



# **Computer Graphics**

**Department of Software,  
Sejong University**

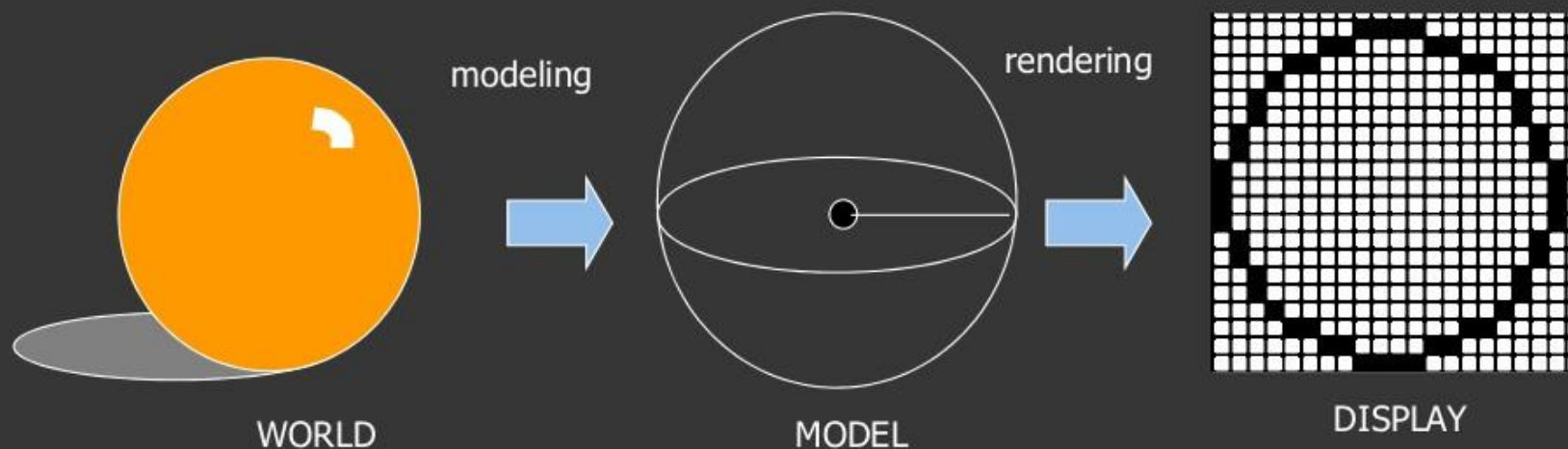
**Sang Il Park**

# 담당교수 소개

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  - 이메일: [sipark@sejong.ac.kr](mailto:sipark@sejong.ac.kr)
  - 전화: 02-3408-3832
- 연구실:
  - 장소: 대양AI센터 626호
  - Office hour: 월/수 16:30~18:00
- 수업 홈페이지:
  - <http://eCampus.sejong.ac.kr>

# Computer Graphics



“Computer Graphics is concerned with producing images (or animations) using a computer.”



Ed Pantera  
[instagram.com/ed\\_pantera\\_3d/](https://www.instagram.com/ed_pantera_3d/)

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# Behind the Scene:

