

# Computer graphics Introduction

COURSE INSTRUCTOR :MAHAM KHAN  
LECTURE 1A

# Topics

1. Introduction
2. Basic math for graphics
3. Transformations
4. Viewing
5. Geometric modeling
6. Shading and illumination
7. Visible surfaces

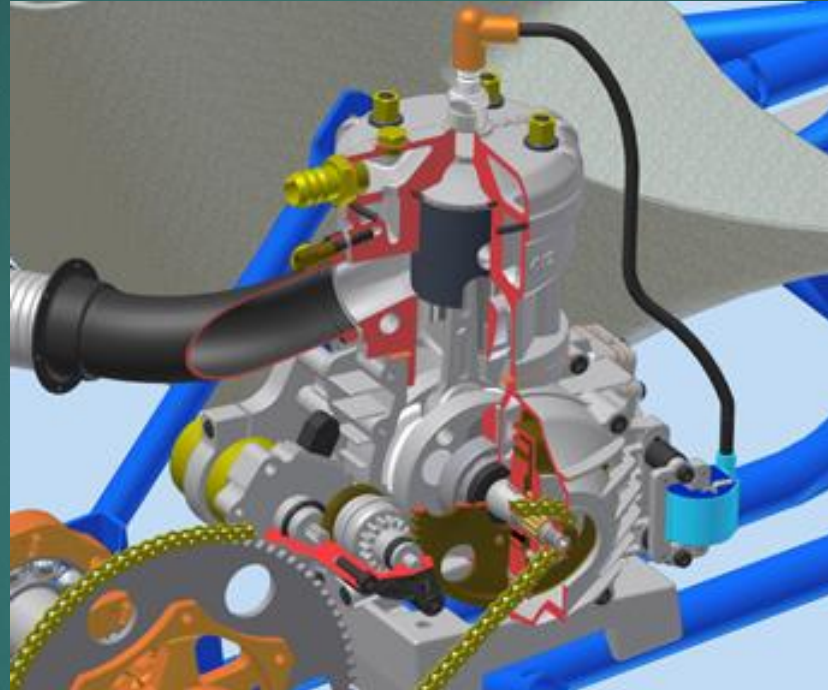
# Why computer graphics?

- ▶ Fun! Visible!
- ▶ Everywhere
- ▶ Visual system offers:
  - ▶ Parallel input
  - ▶ Parallel processing
- ▶ Computer graphics: ideal for human-computer communication

# Applications

- ▶ Graphs and charts
- ▶ Computer-Aided Design
- ▶ Virtual Reality
- ▶ Data Visualization
- ▶ Education and training
- ▶ Computer Art
- ▶ Movies
- ▶ Games
- ▶ Graphical User Interfaces

