Graphics & Media lab
Лаборатория компьютерной графики при ВМК МГУ

Компьютерная графика

Баяковский Юрий Матвеевич, канд. физ.-мат. наук
доцент кафедры АСВК, зав. лабораторией КГ и ММ

Вторник, 14:30 – 16:05
Ауд.: П-5

Страница курса:
http://graphics.cs.msu.su/courses/cg

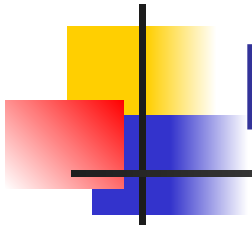
Graphics & Media lab
Лаборатория компьютерной графики при ВМК МГУ

Компьютерная графика

Лекция 1

Введение в предмет. Основные понятия. Организация курса.

9 февраля 2005 года



Мотивация

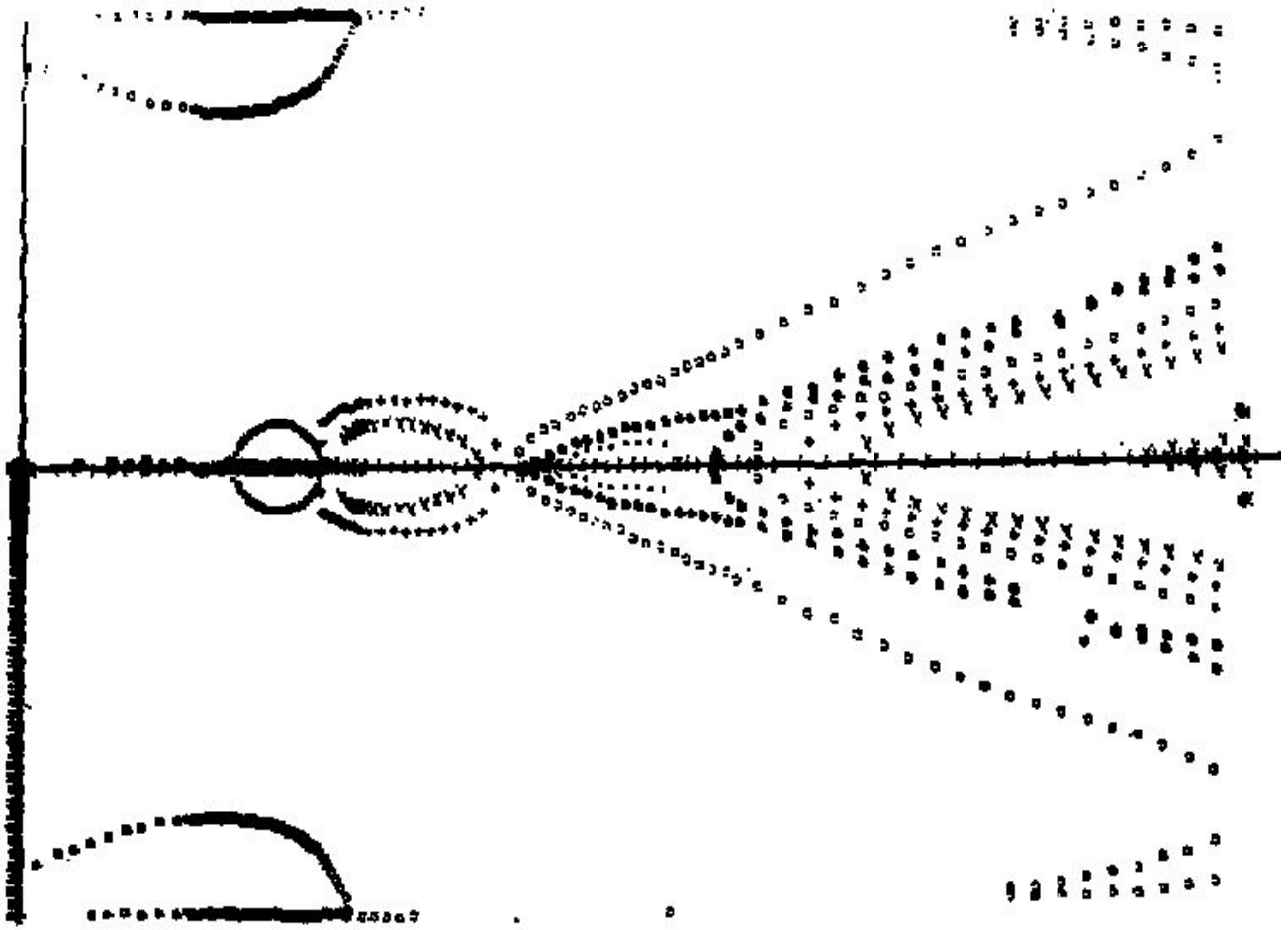
- WHY?
- WHAT?
- HOW?

- Цифровые камеры, ЦТВ
- Цифровые компьютеры
- Цифровой мир

WHY?

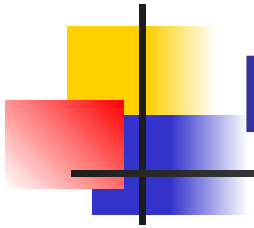
- Цифровые камеры, ЦТВ
- Цифровые компьютеры
- Цифровой мир

Обтекание цилиндра плазмой (1964 год)



Цифровой дом
Цифровой офис

It is also becoming accepted that consumers will agree to become data processors. For example, a few years ago, a 1024*1024 image was considered quite a substantial object for handling on a modern computer, and only computer scientists were really working with digital imagery. Now, consumer cameras costing a few hundreds of dollars, generate such images routinely. Consumers are becoming familiar with the process of capturing images, downloading them onto their home computers, processing them with various software tools, creating custom imagery. Such consumer acceptance will doubtless fuel further investment and technological development.



Example Modern Databases

Human Identity

- For each person, a $256 * 256$ image
- $N = 10^6$ individuals (points)
- $p = 256 * 256 = 65536$ variables (dimensions)

Hyperspectral Image

- For each chemical, a 1024-long spectrum
- $N = 5000$ compounds (points)
- $p = 1024$ variables (dimensions)

WHY?

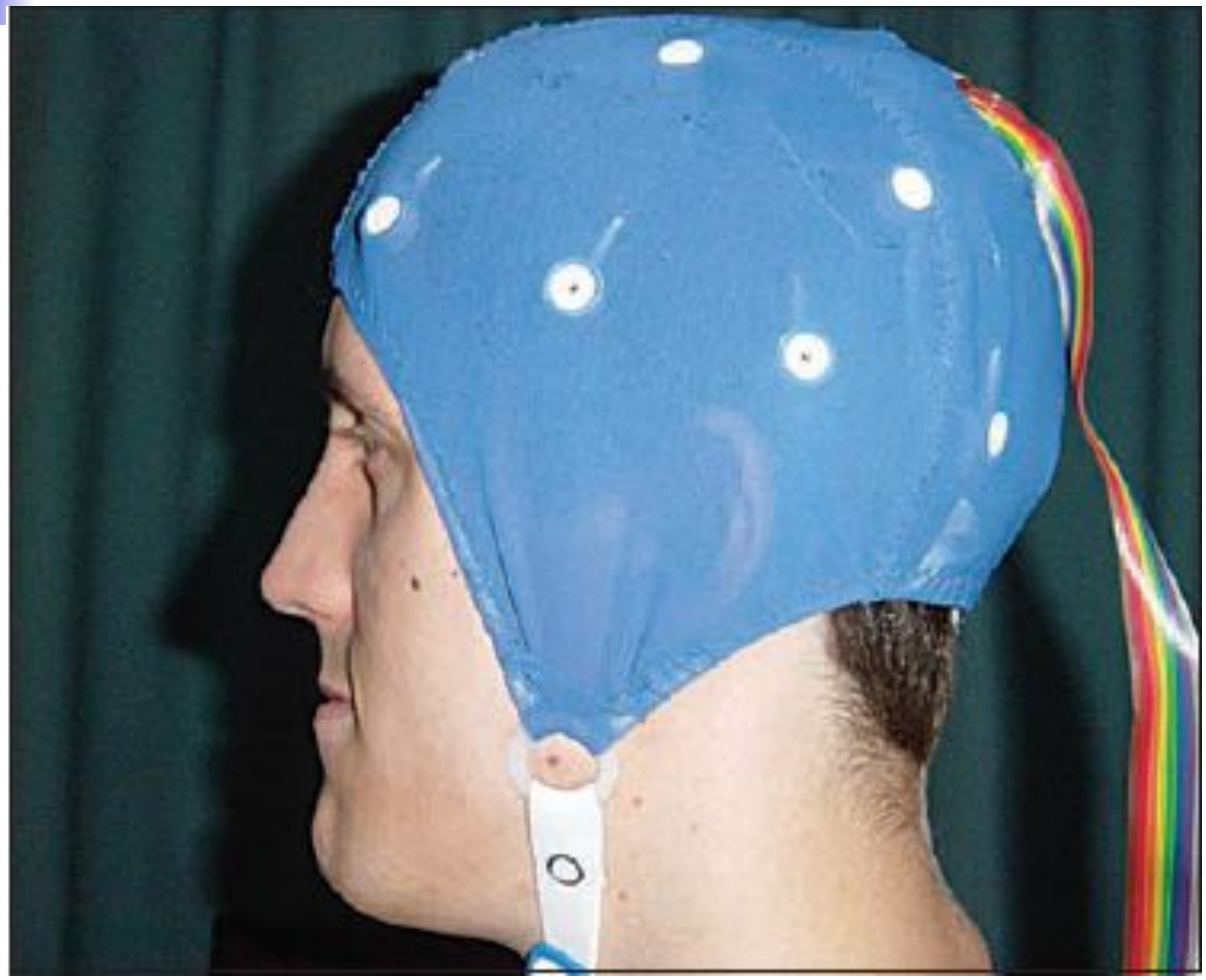
Because of the widespread use of imaging, there is an ever-pressing need to train engineers who are proficient with this new technology. This trend is likely to continue as the cost of imaging devices (digital camera, scanners, etc.) keeps declining and as the power of PCs keeps increasing, making sophisticated IP algorithms available to a larger base of users and increasing the potential number of applications.

WHY?

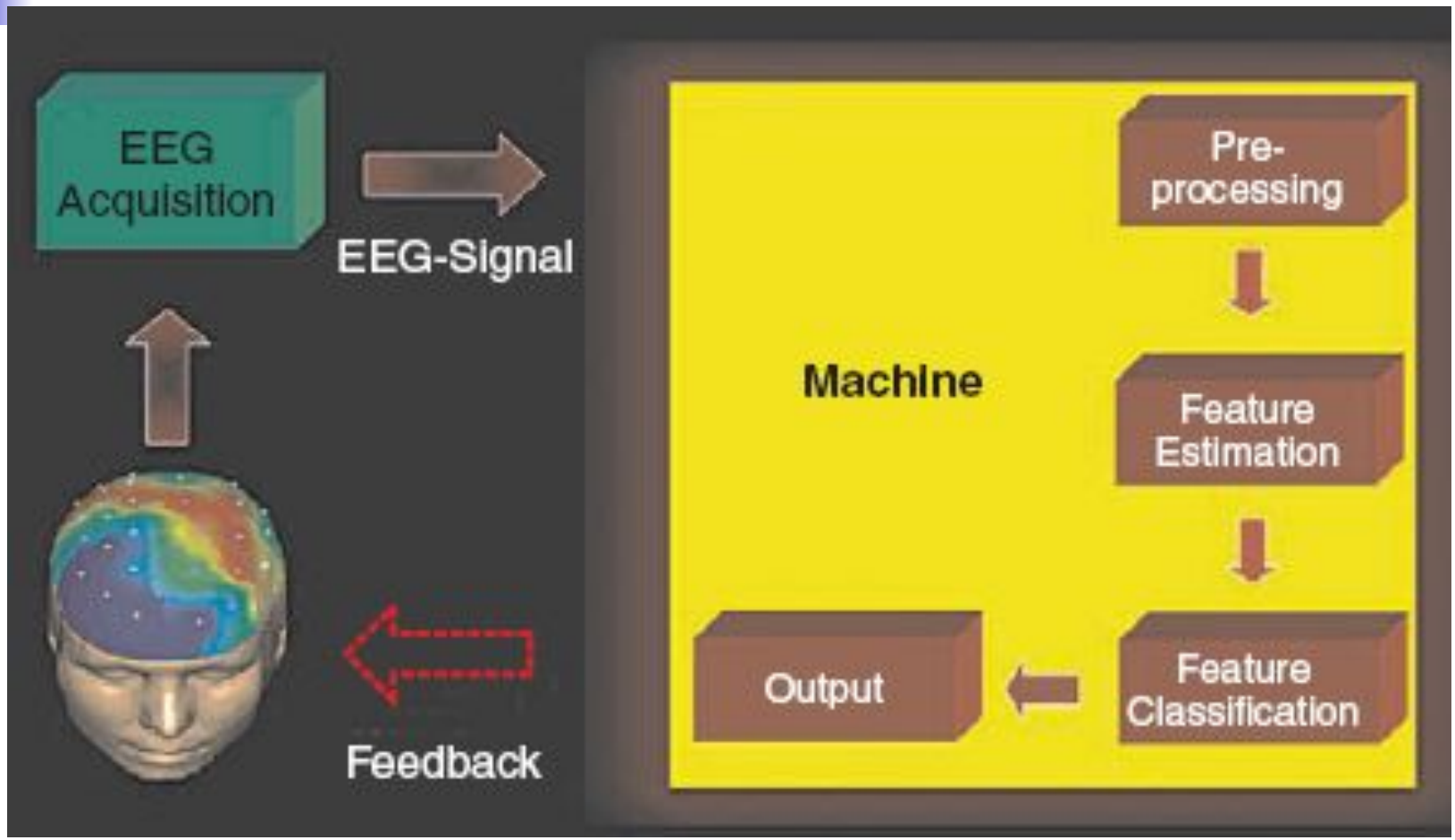
Every undergraduate computer science student should have the opportunity to have at least a meaningful introduction to computer graphics.

