INFOGR – Computer Graphics

Jacco Bikker - April-July 2016 - Lecture 1: “Introduction”

Welcome!

Today’s Agenda:

- Topic Introduction
- Course Introduction
- Team
- Practical Details
- Assignments
- Field Study
- State of the Art

Introduction

Just Cause 3

Introduction

HALO 5

Introduction

GTA V

Introduction

Homeworld Remastered

Introduction

Crysis

Introduction

Crysis

Introduction

Lord of the Rings

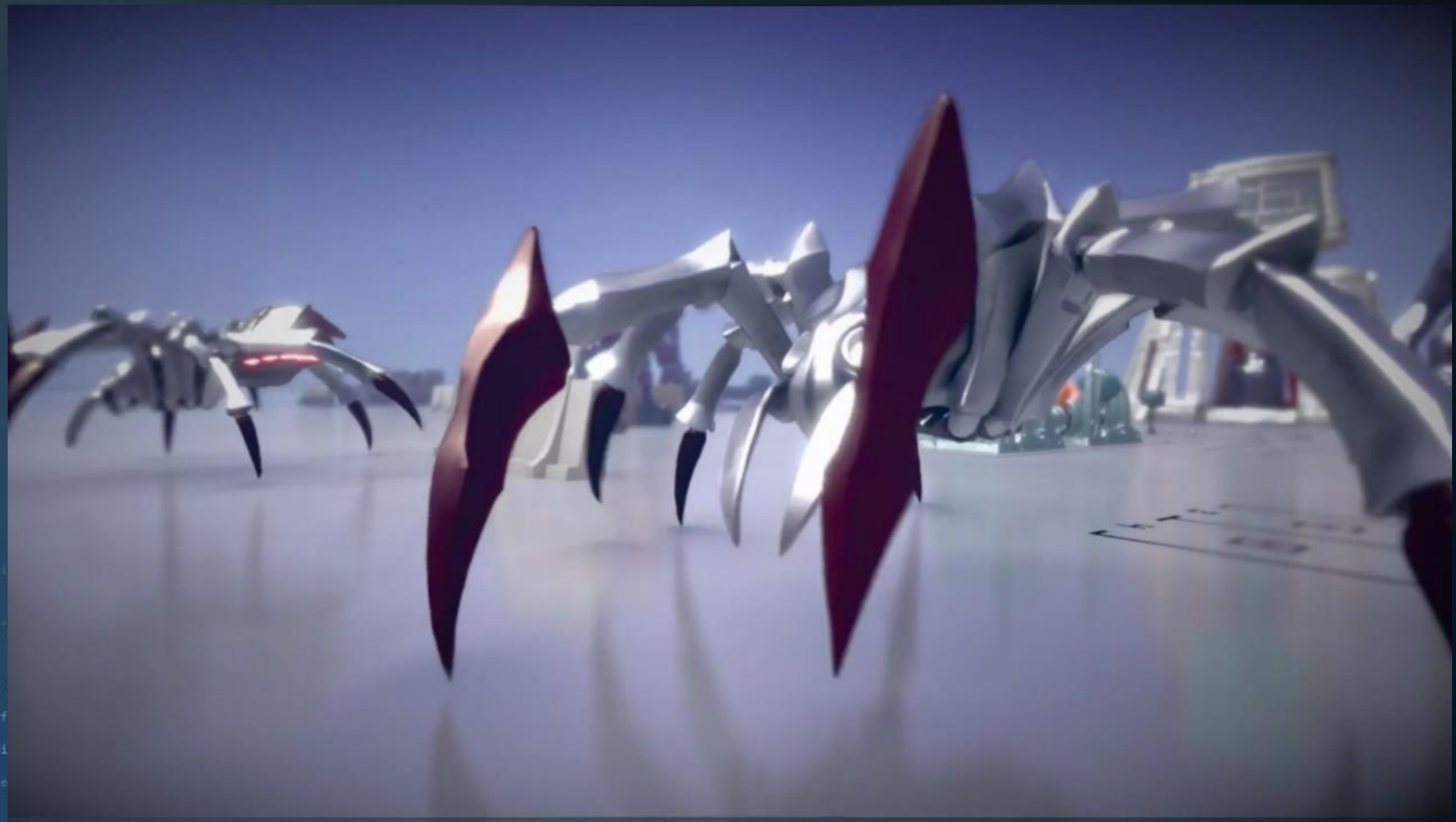
Introduction