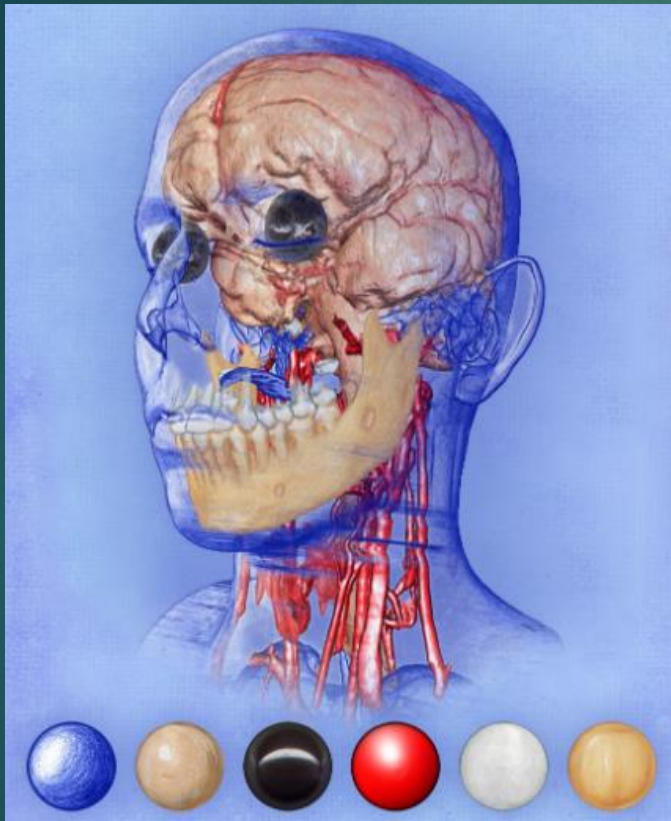
# Computer-Aided Design



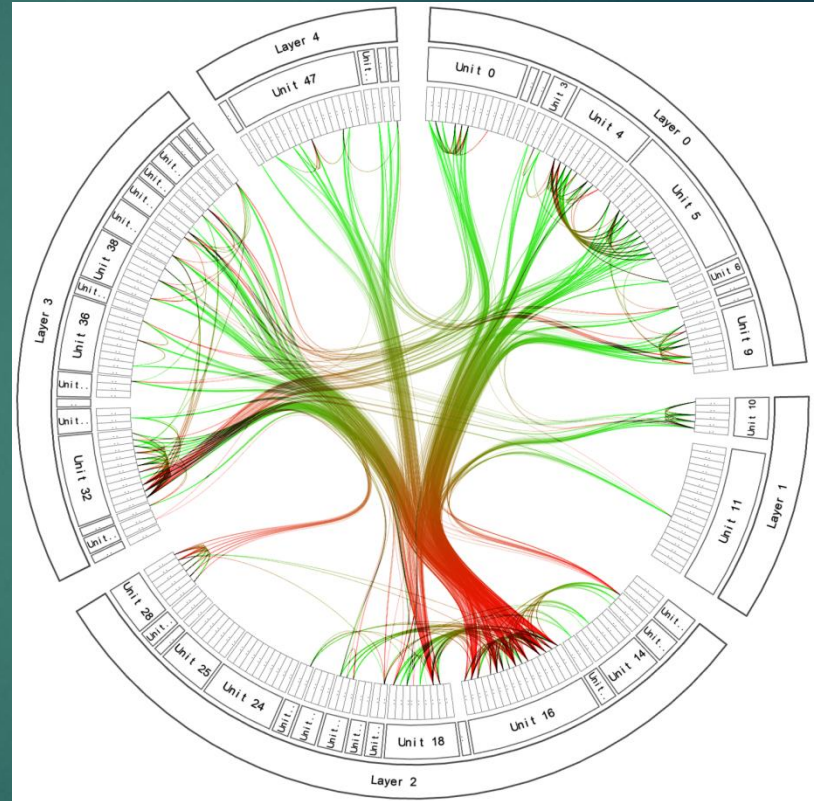
- ▶ AutoDesk
- ▶ IAME 2-stroke race kart engine