С 1994 года все студенты ф-та ВМиК слушают курс «Компьютерная графика»

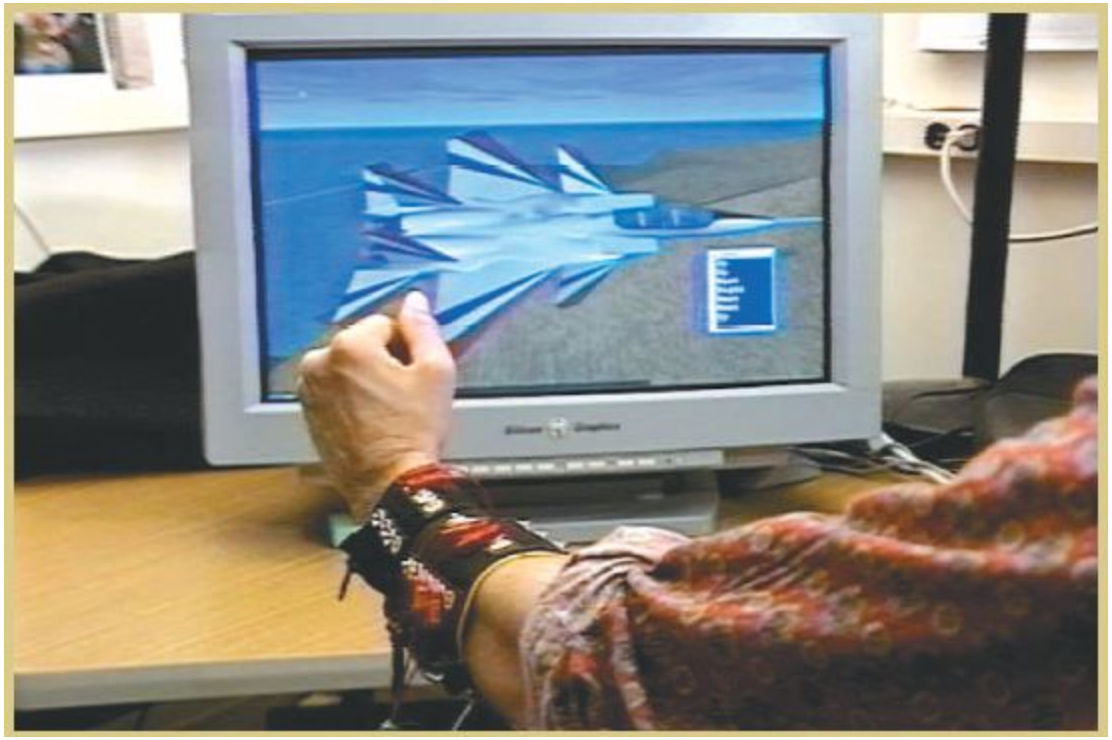
BCI (Brain-Computer Interface)



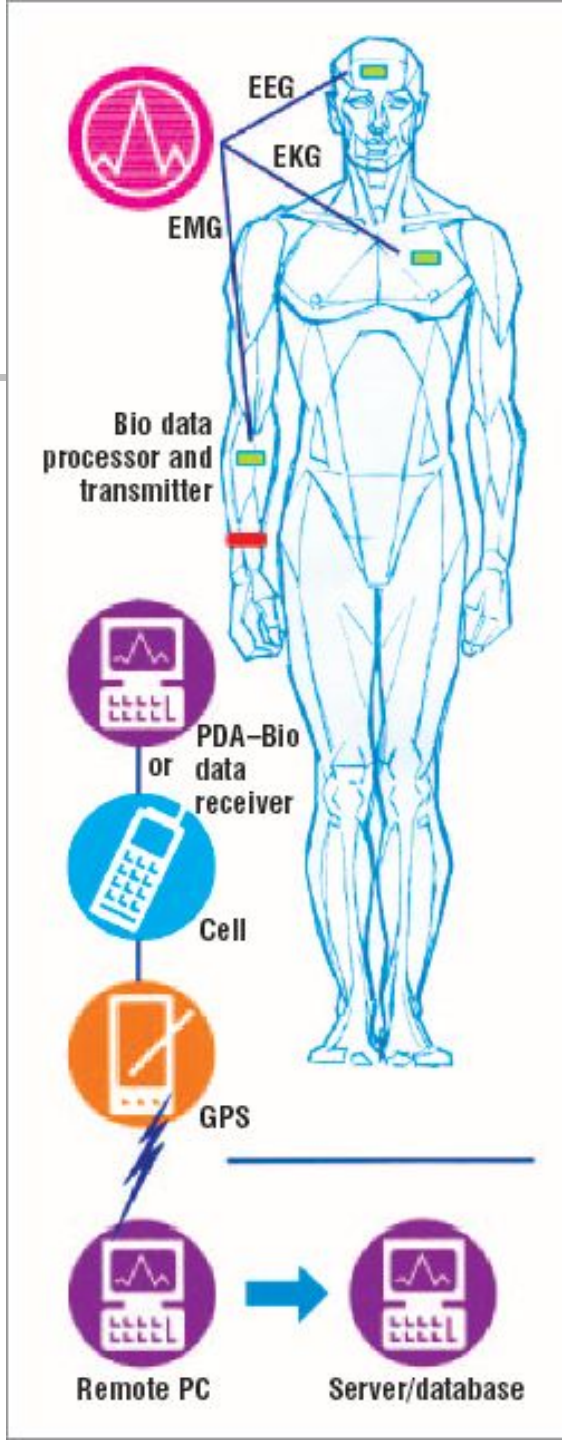
Мозго-компьютерный интерфейс

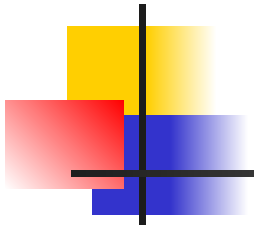


Bio Signals



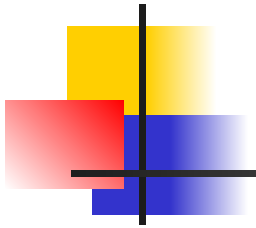
Виртуальный джойстик





WHAT?

- Обработка изображений
- Компьютерное (машинное) зрение
- Компьютерная (машинная) графика



IP -> CV -> CG

Изображение

Обработка изображений
Image Processing

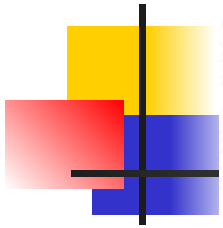
Изображение

Компьютерное (машинное) зрение
Computer (Machine) Vision

Модель (Описание)

Компьютерная (машинная) графика
Computer Graphics

Изображение



Step One: Get the frame from the videotape digitized with a frame-grabber

Step Two: Crop out the stuff that appears to be uninteresting (outside the plate edges)

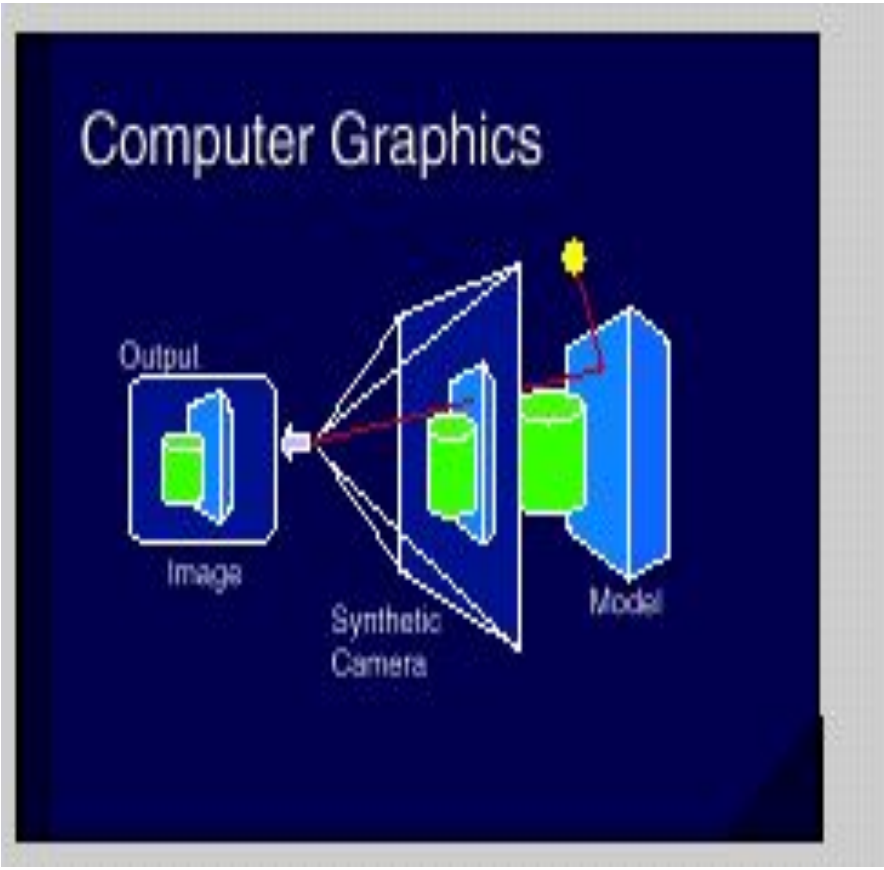
Step Three: Use an edge-sharpening filter to add contrast to the plate number

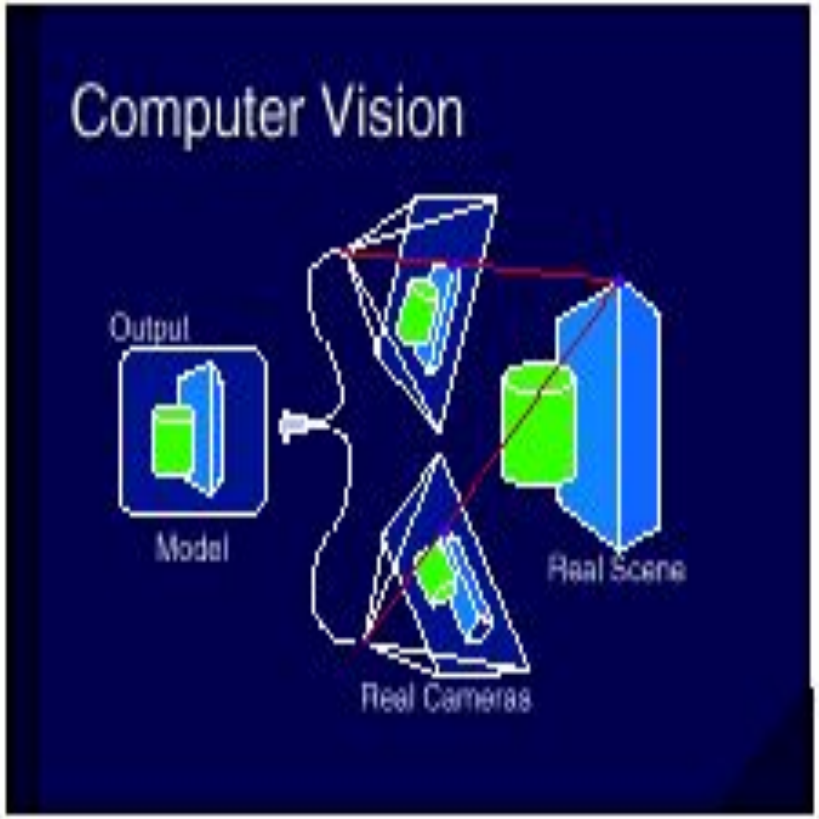
Step Four: Remap the colors to enhance the contrast between the numbers and the plate itself