Star Wars

Introduction

Zootopia

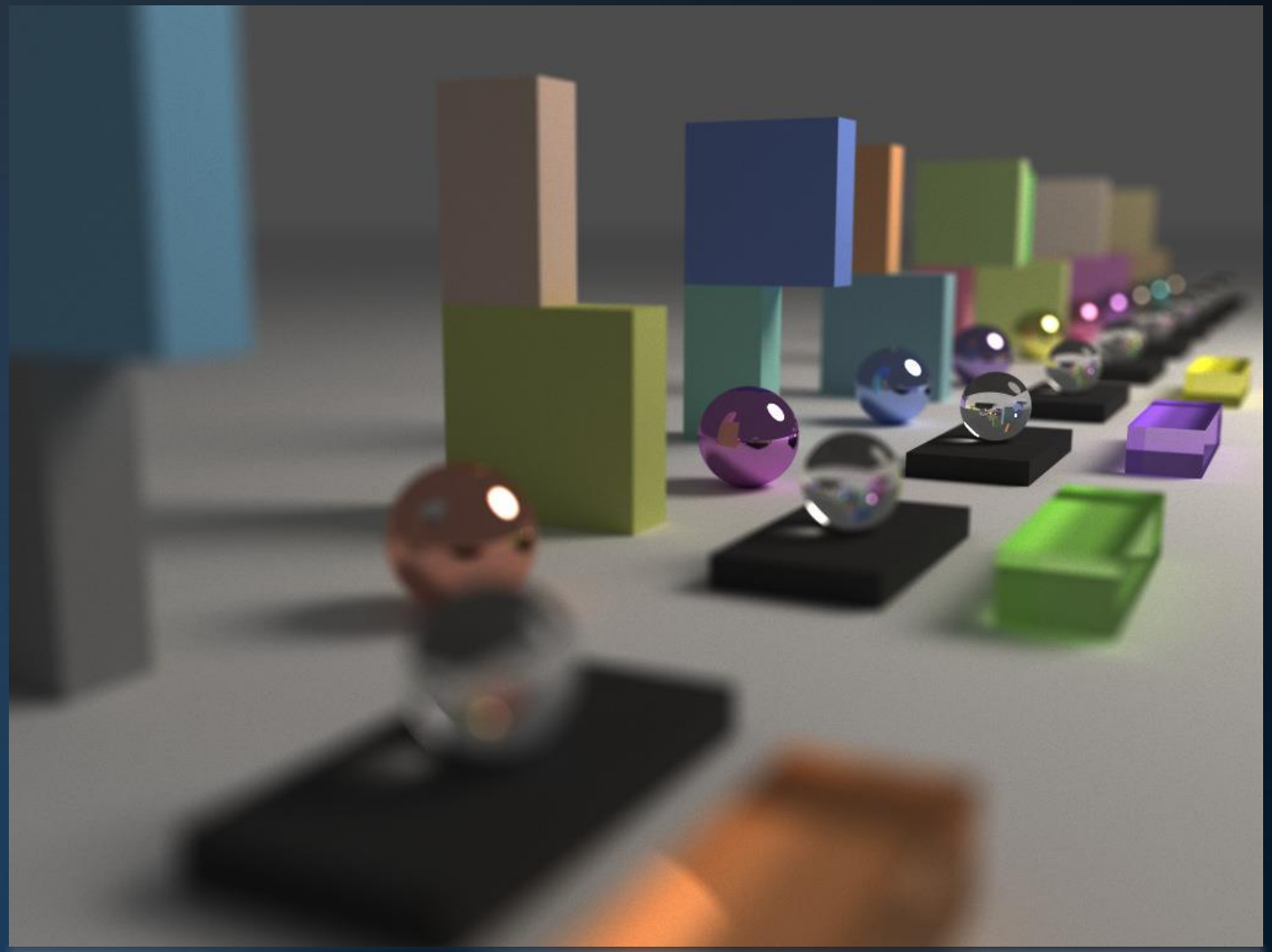
Introduction



Introduction

Just Cause 3

Introduction



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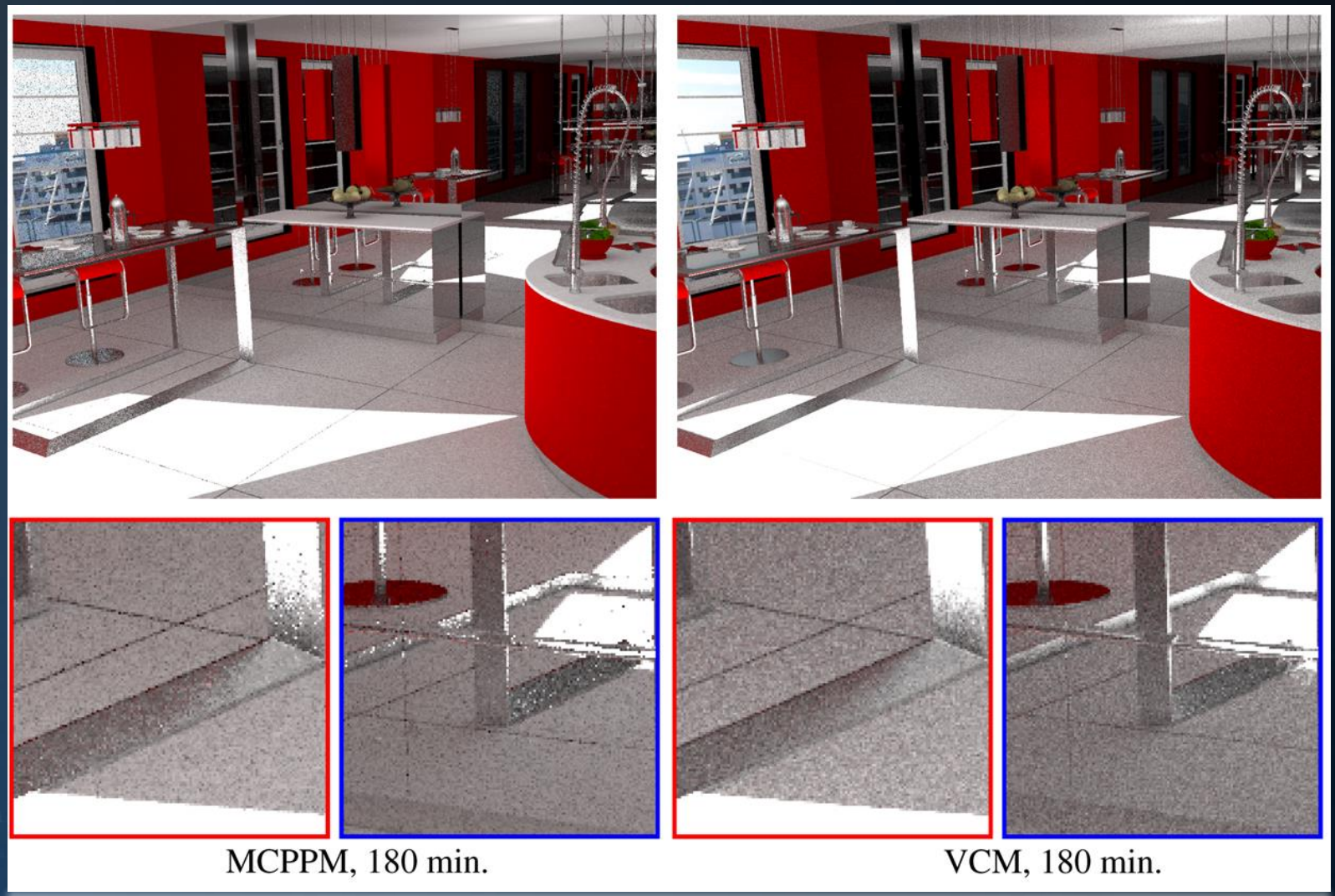