## Computer Graphics

Ed Pantera  
instagram.com/ed\_pantera\_3d



# Computer Graphics

## Modelling



Creating or capturing the representation of objects - motion often geometrical

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## Modelling



Creating or capturing the representation of objects - motion often geometrical

## Rendering

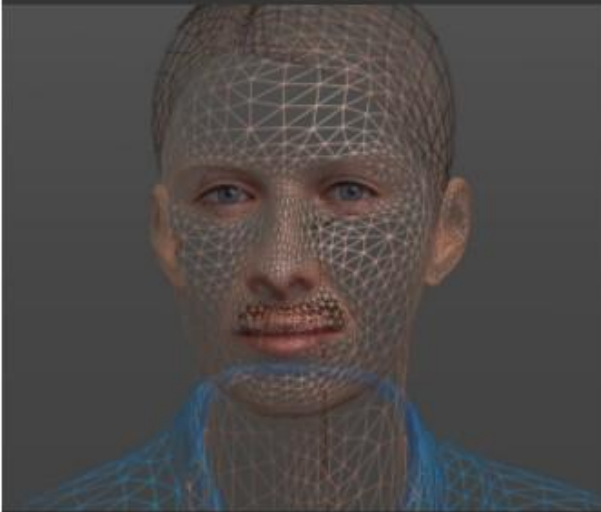


Creating an image of these objects on a display device



# Computer Graphics

## Modelling



Creating or capturing the representation of objects - motion often geometrical

## Rendering



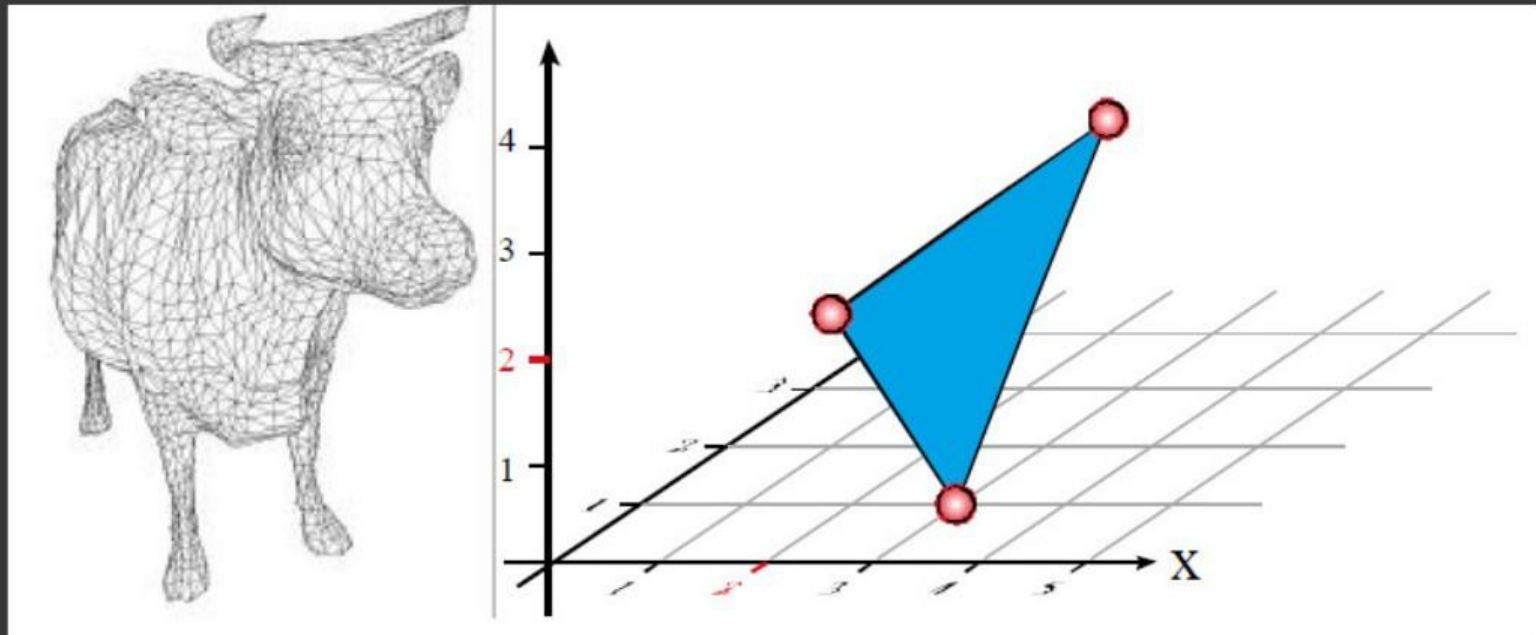
Creating an image of these objects on a display device

