Computer Graphics

- Introduction -

Philipp Slusallek

Overview

- **Today**
  - Administrative stuff
  - Introduction
  - Demo

- **Next lecture**
  - Ray Tracing I

General Information

- **Core Lecture (Stammvorlesung)**
  - Applied Computer Science (Praktische Informatik)
- **Lectures in English**
- **Time and Location**
  - Mo 9-11h, HS 02, E1.3
  - Th 9-11h, HS 02, E1.3
- **ECTS:**
  - 9 credit points
- **Web-Page**
  - http://graphics.cs.uni-sb.de/Courses/ws0607/
  - Schedule, Slides as PDF
  - Literature, Assignments, other Information
- **Sign up for course and e-mail list on web page !**

People

- **Lecturers**
  - Philipp Slusallek
    - E1.1, Room E18
    - Tel. 3830, Email: slusallek@cs.uni-sb.de
- **Assistants**
  - Sven Woop
    - E1.1, Room E08
    - Tel. 3836, Email: woop@cs.uni-sb.de
  - Heiko Friedrich
    - E1.1, Room E13
    - Tel. 3834, Email: friedrich@graphics.cs.uni-sb.de
- **Secretary**
  - Hanna Schilt
    - E1.1, Room E18
    - Tel. 3831, Email: schilt@cs.uni-sb.de

Exercise Groups

- **Group I, Mi 11:00 st - 12:30**
- **Group II, Mi 12:30 st - 14:00**
- **Group III, Fr 11:00 st - 13:00**
- **Group IV, Fr 13:00 st - 15:00**

Weekly Assignments

- **Weekly assignment sheets**
  - Th to Th, starting next week
  - Theoretical & programming assignments
    - You will build your own ray tracing system
    - System will be the basis for the Rendering Competition
  - Not graded, **BUT**
    - Minimum of 30% per exercise sheet
    - Average of >50% of assignments required for admission to final exam
  - Hand in assignments by next Thursday
    - Theoretical: in paper form
    - Code: E-Mail to assistant
  - Exercise meetings
    - You present correct solutions
    - Discuss problems with Bremser

      ➔ Sign-up sheet
  - Groups of max. 2 students allowed

Grading

- **Rendering Competition**
  - Counts 30% towards final grade
    - Technical merit & artistic quality (jury)
  - Groups of max. 2 students
  - Minimum: 50% to pass
  - Special prizes

- **Final Exam**
  - Counts 70% towards final grade
  - Minimum: 50% to pass

Master & Bachelor Students

- **You must register for this course to get credits**
  - Web page
- **You may cancel the course until November 27th**
  - By sending email to me
- **If you are still registered after that, you should**
  - (attend the lectures)
  - participate in the exercise groups
  - take part in the rendering competition, and
  - take the final exam
- **If not, you**
  - Fail the course

Rendering Competition

Rendering Competition

- **Task**
  - Create a realistic image of a virtual environment
  - Several combined assignment instead of one mid-term exams
  - Incorporate advanced technical features into your ray tracer
    - List of new features and techniques with rating
    - Collect > 50% of required points to pass
    - Bonus points count towards exam
  - Design a realistic scene
    - Modeling and shading
    - Aesthetic composition
    - Use new features for best results
- **Due before Christmas**
  - One rendered image
  - Web page with technical detail info

Text Books

- **Suggested Readings:**
  - Matt Pharr, Greg Humphreys, ***Physically Based Rendering : From Theory to Implementation***, Morgan Kaufmann Series, 2005
  - Peter Shirley, ***Fundamentals in CG***, 2. Ed, AK Peters, 2005
  - Alan Watt, ***3D Computer Graphics***, Addison-Wesley, 1999