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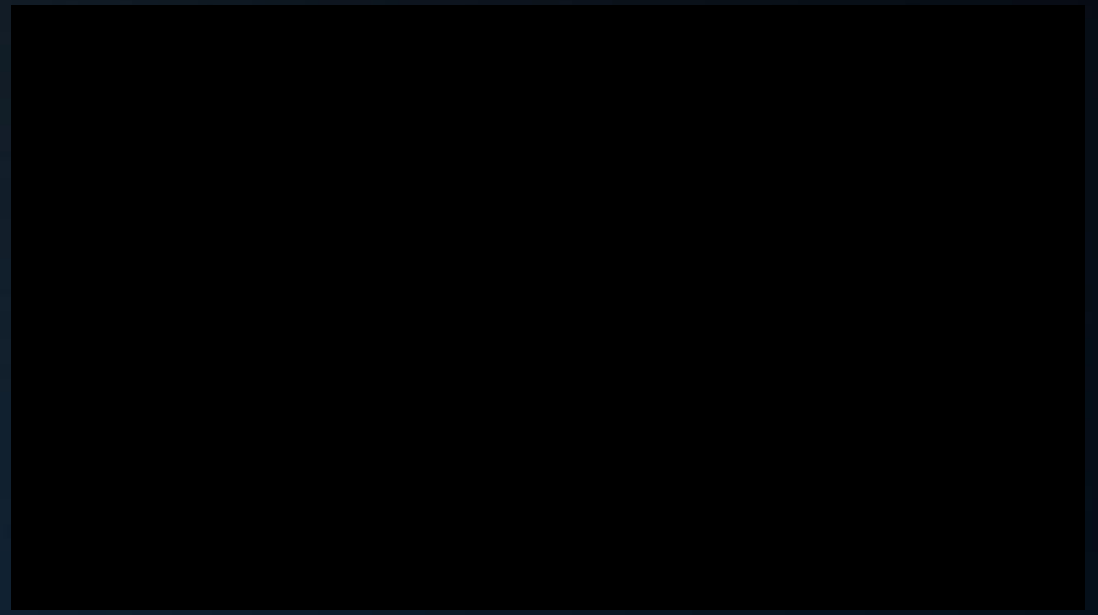
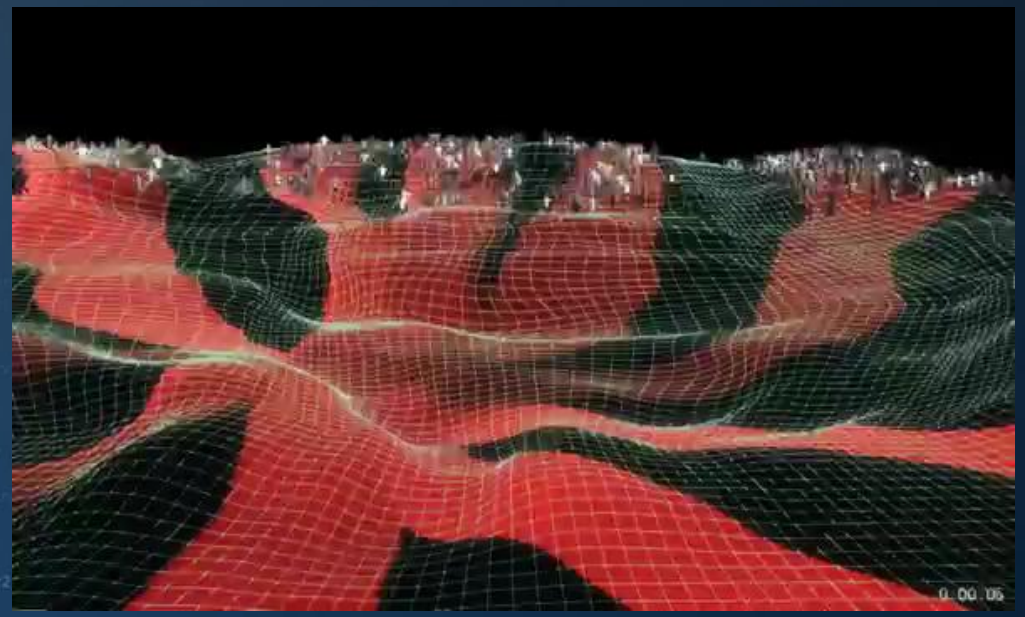
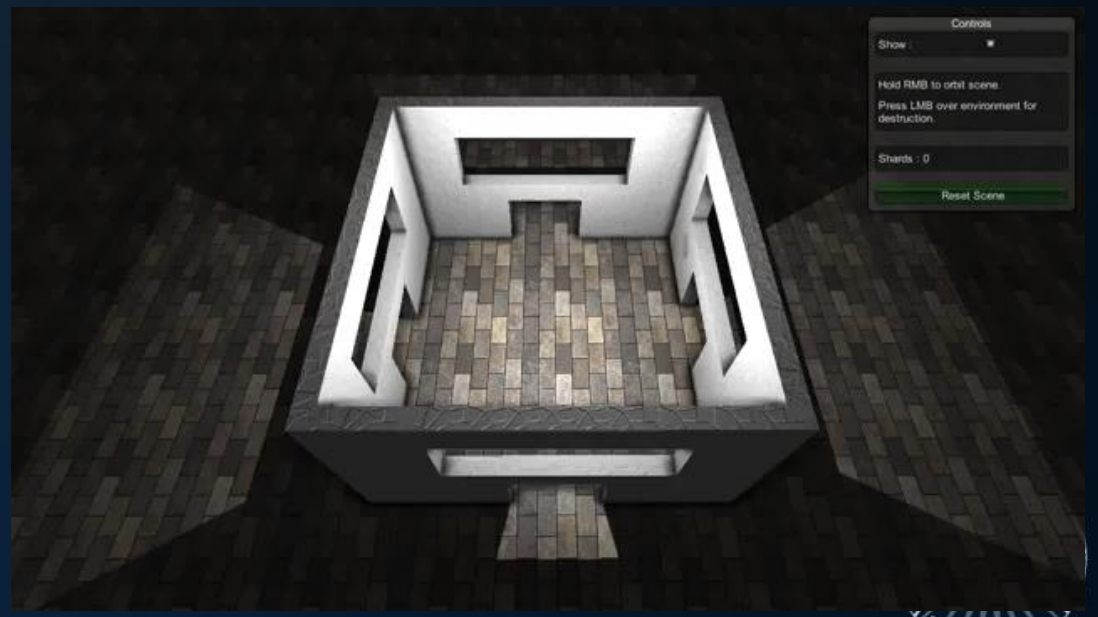