## Animating

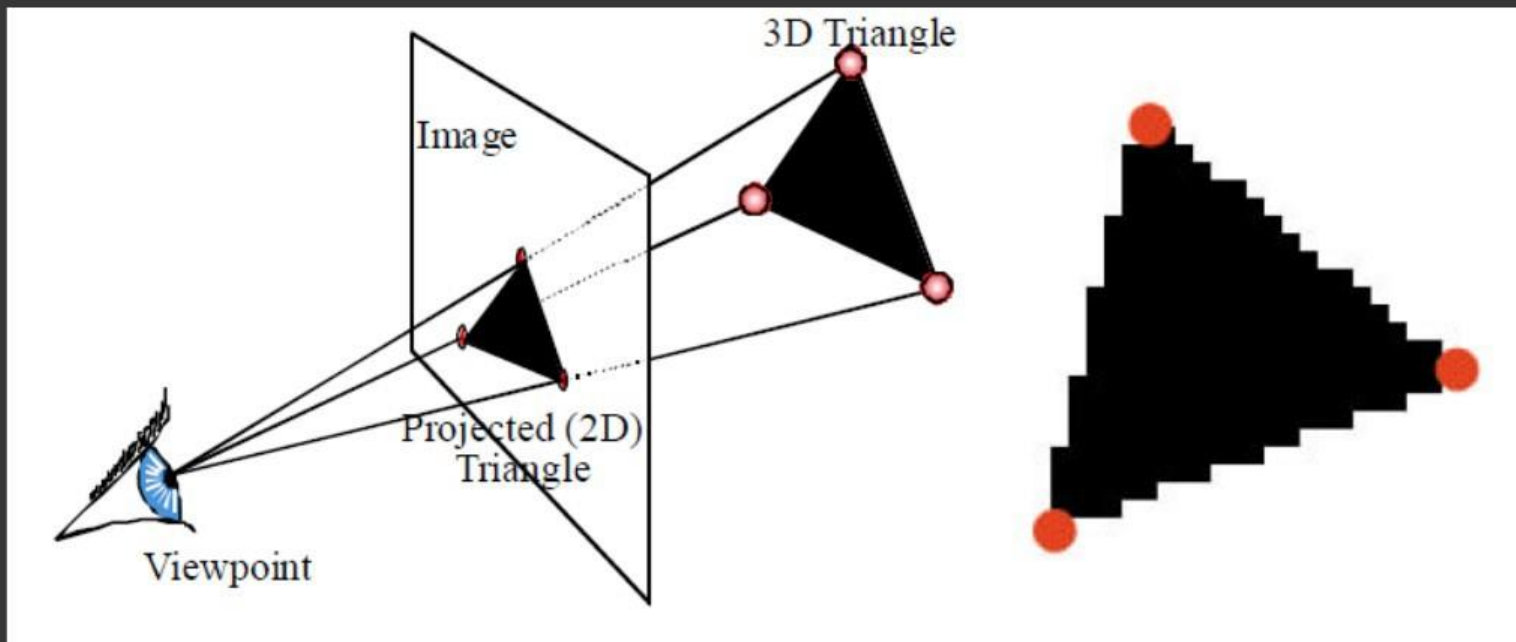


Making objects move by describing how they change over time

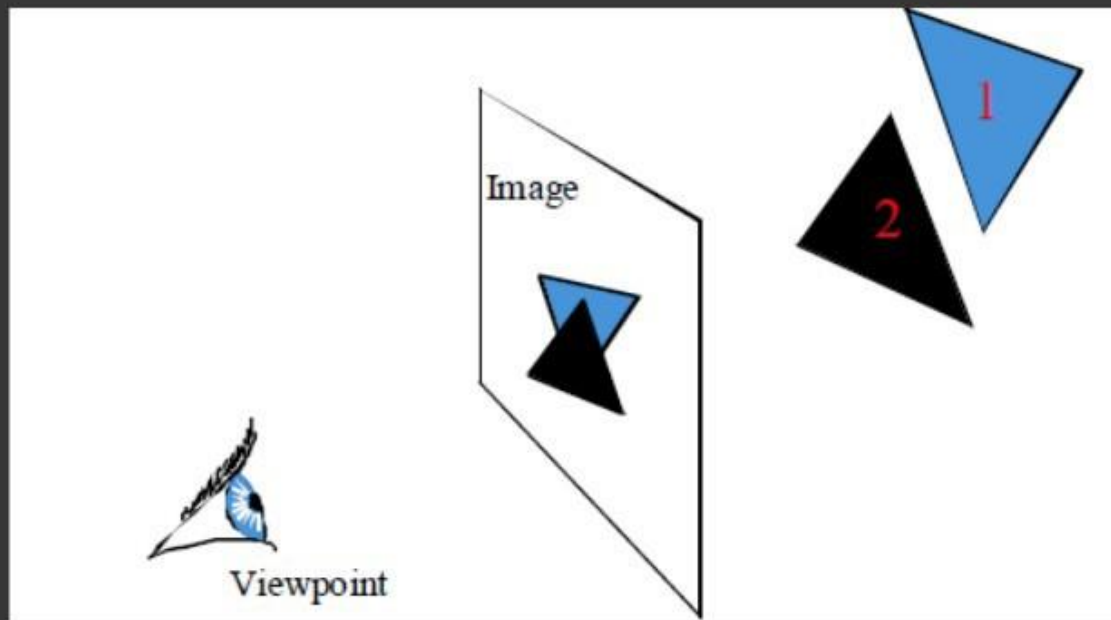
# Polygons



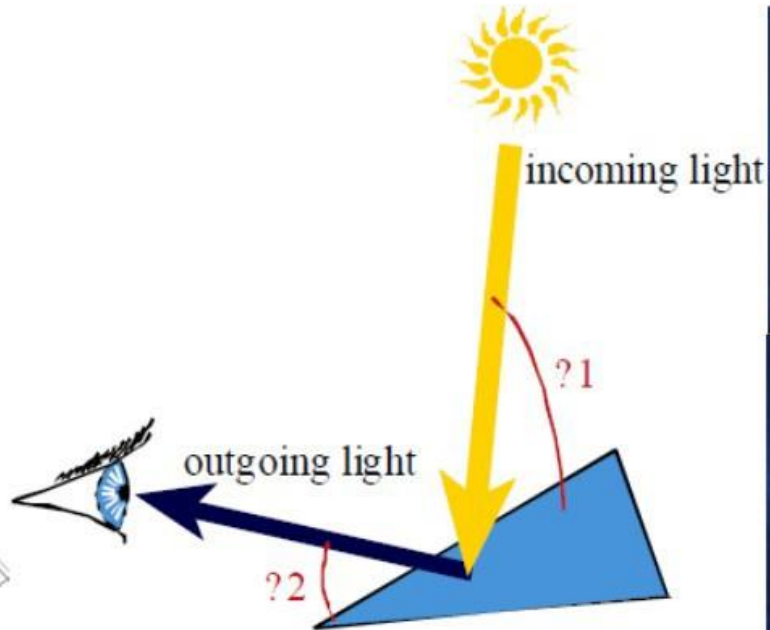
# Rendering



# Visibility



# Shading and Materials



# Why do we learn computer graphics

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2006



19





# Can you see the differences?

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# What is in the behind of the scene?