Исходное изображение

Отображение ночного тона на дневной

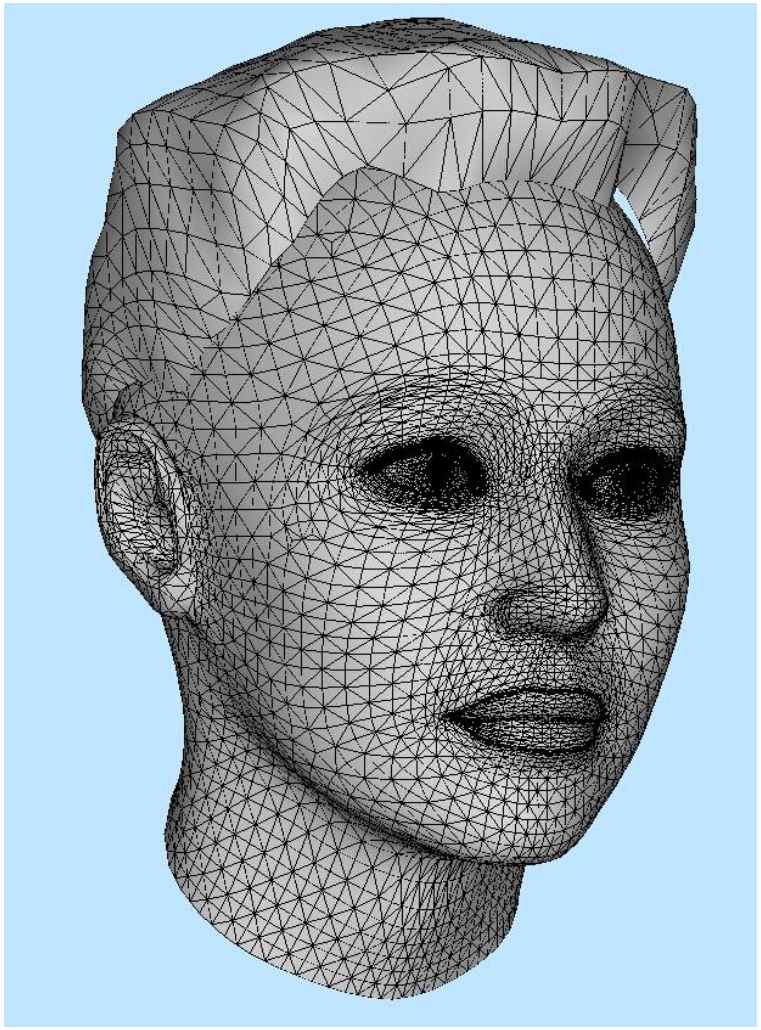
Компьютерная графика & Компьютерное зрение



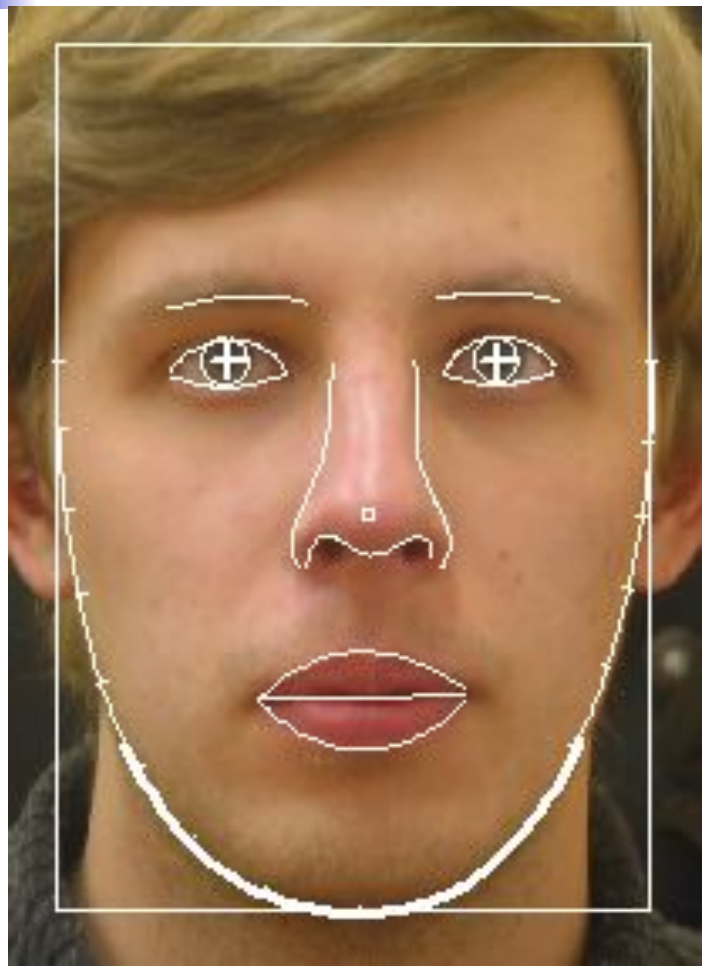


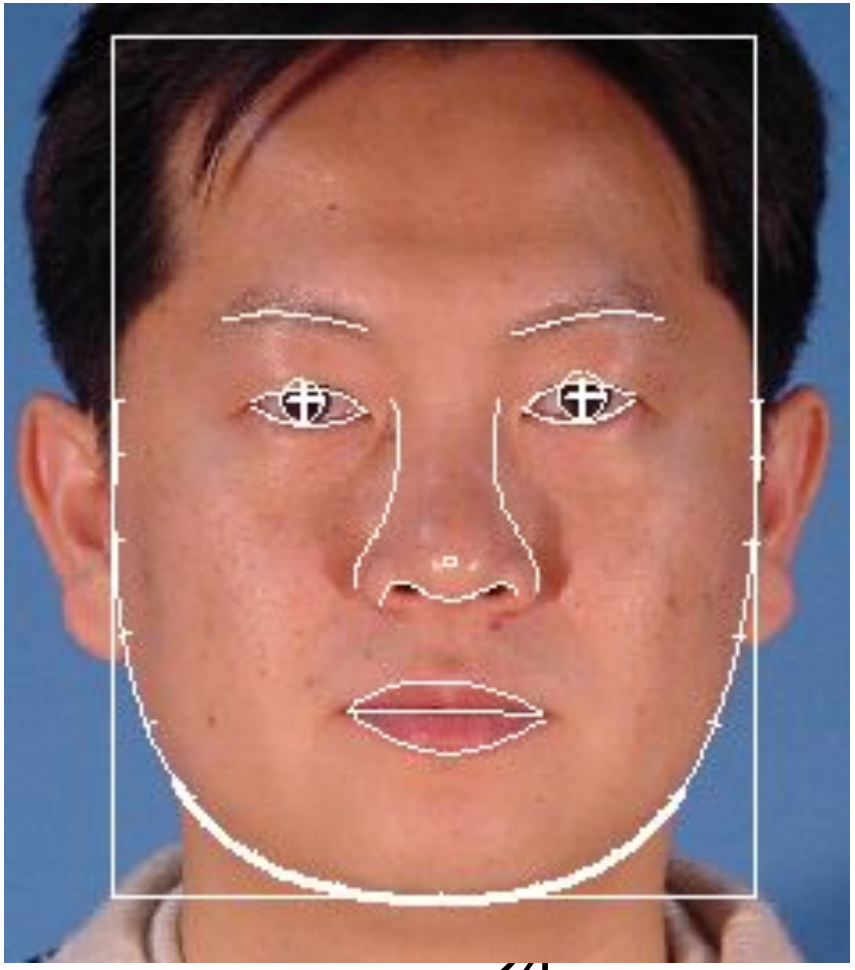
Компьютерное зрение
Computer Vision (1)

Компьютерное зрение
Computer Vision (2)

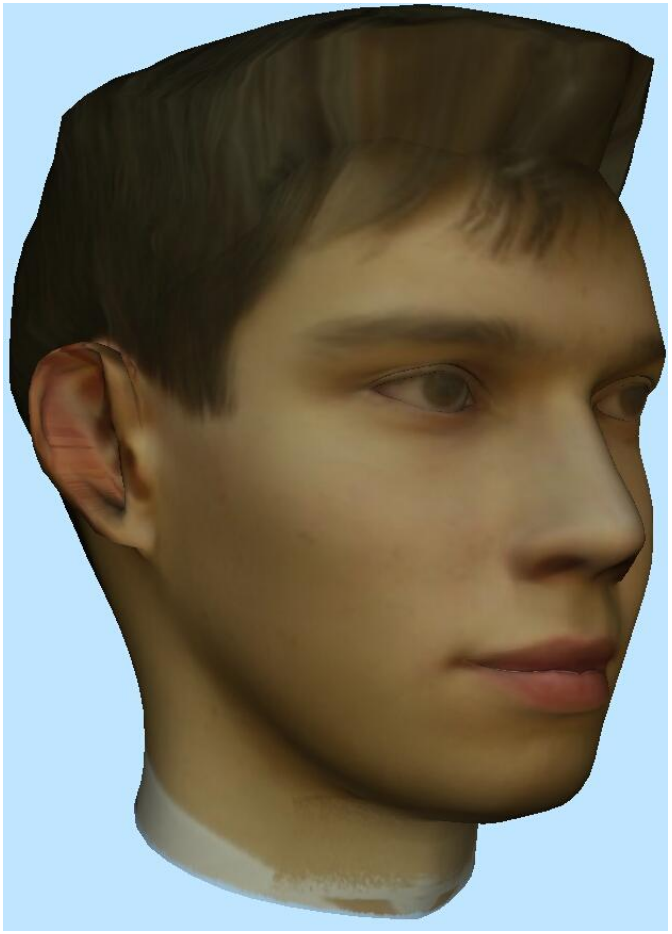


Компьютерное зрение
Computer Vision (3)





Компьютерное зрение
Computer Vision (4)



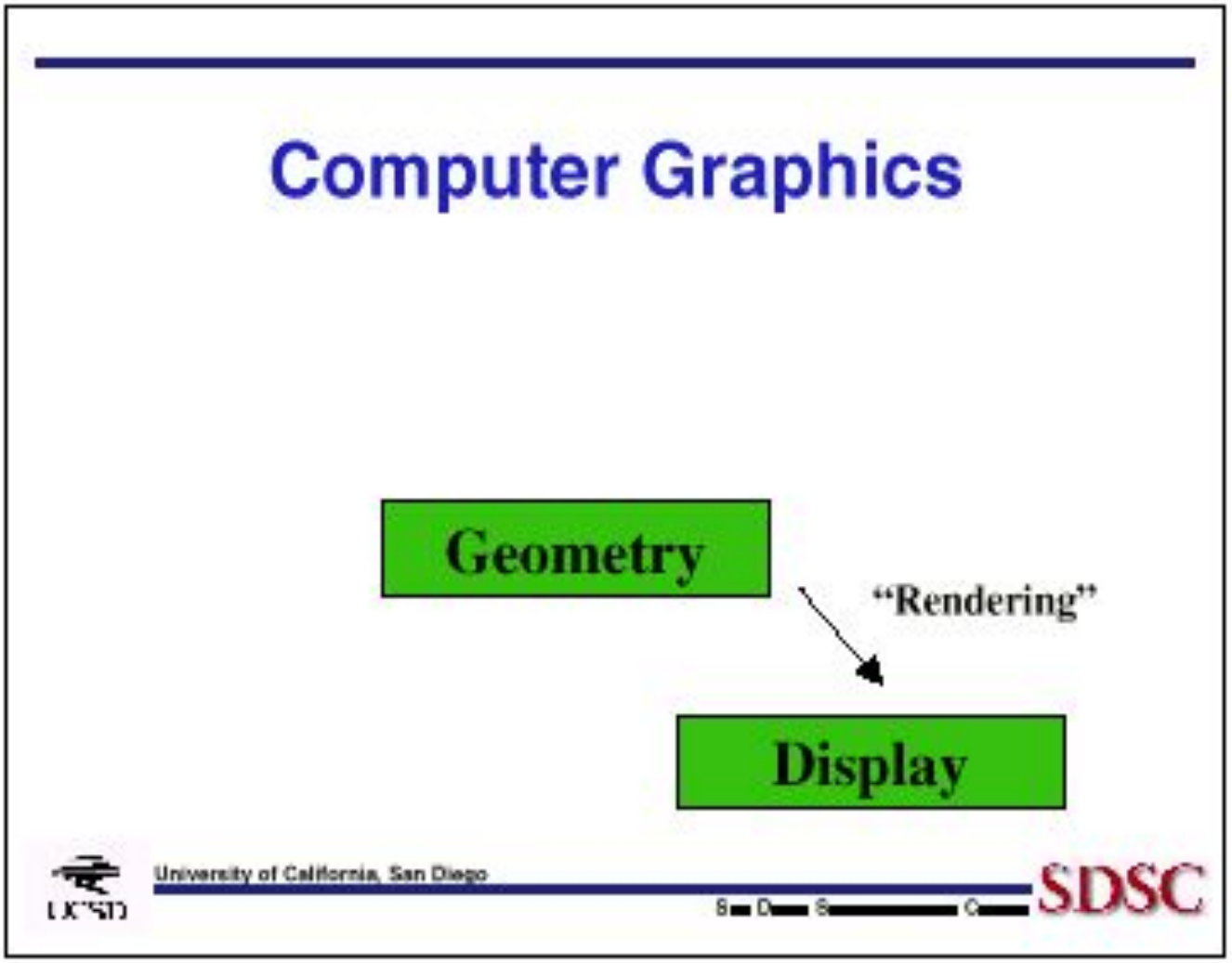
Реконструкция архитектурных объектов по фотографиям