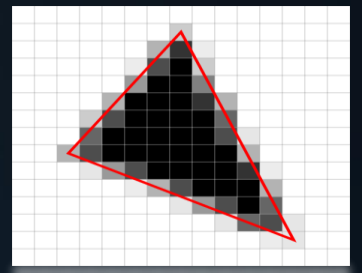


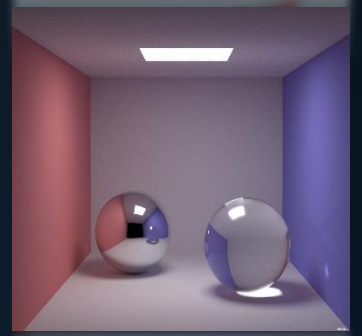
Introduction

Computer Graphics 2016:

Looking for realism (in several wrong places):

1. Rasterization
   - Geometry
   - Textures, shaders
   - Clipping, culling
   - Post processing
   - …
2. Ray tracing
   - Ray/triangle intersections
   - Bounding volume hierarchy
   - Snell, Fresnel, Beer
   - Whitted, Cook, Kajiya
   - …
3. Mathematics
   - Vectors
   - Matrices
   - Transformations





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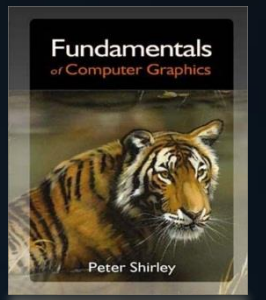


Language: Dutch,
because of reasons.

Prerequisites: C#.

Literature: Fundamentals of Computer Graphics (3rd edition), by Peter Shirley and Steve Marschner (or 4th, or 2nd, or 1st).

15 lectures.

Supporting working colleges in all lecture weeks except the first:

- On Tuesdays,
- In many different rooms – see schedule.

Introduction

Exams:

- Mid-term: May 24th.
- End of term: June 30th.
- Retake: July 14th.

Attendance:

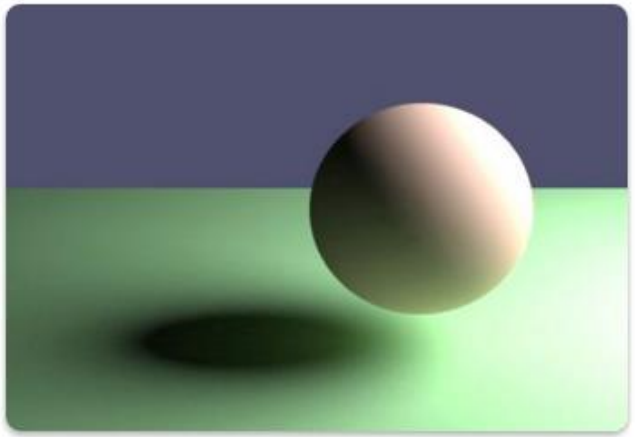
You are not required to attend any of the lectures / tutorials / practica (i.e., if you are here, it’s because you want to).*

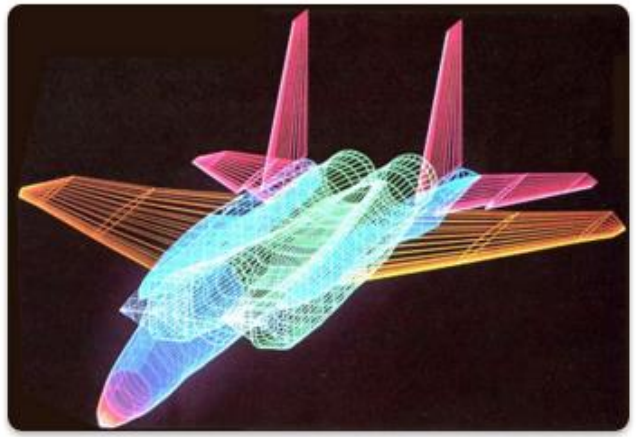
*Obviously, attendance is highly recommended.