# Is this looking good? Why?



<https://www.youtube.com/watch?v=Tk7Zbzd-6fs>



# State-of-the-art of real-time graphics

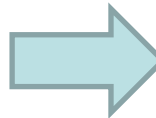
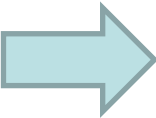
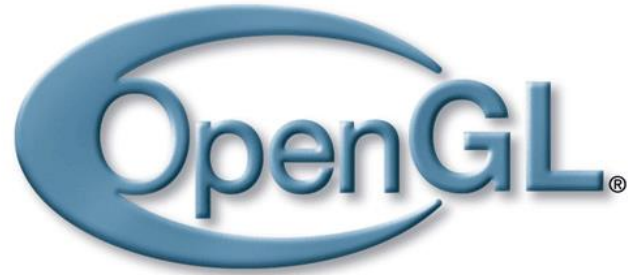


<https://youtu.be/qC5KtatMcUw?t=81>

<https://youtu.be/Dj60HHy-Kqk>

# Paradigm changed

- OpenGL 1.0 (1994)
- OpenGL 2.0 (2004)
- OpenGL 3.0 (2008)
- OpenGL 4.0 (2010)



# Under the hood: *Shaders*

- A new way to program OpenGL
  - Before: Fixed Pipeline
  - After: Programmable pipeline

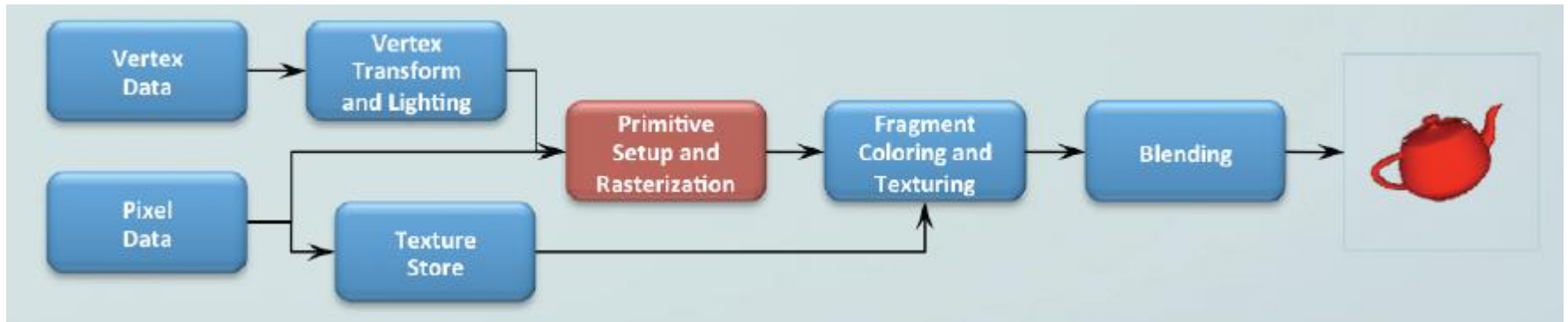


- Modern OpenGL doesn't support many of the classic things such as "glBegin/glEnd".
- Currently all industries use *shaders* for their graphics processing