Фото с базовыми линиями

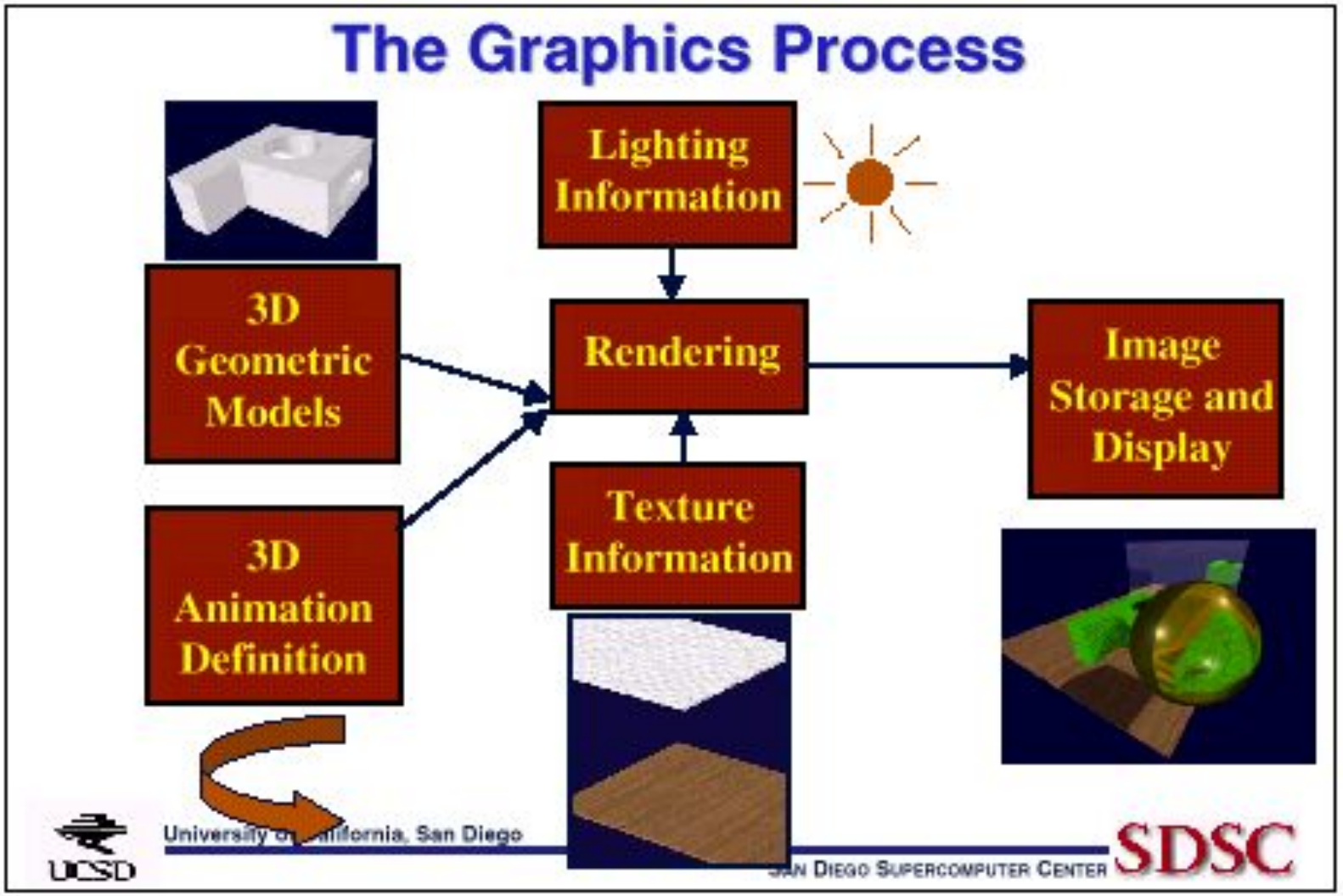
Реконструированная модель

Реконструкция сцены и фотомонтаж

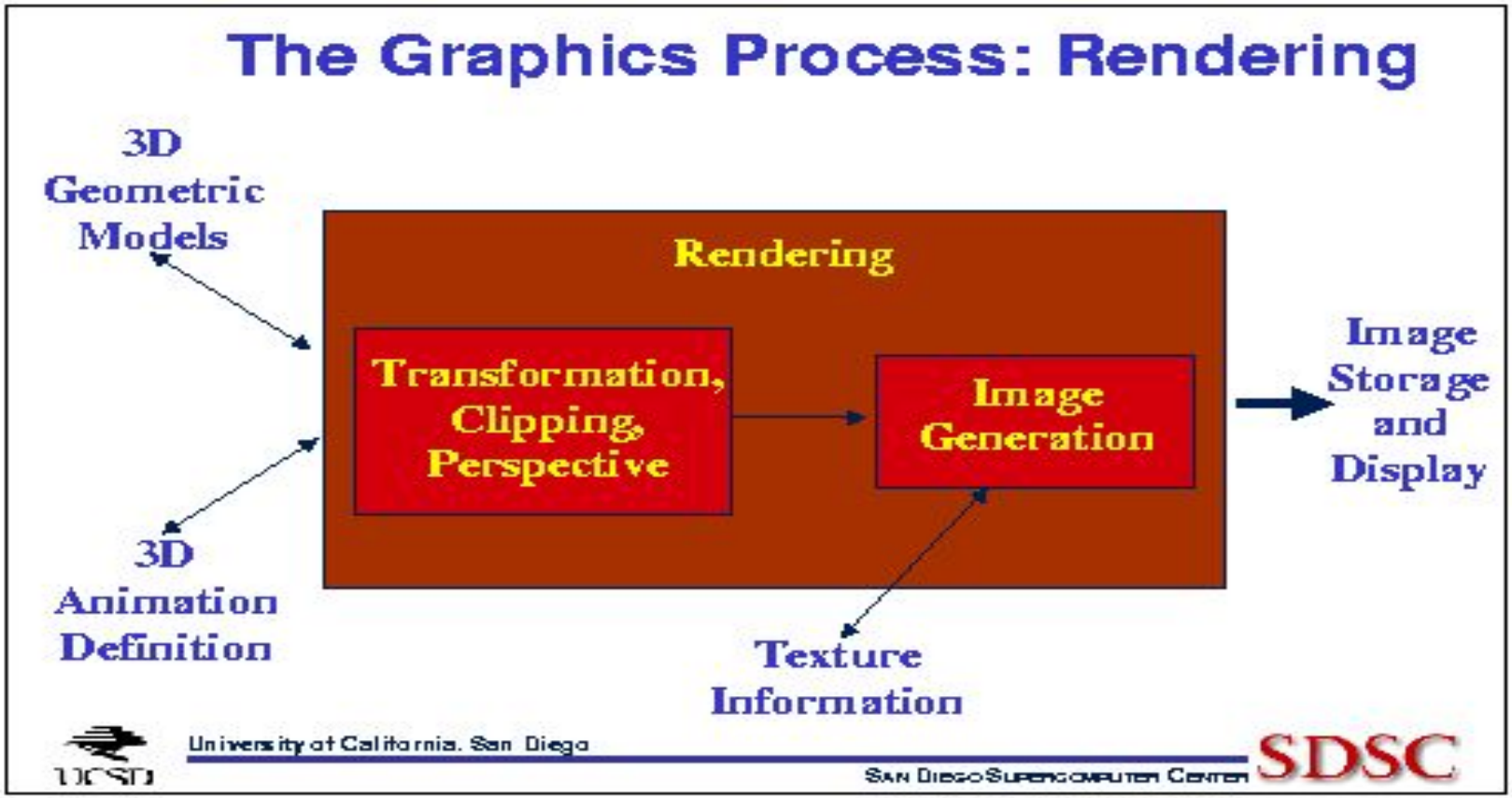
Компьютерная графика



Графический процесс



Синтез изображений (экранизация)



Синтез изображений (Экранизация -- Rendering)

Render *v.t.*

1: To compute an entier scene (as an output array of pixels) from a graphics data base.

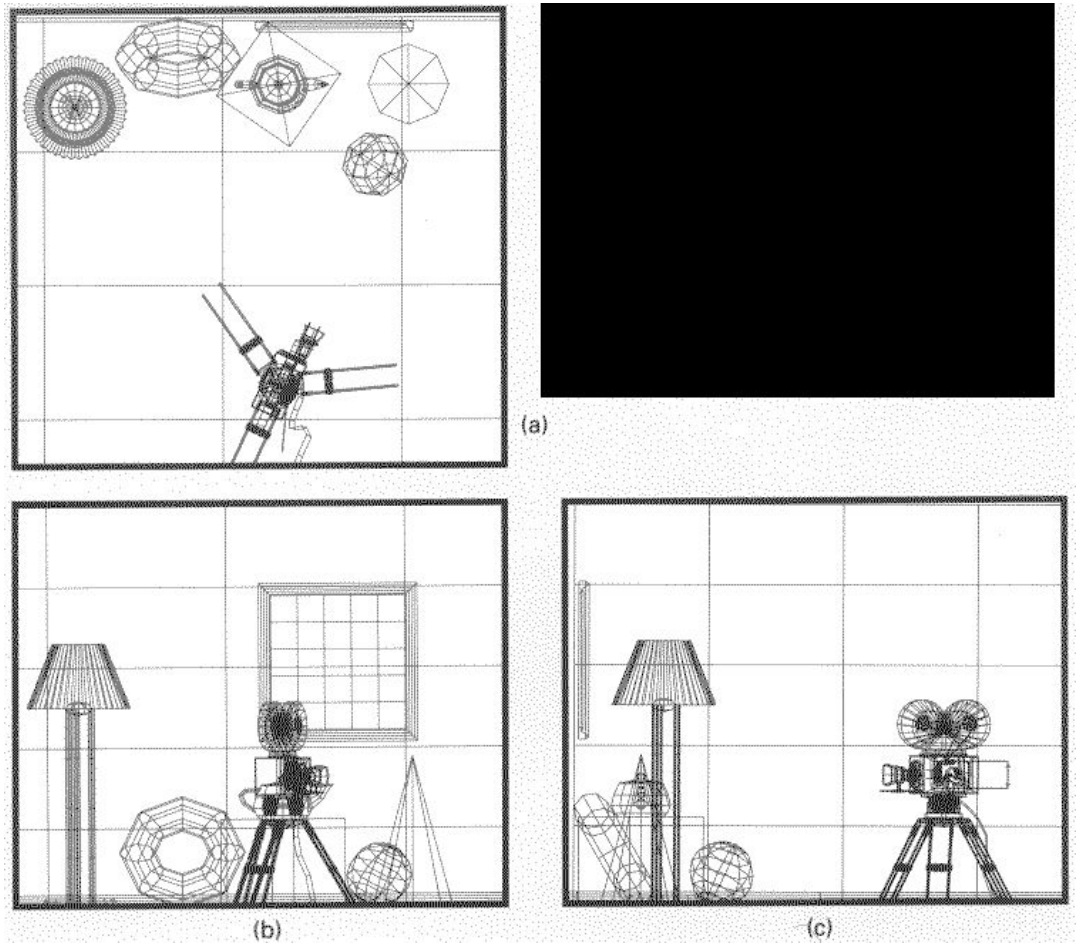
2: To convert a graphics primitive into individual pixels.

Экранизация

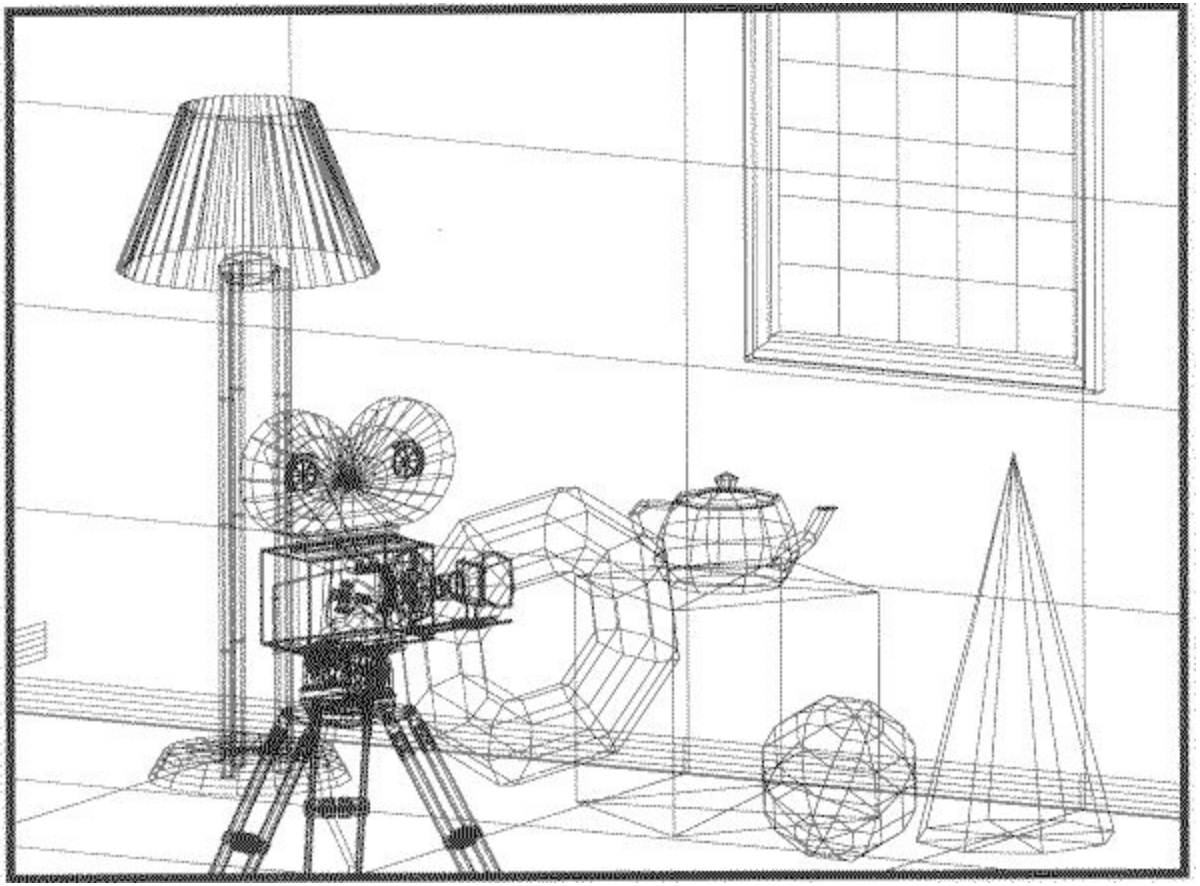
1: Вычисление всей сцены (как выходного массива пикселов) из графической базы данных.