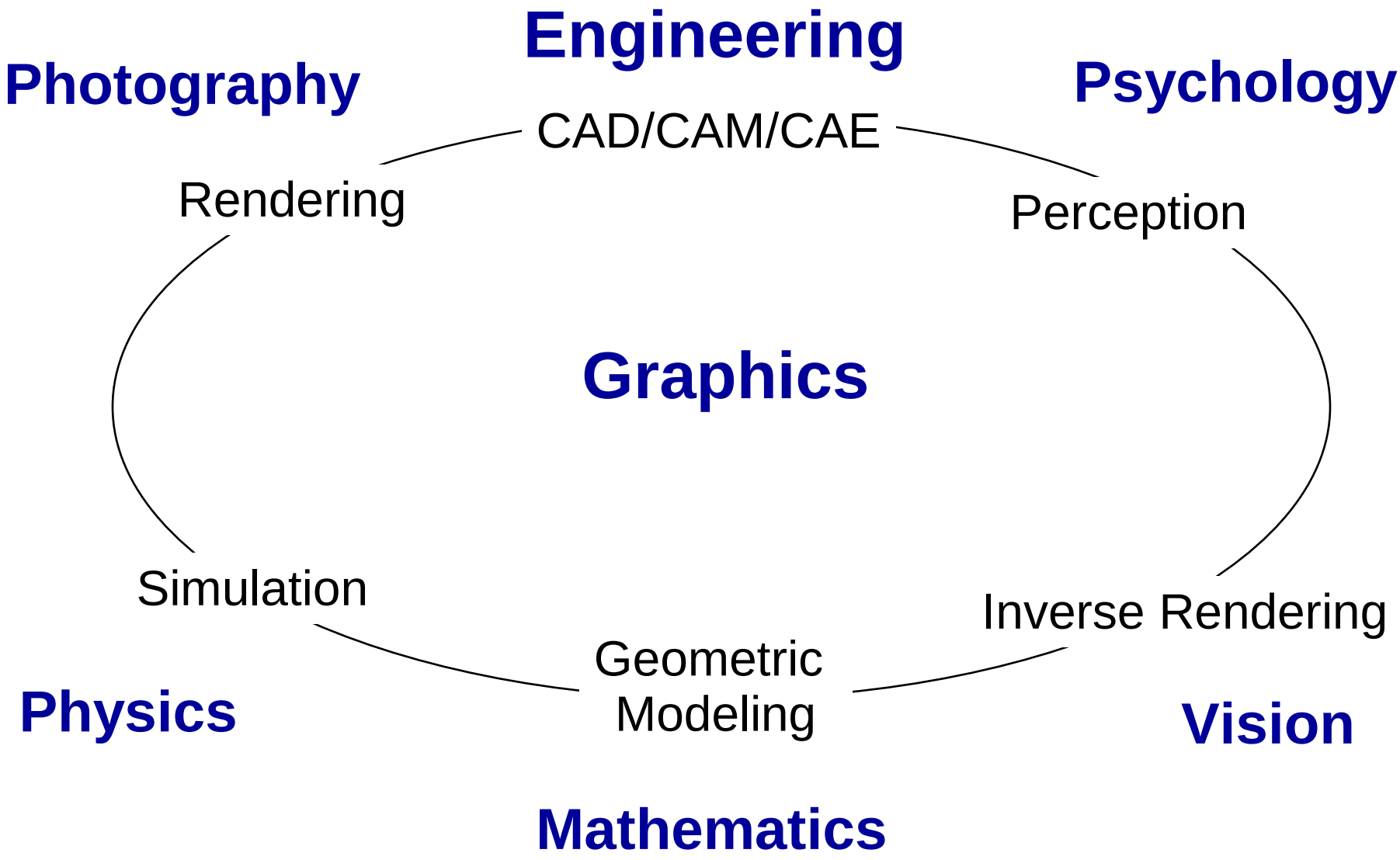
  - Foley, Van Dam, et al., ***Computer Graphics: Principles and Practice***, Addison-Wesley, 2. Ed, 1996
  - Andrew Glassner, ***An Introduction to Ray-Tracing***, Academic Press, 1989
  - Andrew Glassner, ***Principles of Digital Image Synthesis***, 2 Bände, Morgan Kaufman, 1995