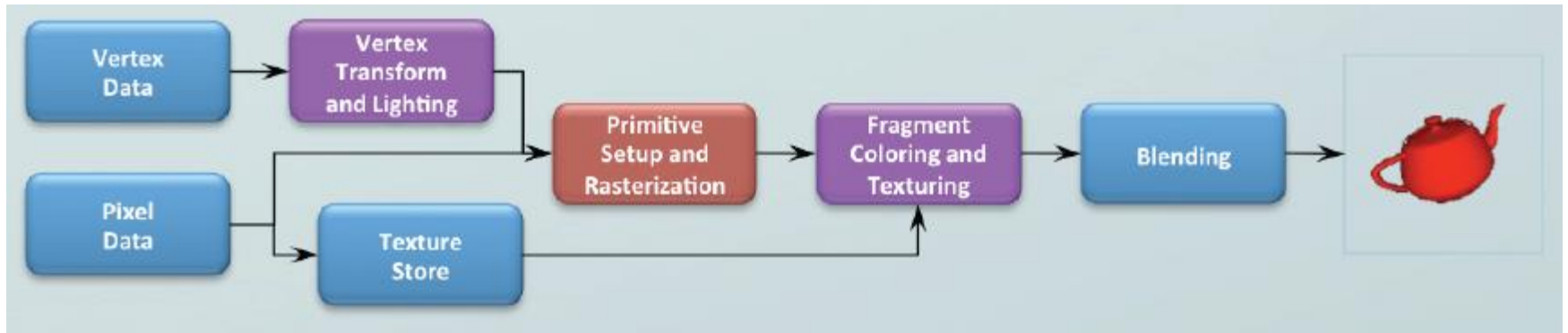
# OpenGL 1.0 - 1994

- Fixed-function pipeline



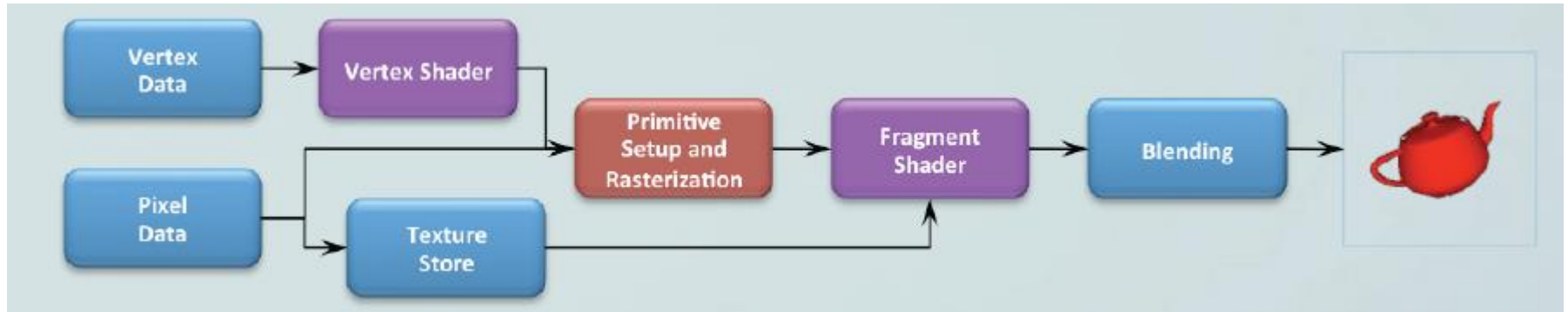
# OpenGL 2.0

- Officially added programmable pipeline



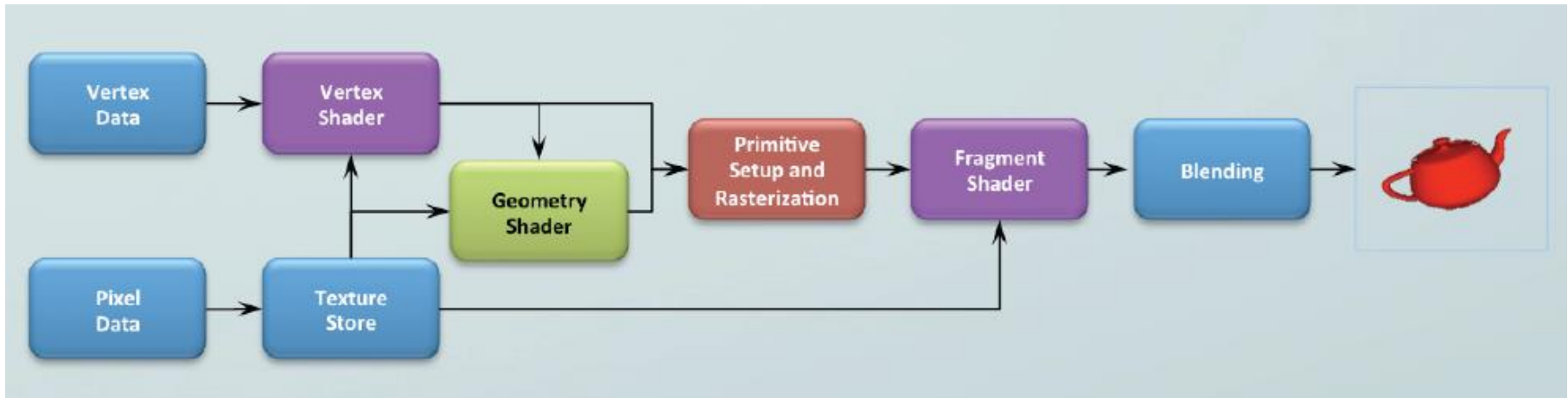
# OpenGL 3.1

- Removed the fixed-function pipeline



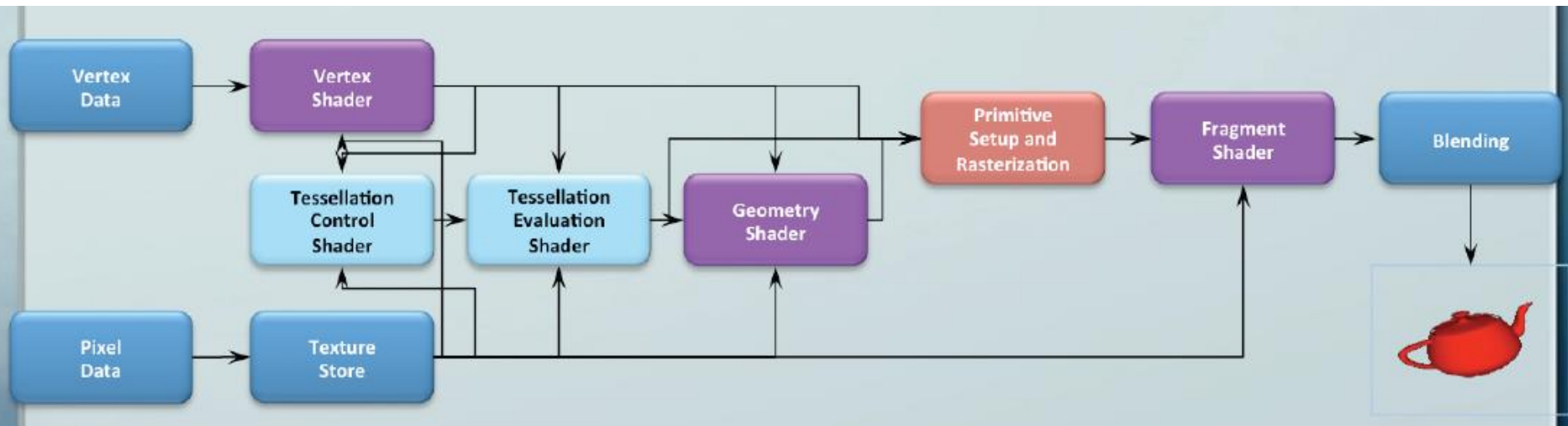
# OpenGL 3.2

- Additional shading stage : geometry shader



# OpenGL 4.5

- More of shaders!



# WebGL

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- WebGL
  - JavaScript implementation of OpenGL