2: Преобразование графических примитивов в индивидуальные пикселы.

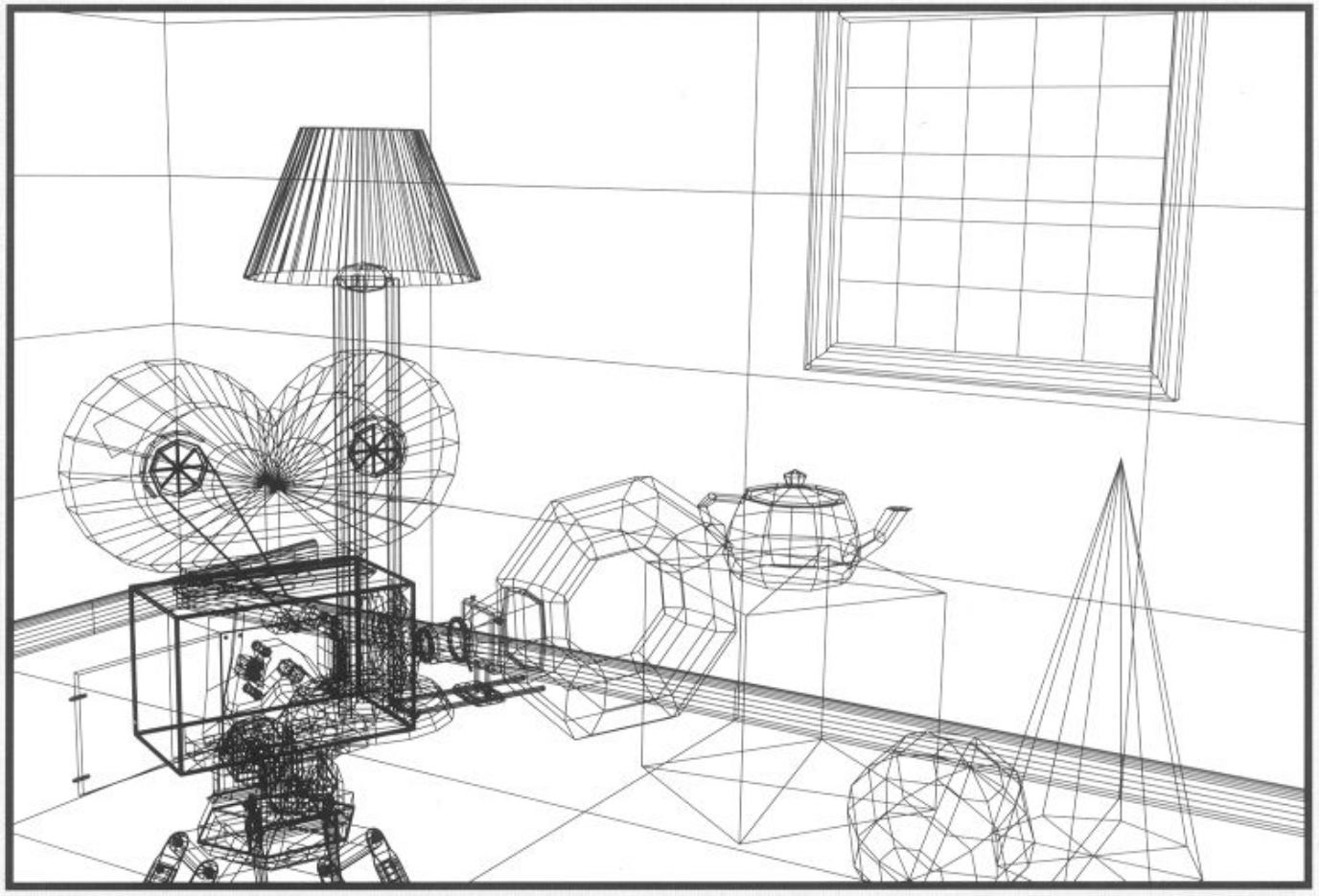
Ортографическая проекция



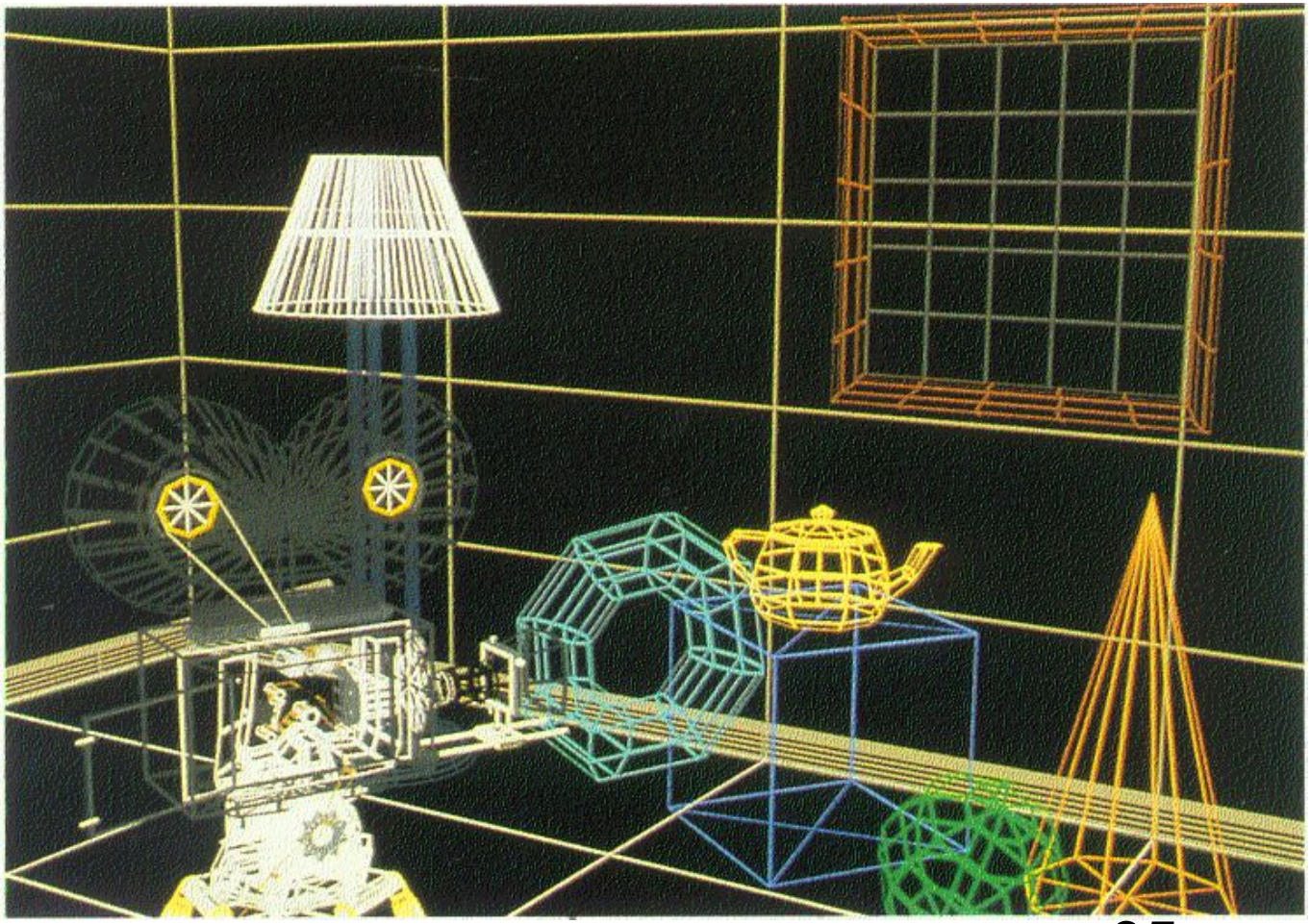
Аксонометрическая проекция



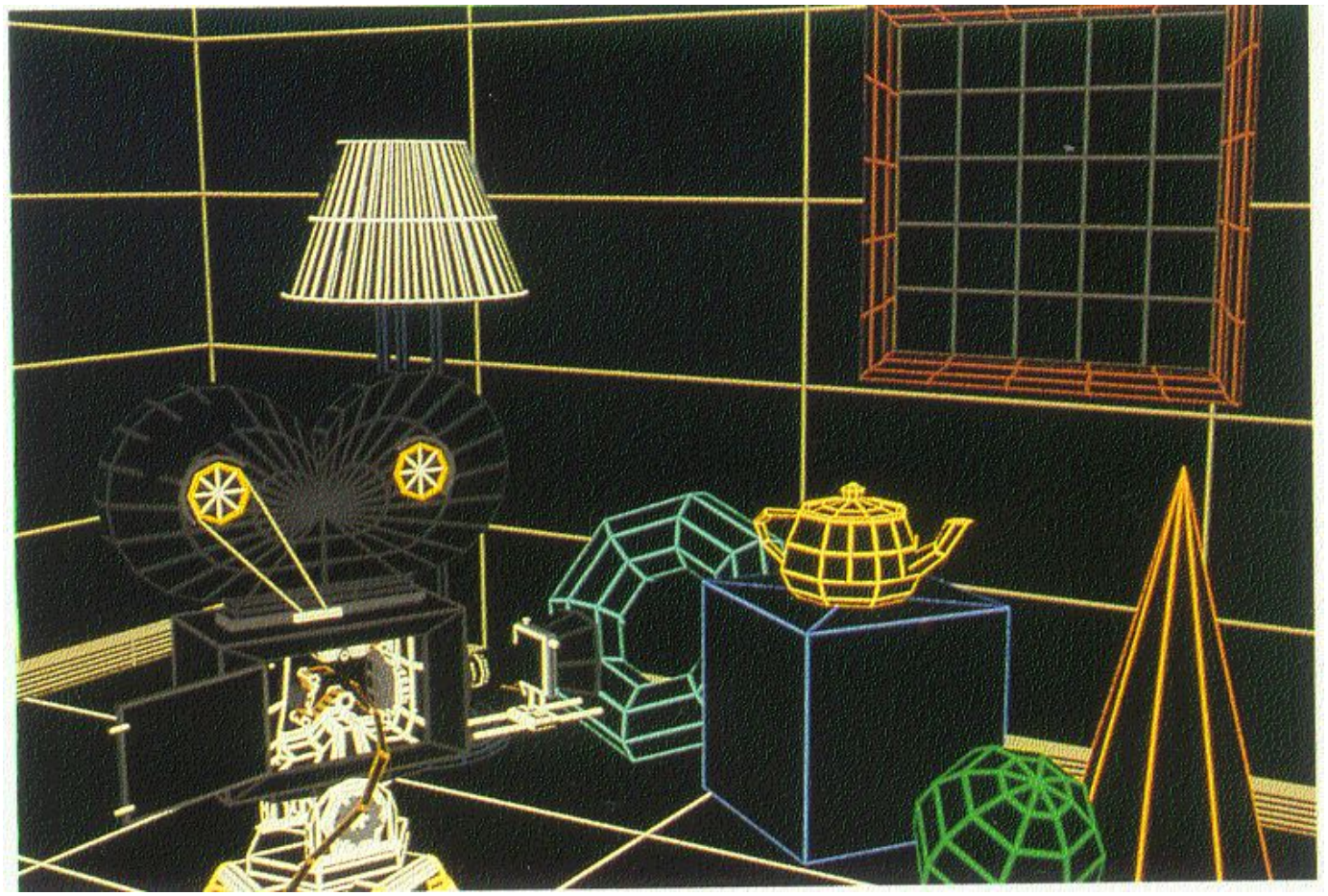
Перспективная проекция



Цветные линии