# Data Visualization



Bruckner and Groeller,  
TU Vienna, 2007



Holten, TU/e, 2007

# Gaming



H&B 1:2-32

Movies

expression

depth of field



fracture

motion

water

reflection

hair

H&B 1:2-32



# Beyond the laptop screen

## ► Microsoft Surface



## • Apple iPad



# Beyond the laptop screen

- Roll-up screen, Philips



# Beyond the laptop screen

- ▶ 24 screen configuration, Virginia Tech

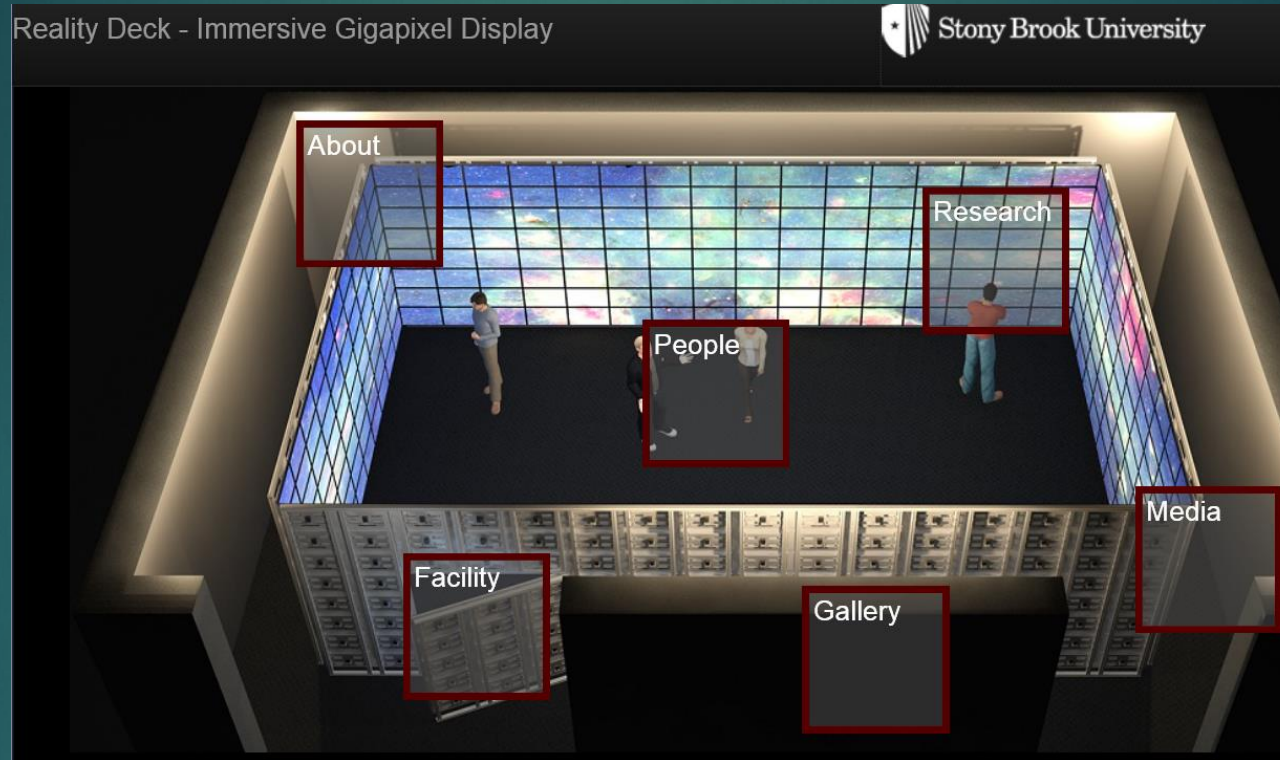


- 50 LCD touchscreens





# Beyond the laptop screen



- ▶ Reality Deck – Stony Brook University
- ▶ 416 2560×1440 27" monitors

# Beyond the laptop screen

## Head mounted displays

Parachute training  
US Navy





# Beyond the laptop screen

## ► Oculus Rift



# Generating graphics

- ▶ Special-purpose programs
  - ▶ Photoshop, Powerpoint, AutoCAD, StudioMax, Maya, Blender, PovRay, ...
- ▶ General graphics libraries and standards
  - ▶ Windows API, OpenGL, Direct3D,...

# CG standards

- ▶ Set of graphics functions, to be called from programming language
- ▶ Access to and abstract from hardware
- ▶ Standardization

Fortran, Pascal, ...	
Display	Input dev.

1975

C, C++, Java, Delphi,...	
CG API	
Drivers	
Display	Input dev.

2000

# Functions

- ▶ Graphics Output Primitives
  - ▶ Line, polygon, sphere, ...
- ▶ Attributes
  - ▶ Color, line width, texture, ...
- ▶ Geometric transformations
  - ▶ Modeling, Viewing
- ▶ Shading and illumination
- ▶ Input functions

# Software standards

- ▶ GKS, PHIGS, PHIGS+ (1980-)
- ▶ GL (Graphics Library, SGI)
- ▶ OpenGL (early 1990s)
- ▶ Direct3D (MS), Java3D, VRML,...

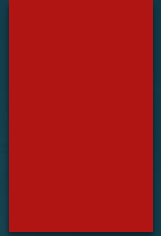


# OpenGL



- ▶ 3D (and 2D)
- ▶ Fast
- ▶ Hardware, language, OS, company independent
- ▶ OpenGL architecture review board
- ▶ Broad support
- ▶ Low-level (right level!)
- ▶ Standard graphics terminology

# Example 3D



- ▶ Quick, minimal example
- ▶ Lots of jargon and new material
- ▶ Motivate studying theory
- ▶ Enable quick start assignment
  
- ▶ Here: viewing and modeling transformations