  - Runs on most recent browsers (Even on your mobiles!)
    - <http://davidwalsh.name/webgl-demo>



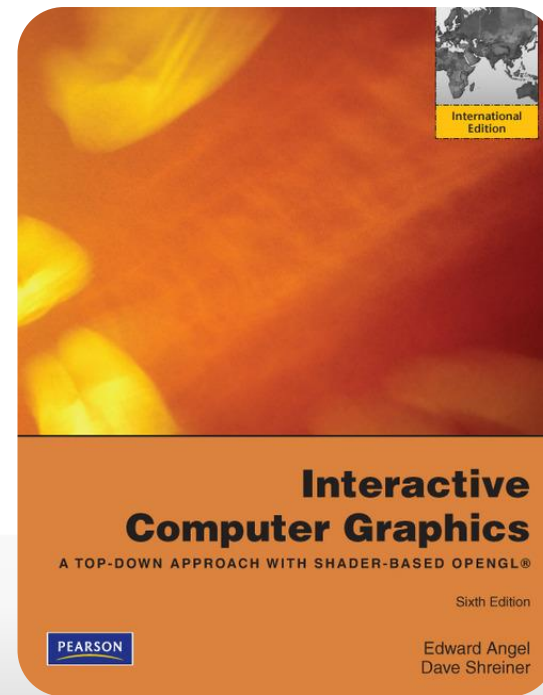
# 수업 소개

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- 컴퓨터 그래픽스 심화/최신 이론 학습
  - 기본적인 수학/물리 이론들 review
  - 다양한 기하 요소들에 관한 이론 및 활용
- 프로그래밍 능력 배양
  - 프로그래밍 중심 수업임 (OpenGL 활용)
  - Modern Graphics Pipeline 연습  
: Shader-based OpenGL programming

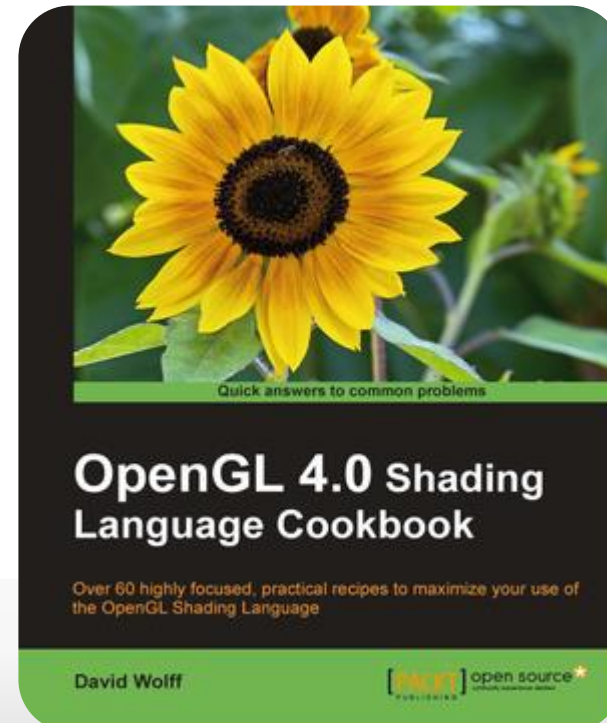
# 교과서

- **Interactive Computer Graphics – 6<sup>th</sup> edition**  
(A top-down approach with shader-based  
OPENGL) by E. Angel and D. Shreiner



