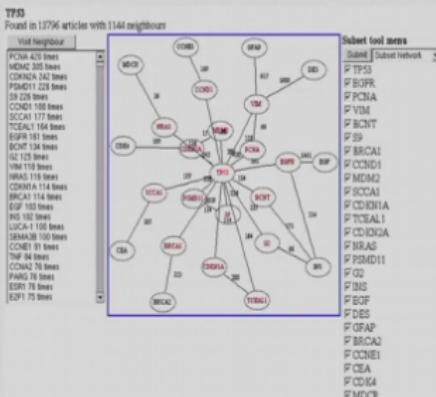
## Example – 3 (Visualization)

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- DNA visualization
  - Example of scientific visualization (things that occur in nature but we can't see otherwise or difficult to see)

# What We Do With Computers?

### Example – 3 (Visualization)



# Computer network (traffic flow) visualization

# What We Do With Computers?

## Example – 3 (Visualization)

- Computer network visualization
  - Example of information visualization (visualization of unnatural/man-made information)

# Computer Graphics

- Each an example of usage of Computer graphics
- Each and everything that we get to see around us involving computers are basically applications of computer graphics and it is definitely not possible to least all those applications.
- Computer Graphics used in Mobile phones, information kiosks at popular spots such as airports, ATMs, large displays at open air music concerts, air traffic control panels even movie screens in the theatres all these are some kinds of display and whatever is being shown on this displays are mostly applications of computer graphics.

# Computer Graphics

What is common in all these applications?

- Instances of images that are displayed
- Images are constructed with objects, which are basically geometric shapes (characters and icons in example 1 and 2) with colors assigned to them.
- When we create edit or view a document we are dealing with alphanumeric characters and each of these characters is an object.

# Computer Graphics?

How can a computer do all these stuff?

- We know computers understand only binary language of 0s and 1s.
- Letters, numbers, symbols, or characters are definitely not strings of 0s or 1s!

# Motivation

- How we can represent such objects in a language understood by computers so that can be processed by computer?
- How can we map from the computer's language to something that we can perceive (with physical properties such as shape, size and color)
- In other words, how we can create or represent synthesize and render images on a computer display?

# Computer Graphics

In computer graphics, we seek answer to these questions.

- In summary, we can say "Computer Graphics" is the process of rendering static images or animation (sequence of images) on computer screens in an efficient way.

## References

- Introduction to Computer Graphics by David J. Eck  
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