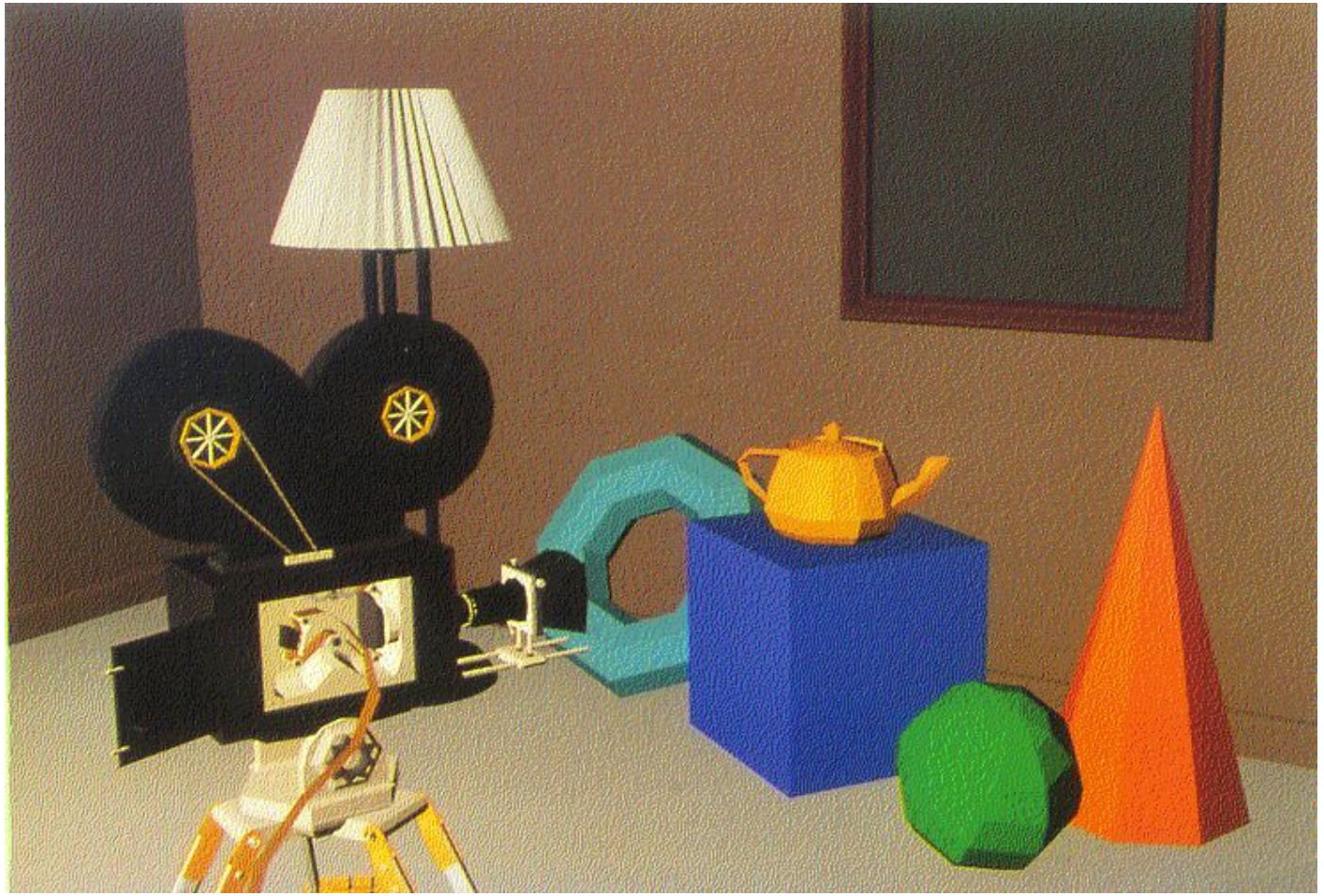


Удаление невидимых линий

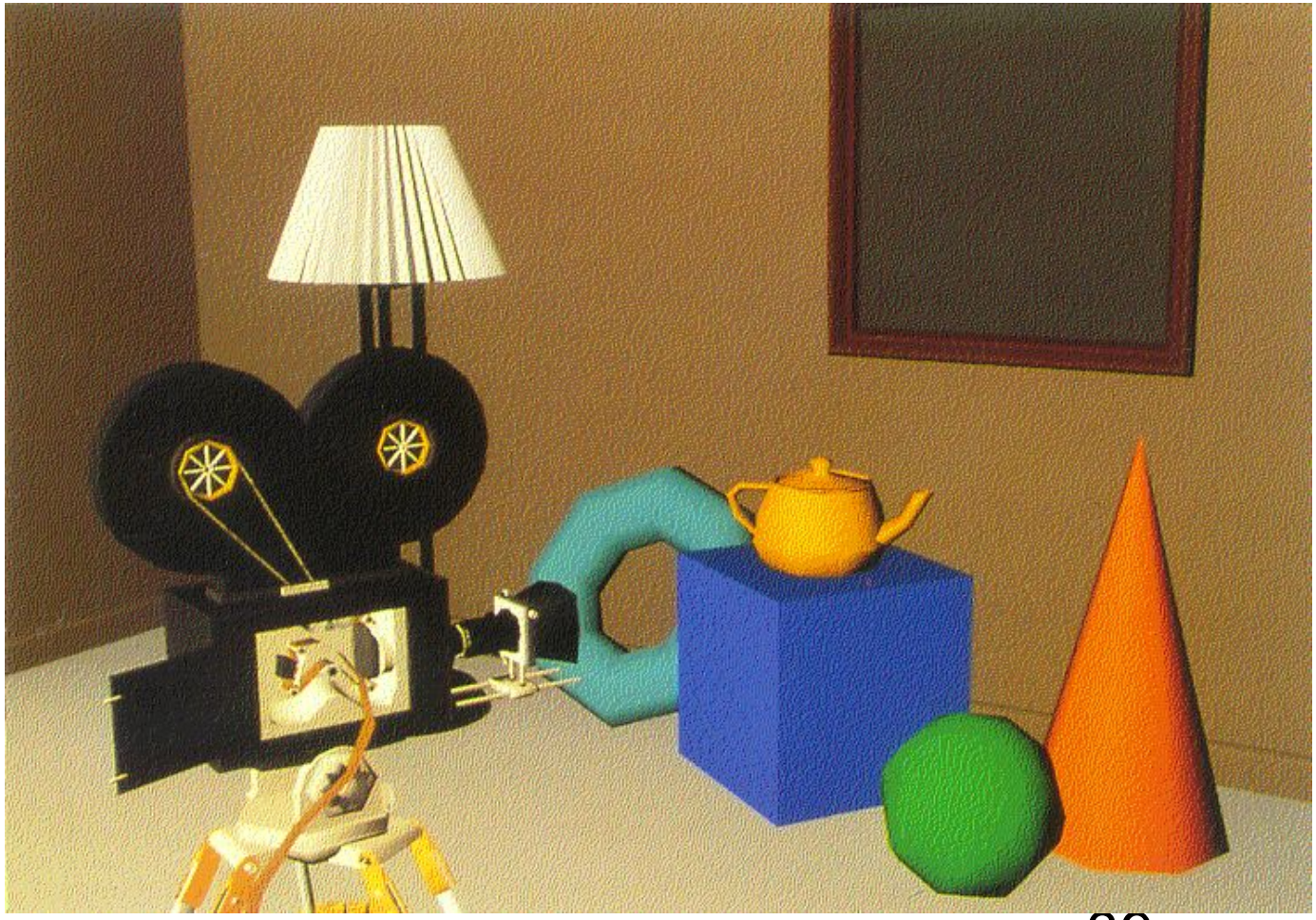


Определение видимых поверхностей (рассеянный “ambient” свет)

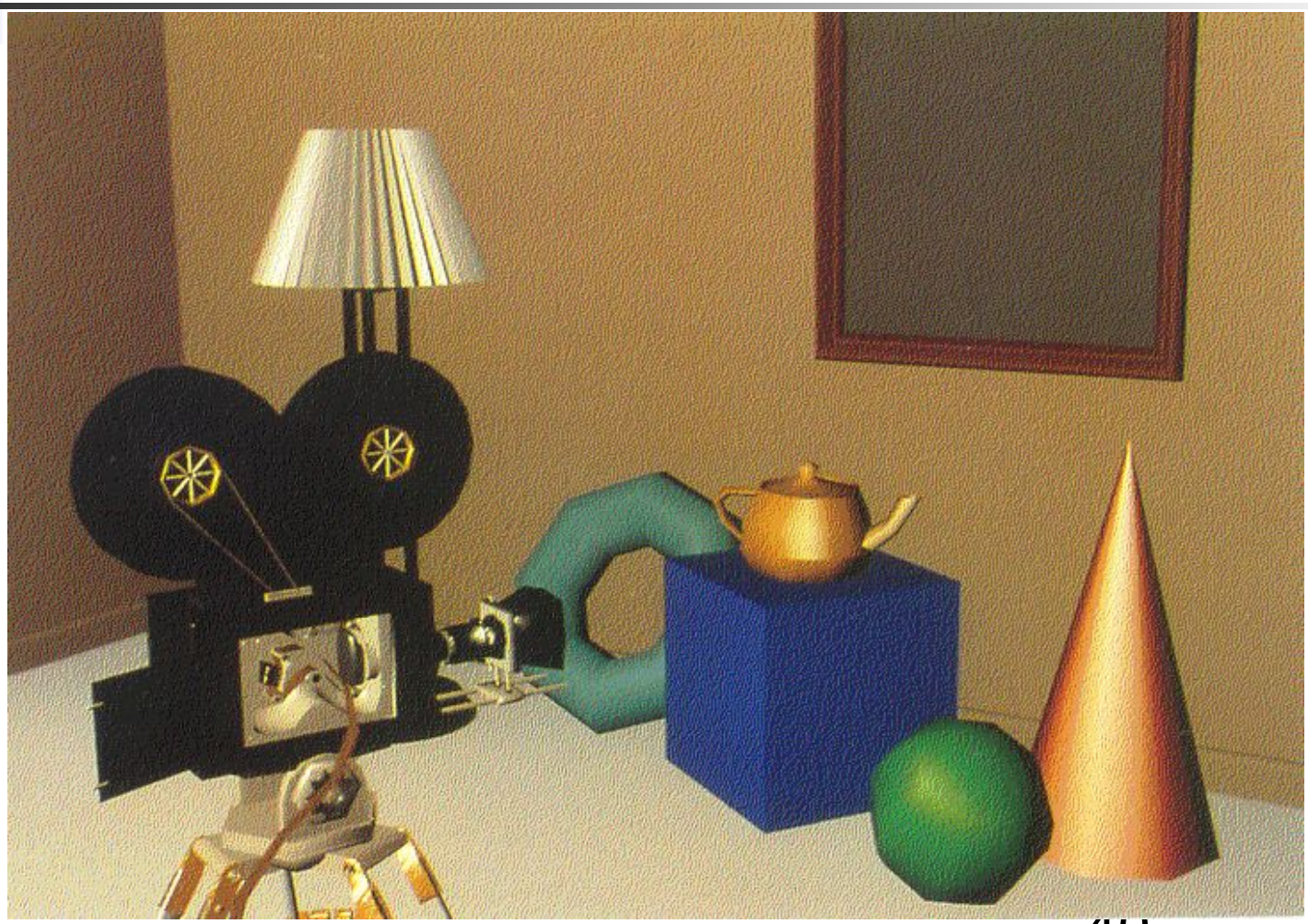
Закраска индивидуальных полигонов (плоская “flat” закраска)