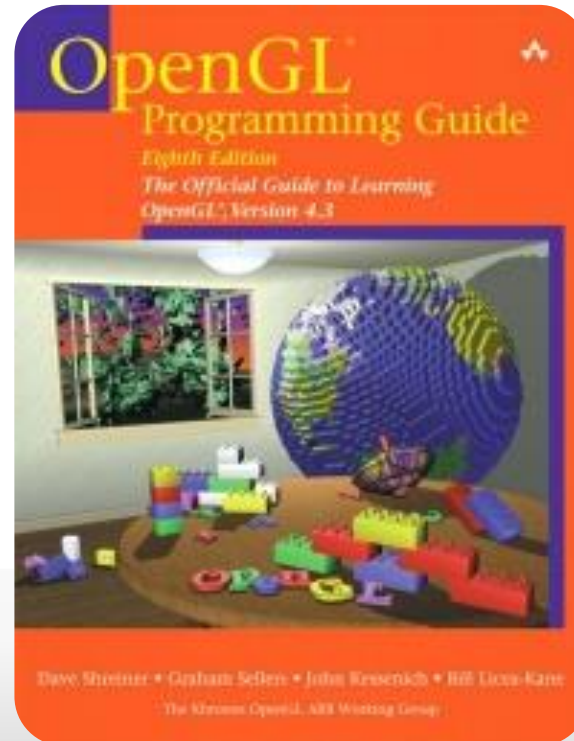
# 있으면 좋을 책

- OpenGL 4.0 Shading Language Cookbook
  - many interesting examples



# 있으면 좋을 책

- OpenGL Programming Guide 8<sup>th</sup> edition (“Red Book”) – everything about OpenGL



# 수업방법

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- 강의:
  - 이론(50%), 실습(50%), 수시고사 등으로 구성
- 과제
  - 프로그래밍 (5번 정도 예상)
- 성적
  - 중간고사(25%)/기말고사(25%)
  - 과제 (50%)
  - 출석 (~10%)
    - 출석은 하루 결석에 전체 총점에서 2점씩, 최대 10점 감점 (6번 이상 결석은 F 처리)
    - 지각 2번은 결석 1번으로 처리

# 수강필요조건

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- C/C++ programming skills
- Basic Data Structures
  - linked list, arrays
- Linear Algebra
  - vector/matrix
- Multimedia Programming
  - some experiences in dealing with images and *2D Matrix Transform*