  - Andrew Woo, et al., ***OpenGL Programming Guide***, 3. Ed., Addison-Wesley, 1999
  - Thomas Akenine-Möller, Eric Haines, ***Real-Time Rendering***, 2nd Ed., AK Peters, 2002
  - Randima Fernando, Mark Kilgard, ***The Cg Tutorial***, Addison Wesley, *2003*
  - Randima Fernando, ***Cg Gems***, Addison Wesley, 2004

Course Syllabus

- **Ray Tracing**
  - Basics
  - Acceleration strategies
  - Light – Matter interaction
  - Textures
  - Modeling
  - Signal processing, anti-aliasing
  - Transformations and Projections
- **Graphics Pipeline**
  - OpenGL
  - Rasterization
  - Clipping, visibility, imaging
  - Programmable graphics hardware
- **Advanced Topics**
  - Perception
  - Global illumination

What is Computer Graphics ?



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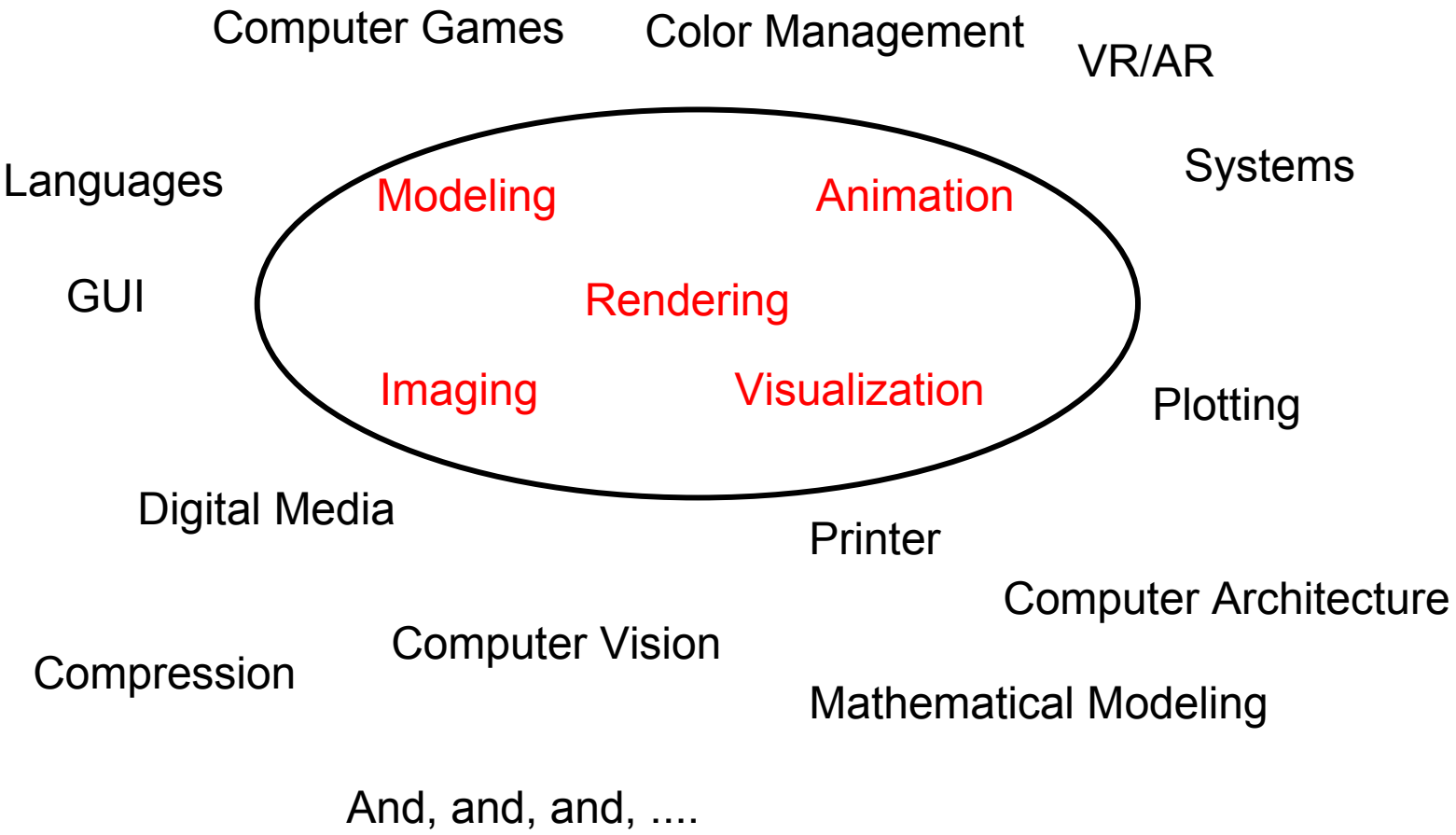
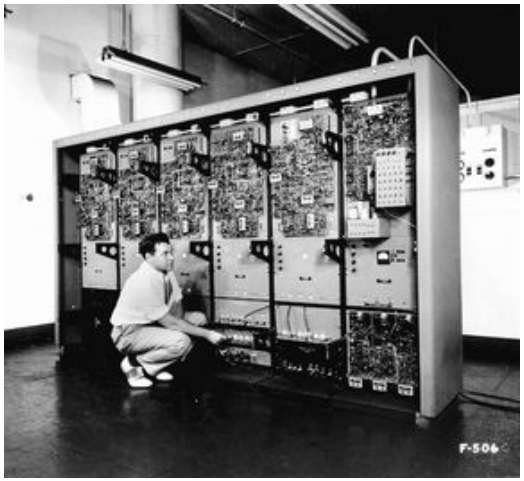