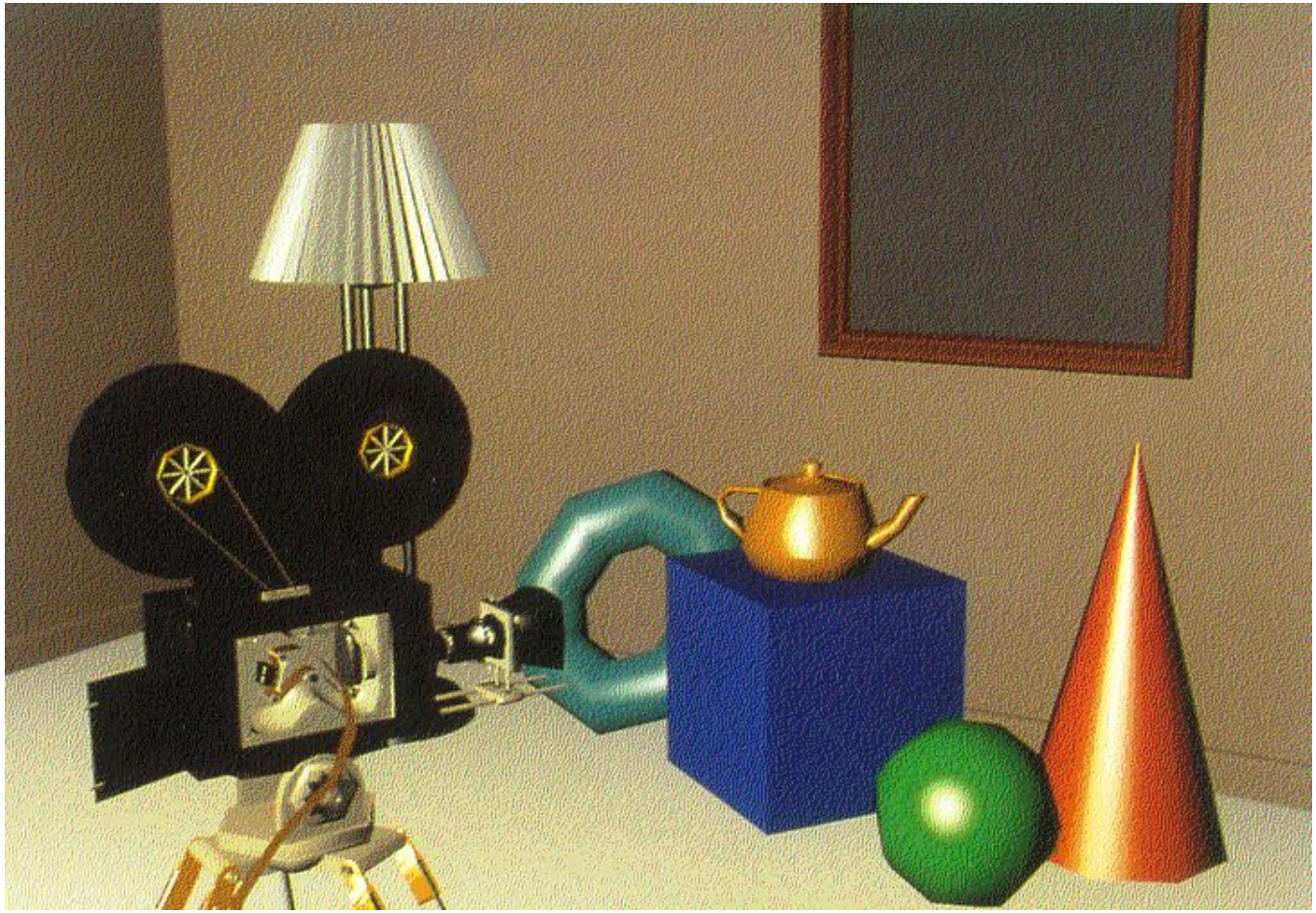
Закраска Гуро (Gouraud) (диффузное отражение)



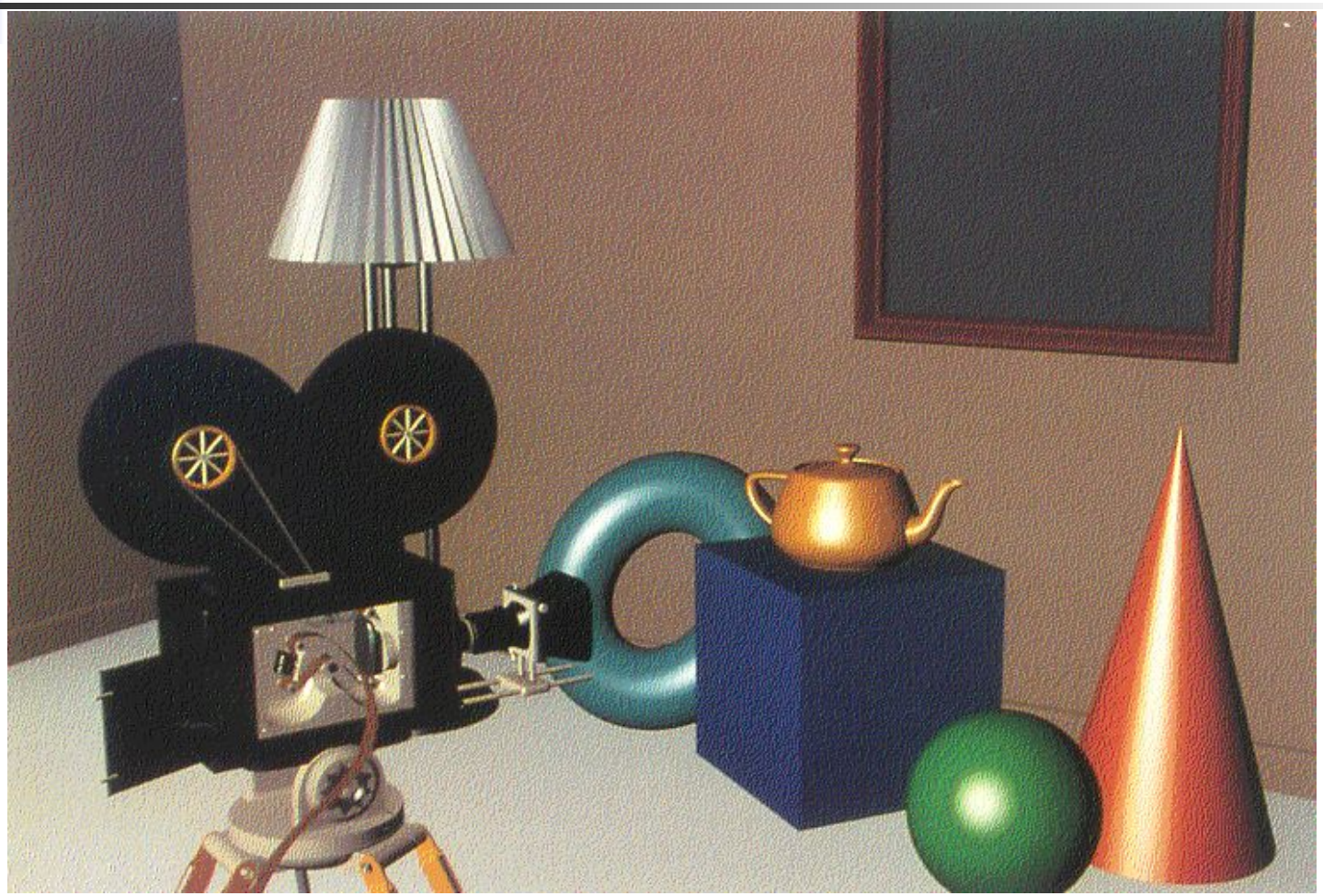
Закраска Гуро (Gouraud) (зеркальное “specular” отражение)



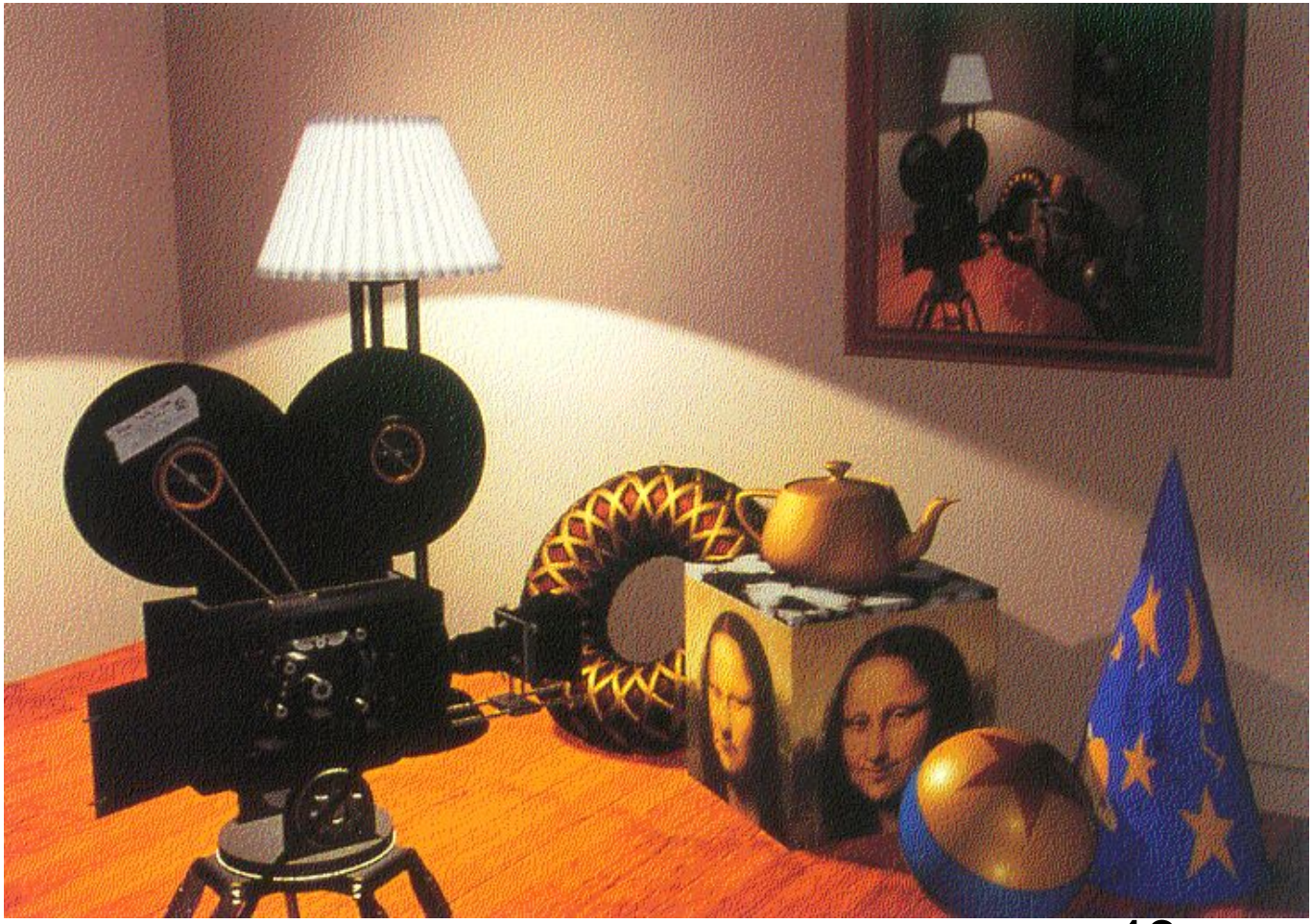
Закраска Фонга (Phong) (зеркальное отражение)



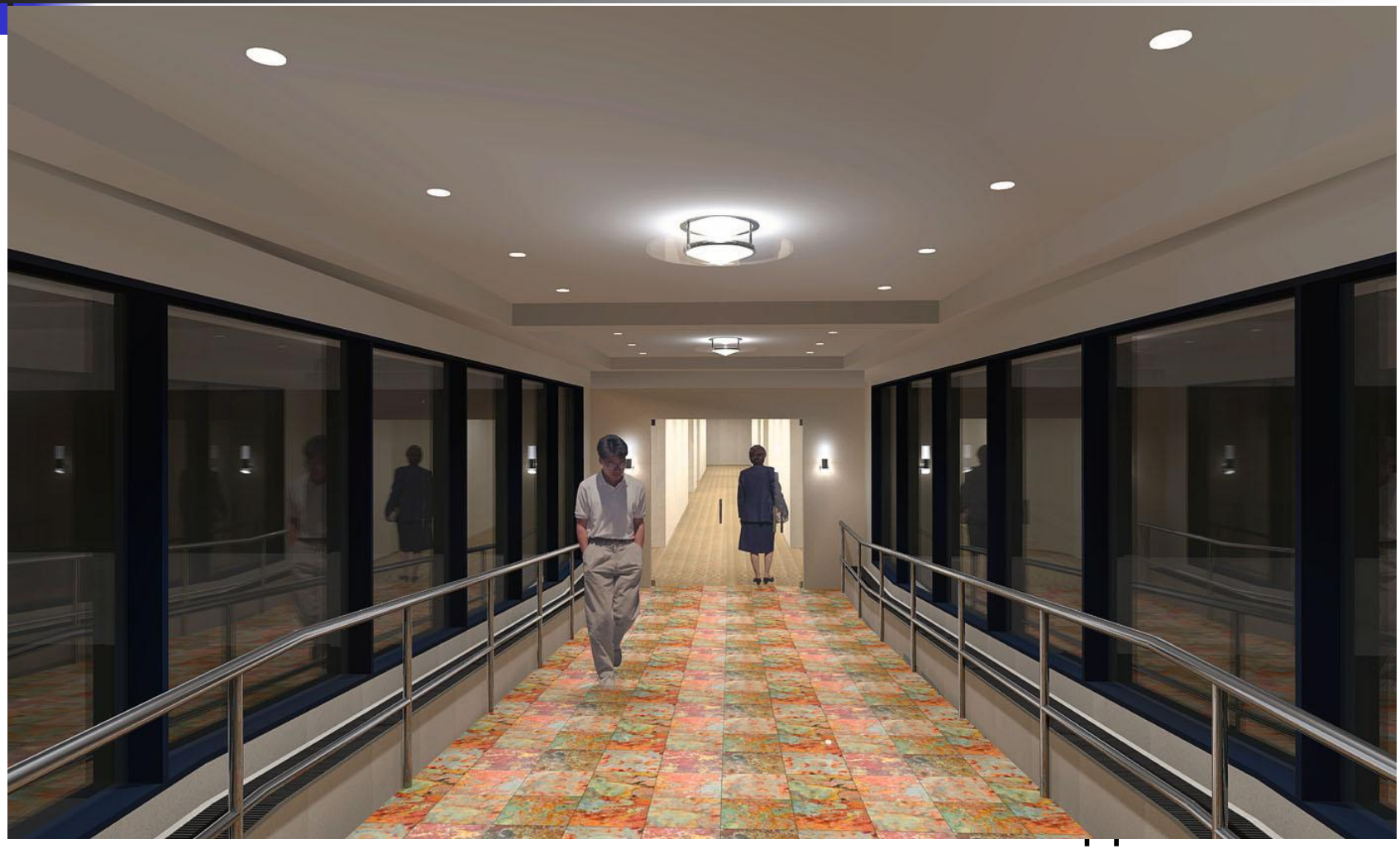
Криволинейные поверхности (зеркальное отражение)