# 시험 방식

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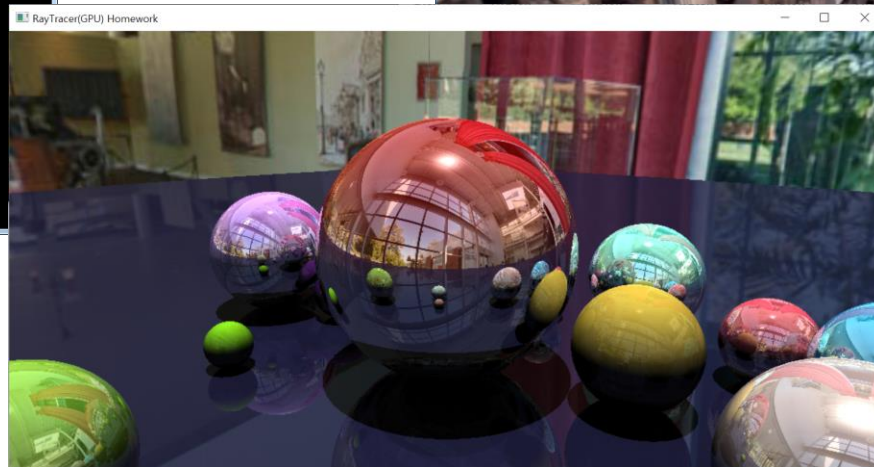
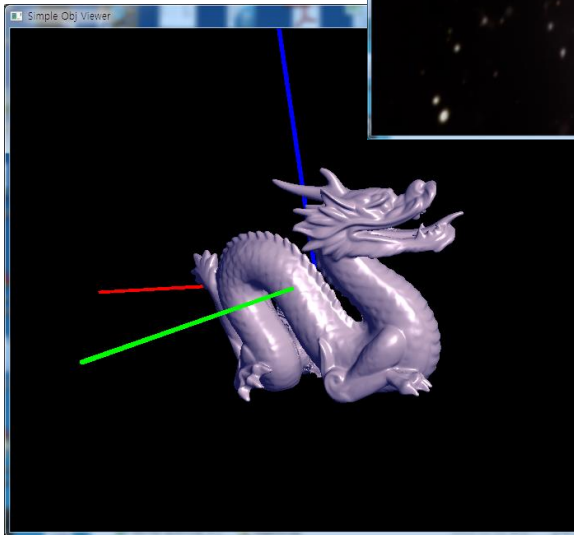
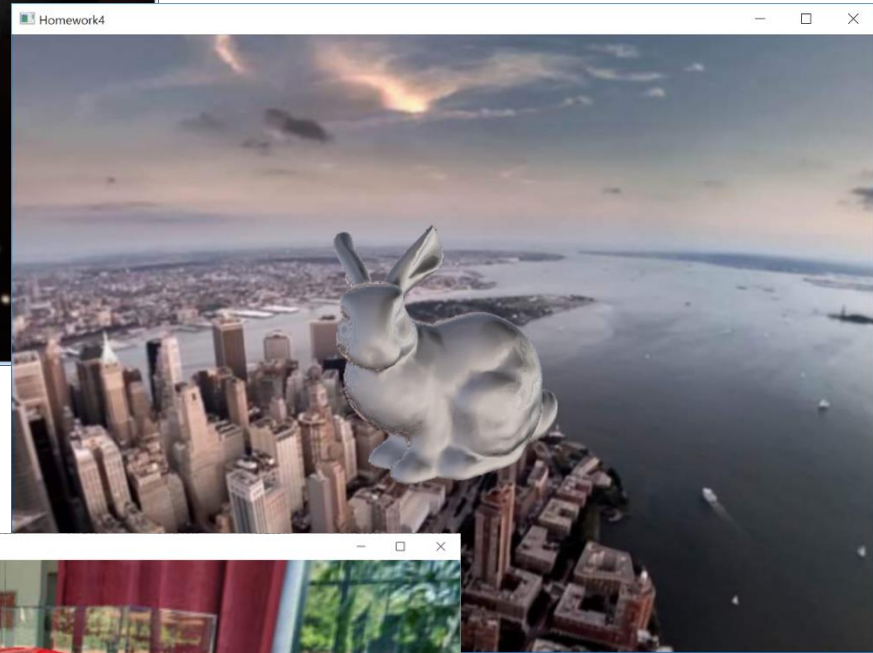
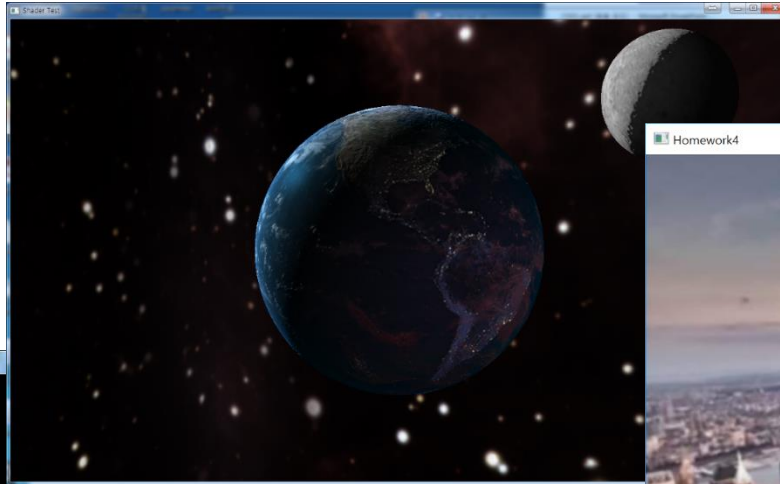
- 주로 필기로 구성 (중간, 기말)
- 필기: 이론 + 프로그래밍

# 숙제에 관하여

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- 모든 숙제는 개별 과제 **No Collaboration!**
- Do not copy any parts of any of the assignments from anyone.
- Programming Assignments:
  - eCampus.sejong.ac.kr을 통해 제출
  - 주어진 조건의 구현
  - 예술성을 높이기 위한 추가적인 구현도 적극 권장
  - 늦게 제출할 경우 감점
  - 3일 이상 늦을 경우 받지 않음.

# 지난 프로그래밍 과제 예시:



# Welcome to the Graphics World!

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- Creating synthetic images indistinguishable from reality.
- Practical, scientifically sound, in real time
- Creating your own translation of the reality



# SIGGRAPH

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- Special Interest Group on Graphics
- Main computer graphics event in the world
- Once per year
- 30,000 attendees
- Academia, industry



ACM**SIGGRAPH**

- Technical papers in SIGGRAPH 2023:  
<https://youtu.be/VBZ2sDxvZQE>
- NVidia CEO Keynote at SIGGRAPH 2023:  
<https://youtu.be/Z2VBKerS63A>
- NVidia Omniverse Address at SIGGRAPH 2023:  
<https://youtu.be/7yjNW04gVMw>

# See you on this Wednesday

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- Your very first 3D programming begins
- We will learn how to install required libraries.
  - OpenGL on your computer