Historical Perspective

- **A short history of graphics:**
  - 1950: MIT Whirlwind (CRT)
  - 1955: Sage, Radar with CRT and light pen
  - 1958: Willy Higinbotham “Tennis for Two”
  - 1960: MIT „Spacewar“ on DEC PDP-1
  - 1963: Ivan Sutherland‘s „Sketchpad“ (CAD)
  - 1969: ACM Siggraph founded
  - 1968: Tektronix storage tube ($5-10.000)
  - 1968: Evans&Sutherland (flight simulators) founded
  - 1968: Douglas Engelbart: computer mouse
  - 1970: Xerox: GUI
  - 1971: Gourand shading
  - 1974: Z-buffer
  - 1975: Phong shading model
  - 1979: Eurographics founded
  - 1980: Whitted: Ray tracing



Historical Perspective

- **A short history of graphics (Cont.):**
  - 1981: Apollo Workstation, IBM PC
  - 1982: Silicon Graphics (SGI) founded
  - 1984: X Window System
  - 1984: First Silicon Graphics Workstations (IRIS GL)
  - Until mid/end of 1990s: Dominance of SGI in the high end
    - HW: RealityEngine, InfiniteReality, RealityMonster, ...
    - SW: OpenGL, OpenInventor, Performer, Digital Media Libs, ...
  - End of 1990s:
    Low- to mid range taken over by „PCs“ (Nvidia, ATI, ...)
    - HW: Fast development cycles, Graphics-on-a-chip, ...
    - SW: Direct 3D & OpenGL, computer games
  - Today
    - Programmable graphics hardware, Cg
    - Realtime Ray Tracing

Wrap-Up

- **Computer Graphics**
  - Rendering
  - Modeling
  - Visualization
  - Animation
  - Imaging
- **Young, dynamic area**
  - Progress driven by research & technology
- **Big industry !**
- **Interdisciplinary field**
  - Relations to mathematics, physics, engineering, psychology, art, entertainment, …

Master in Visual Computing

- **Research oriented international course of studies**
- **Three major areas**
  - Image acquisition and geometric foundations
  - Image analysis (image processing, computer vision, ...)
  - Image synthesis (computer graphics, visualization, ...)
  - Related fields
    - Telecommunications, machine learning, artificial intelligence, signal processing, computational linguistics, medical engineering, cognitive sciences, ...
  - Foundations in mathematics, computer science, physics, and mechatronics
- **More information:**
  - http://www.master-visual-computing.de/