Текстуры и тени (отражение в зеркале)

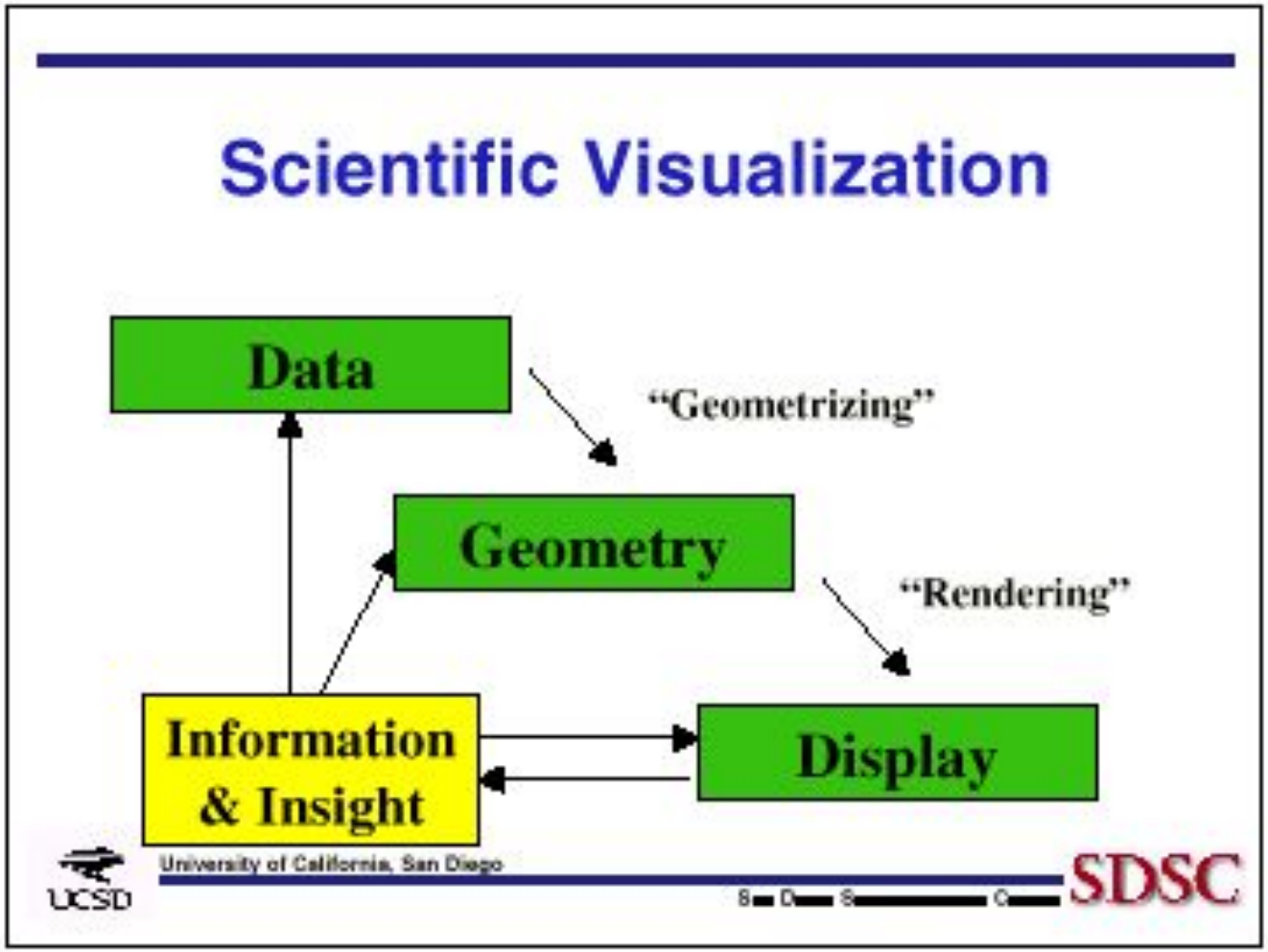


Дневное и ночное освещение

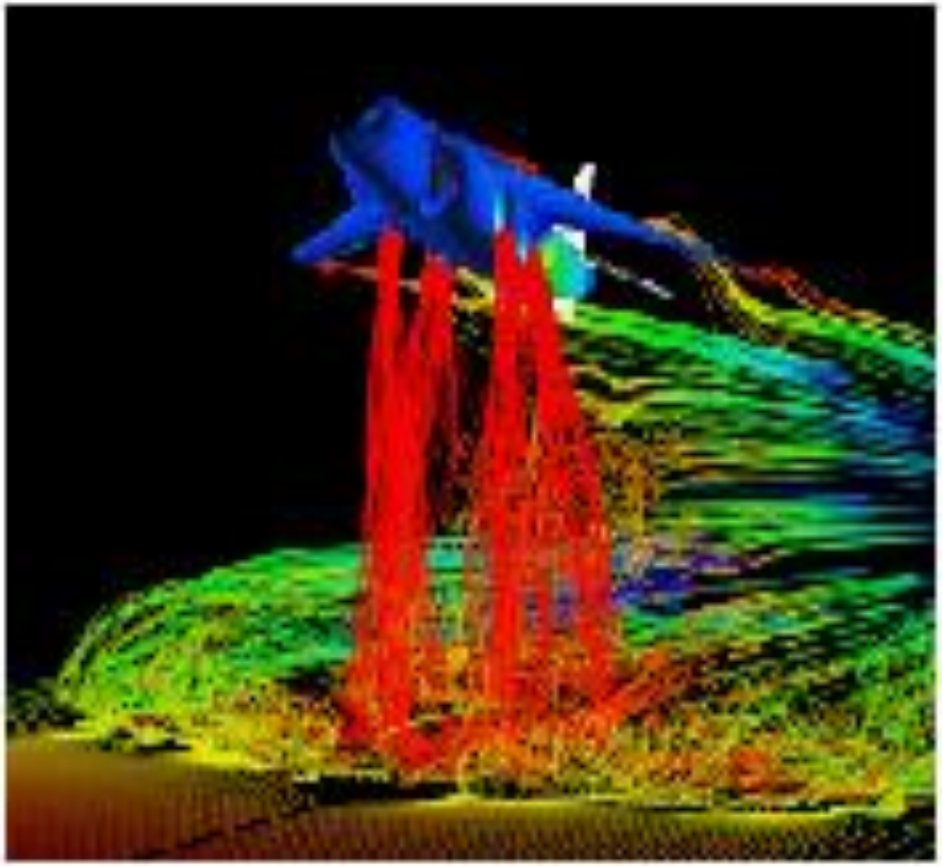


Здание в условиях ночного освещения

Научная визуализация



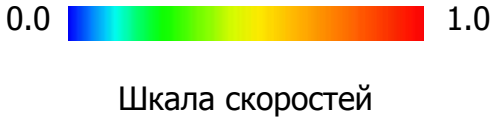
Visualization: NASA's FAST



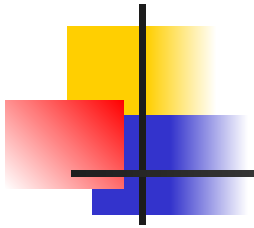
Airflow around a Harrier Jet
FAST System

Nasa Ames

Векторное поле



Распределение температуры в салоне автомобиля



HOW?

- Лекции
- Задания (проекты)
- Экзамен (тест)

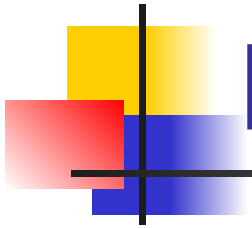
Основные принципы

Learning instead of Teaching

(*Не учить, а учиться*)

Learning by Doing

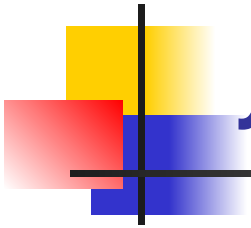
(*Учиться, делая*)



Цели

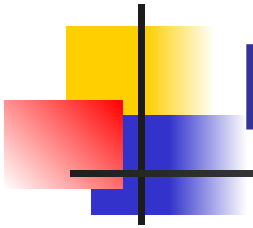
For the course itself, we identified the course goals using an outcomes-based definition of ***learning*** that has three components:

- ✔what the student knows,
- ✔what the student can do and
- ✔what attitudes and approaches the student has developed.



Лекционные знания

- Transformations
- Modeling: primitives, surfaces and scene graphs
- Viewing and projection
- Perception and color models
- Lighting and shading
- Interaction, both event-driven and using selection
- Animation and time-dependent behavior
- Texture mapping
- Image processing & Computer Vision



Практические навыки

The student should be able to use a modern graphics API to create a graphics application that can be integrated with other computer applications.

This learning is primarily focused in the projects that accompany a graphics course, and we suggest that these projects should not be artificial exercises that use graphics without reference to application areas but should integrate graphics with areas where the graphics is a key component.

Подходы к решению задачи

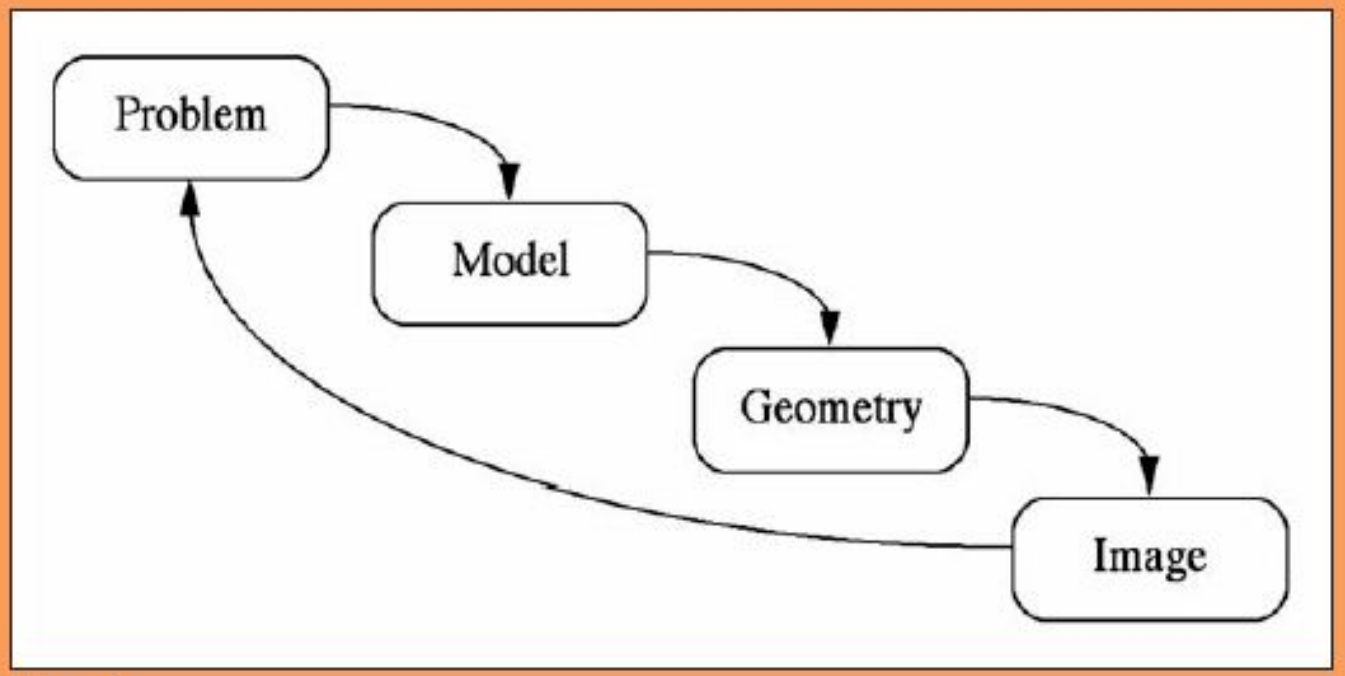
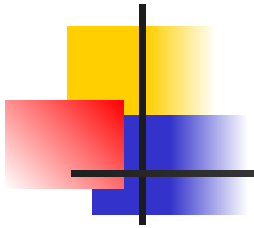
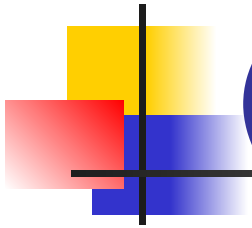


Figure 1



- What the Student Should Know
- What the Student Should Be Able To Do
- What Approaches the Student Should Bring to a Problem

Организация курса (Course Mechanics)



ИНТЕРНЕТ

http://graphics.cs.msu.su/courses/cg

ЛЕКЦИИ

ЦИФРОВАЯ БИБЛИОТЕКА

Литература

Конспекты

ДОМАШНИЕ ЗАДАНИЯ

ОЦЕНКИ