Graphics

UNIVERSITEIT UTRECHT - INFORMATION AND COMPUTING SCIENCES

academic year 2015/16 – 4th period





http://www.cs.uu.nl/docs/vakken/gr

News	Lectures (Topics, Slides)	Tutorials	Exam & Grading
Course Overview	Schedule	Practica	Literature & Links

Inbox - bikker.j@gmail.com | Google Calendar - Week of | general | Graphics 2015/201 | WhatsApp Web

https://infogr2016.slack.com/messages/general/details/

Apps | Bookmarks | google | gmail | news | tech | games | misc | coding | download | tools | INFOGR | ag | Slack | Thesis Tigran

Graphics 2015/2...
jbikker

CHANNELS (2)
general
random

DIRECT MESSAGES (13)
slackbot
aquila169
extrabb
gerbenaalvanger
hugo.hogenbirk
marijns95
mthq
snookik
sp
yorick

+ Invite People

#general
13 members | Company-wide announcements and work-based matters

Search

Send this link to your team to invite them

April 22nd

jbikker 2:36 PM
joined #general

jbikker 2:48 PM
set the channel purpose: Discuss INFOGR related topics here.

hugo.hogenbirk 3:19 PM
joined #general. Also, @aquila169 joined, @extrabb joined,

https://infogr2016.slack.com

mthq 2:45 PM
Kan je je ook aanmelden voor deze slack met een @students.uu.nl adres?

jbikker 5:45 PM
Ik had m ingesteld op uu.nl, hoe voeg ik domains toe?

jbikker 5:56 PM

About #general

Channel Details

Purpose
Discuss INFOGR related topics here.

Created by you on April 22nd

nned Items

1/13 Members

jbikker
aquila169
datdutchdude

GMT

Search...

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Board index › Game Technology Bachelor Courses › Graphics (INFOGR)

Graphics (INFOGR)

New Topic | Search this forum...

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Announcements	Replies	Views	Last post
General forum rules by Arjan Egges » Tue Mar 01, 2016 3:25 pm » in General	0	1319	by Arjan Egges Tue Mar 01, 2016 3:25 pm

Display topics from previous: All Topics | Sort by Post time | Descending | Go

New Topic

0 topics • Page 1 of 1

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Jump to

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You **cannot** delete your posts in this forum
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Board index | Contact us | The team | Delete all board cookies • All times are UTC+02:00

Introduction

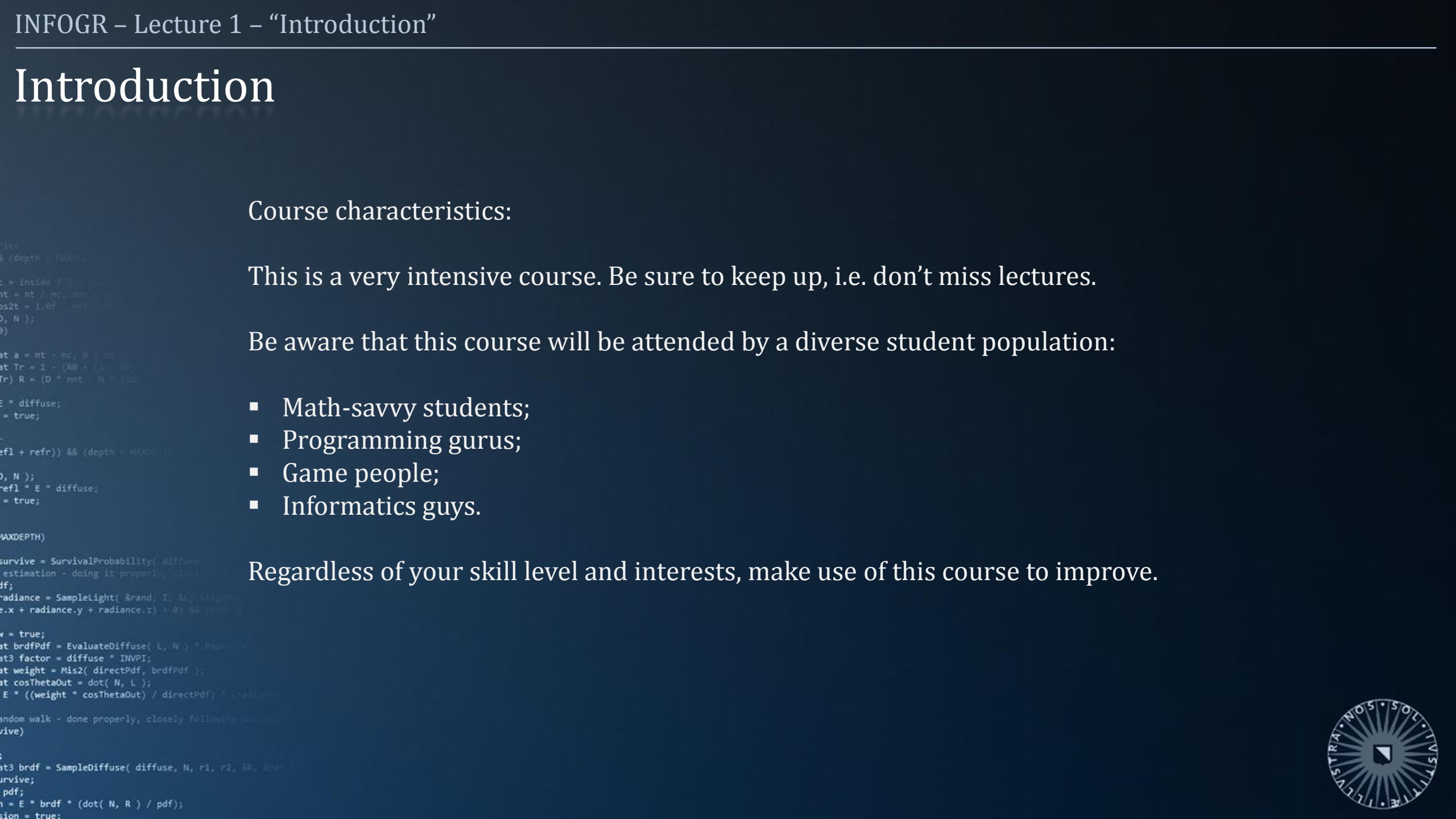
Course characteristics:

This is a very intensive course. Be sure to keep up, i.e. don’t miss lectures.

Be aware that this course will be attended by a diverse student population:

- Math-savvy students;
- Programming gurus;
- Game people;
- Informatics guys.

Regardless of your skill level and interests, make use of this course to improve.



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Team

Lecturer:

Jacco Bikker

bikker.j@gmail.com / j.bikker@uu.nl
Office: BBL 424

Background:

Gamedev:

- Lost Boys
- Davilex
- Green Dino
- Overloaded
- Vanguard

Academia:

- IGAD

Education:

- HBO
- Doctoral
  (Delft; Ray Tracing in Games, 2012)

Team

Student Assistants:

1. Gerben Aalvanger
2. Hugo Hogenbirk
3. Casper Schouls
4. Bruno dos Santos Carvalhal
5. Sam van der Wal

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Practical Details

Assignment Overview:

i. P1: Tutorial;
ii. P2: Ray Tracing;
iii. P3: Rasterization.

Final practicum grade is 0.2 * P1 + 0.4 * P2 + 0.4 * P3.

Exam overview:

i. T1: Mid-term exam;
ii. T2: Final exam.

Final exam grade is 05 * T1 + 0.5 * T2.

Final grade: (2T + P) / 3

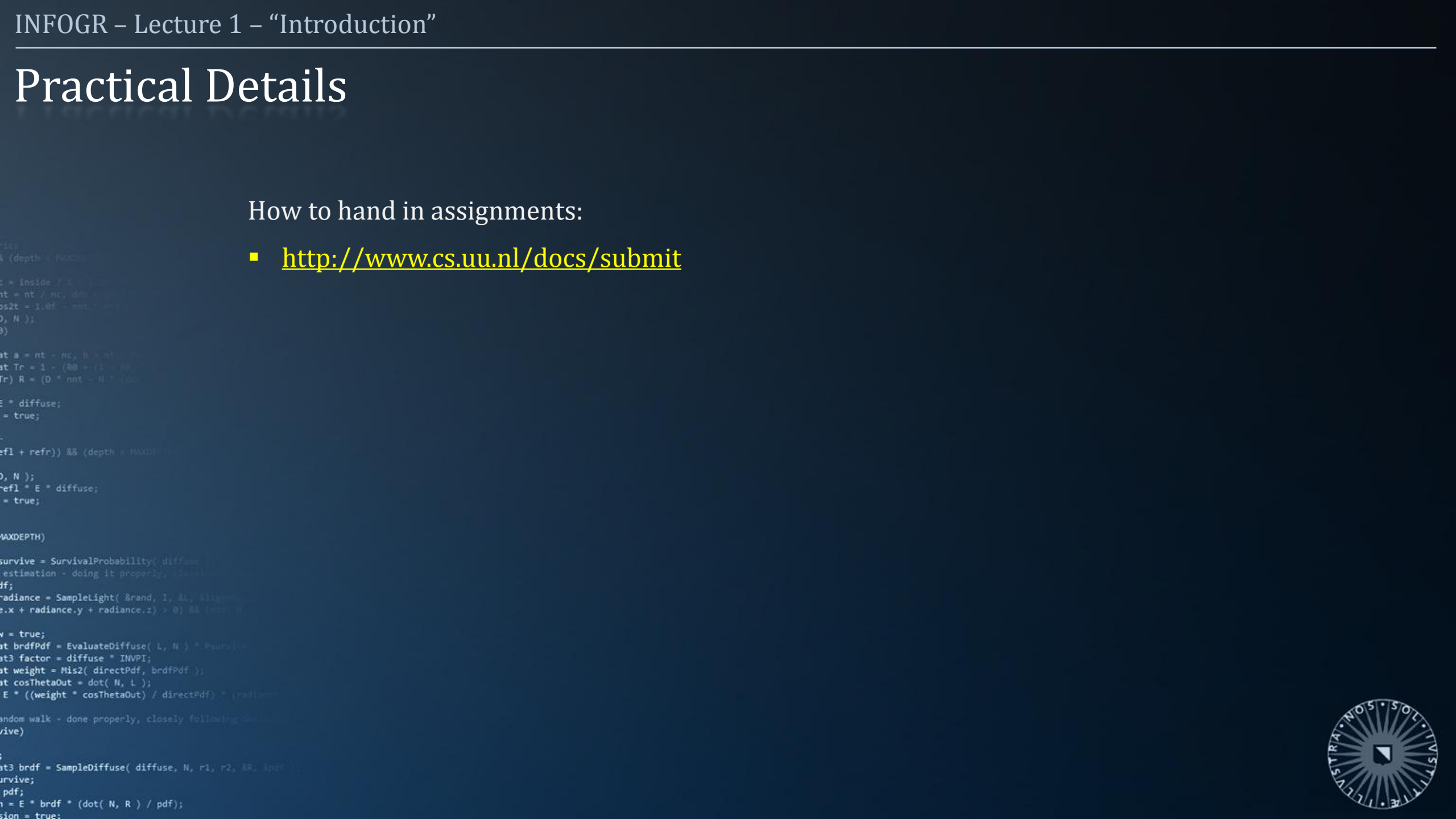
Passing criteria:

Final Grade ≥ 6.0 (after rounding); both T and P ≥ 5.0 (after rounding).

Practical Details

How to hand in assignments:

- http://www.cs.uu.nl/docs/submit



Practical Details

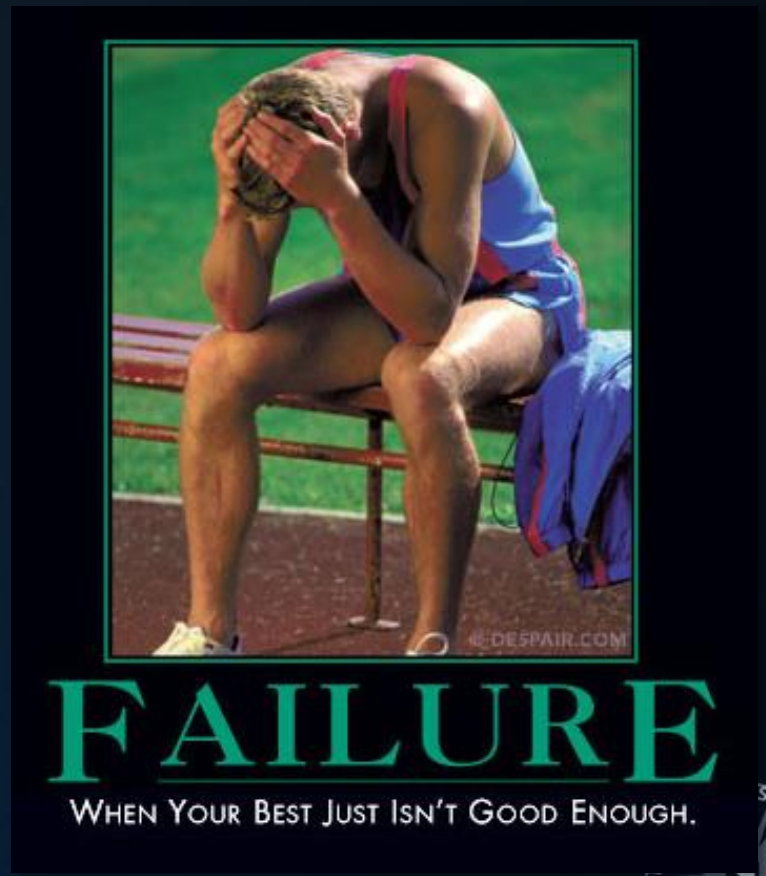
Retake: only if you failed the course, and scored at least a 4.0 (before rounding).

Retake / Theory:

- Retake covers all theory and replaces min(T1, T2).

Retake / Practical:

- Retake replaces min(P1, P2, P3).
  Topic will be assigned individually.



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Assignments

PART 1: Mathematics

Tutorial 1 will be available on Thursday, April 28th.

PART 2: Programming assignment

P1 (OpenTK Tutorial) is now available from the website.
Assistance is available on Tuesday, May 3rd in rooms BBG-079, -083, -109 and -112.

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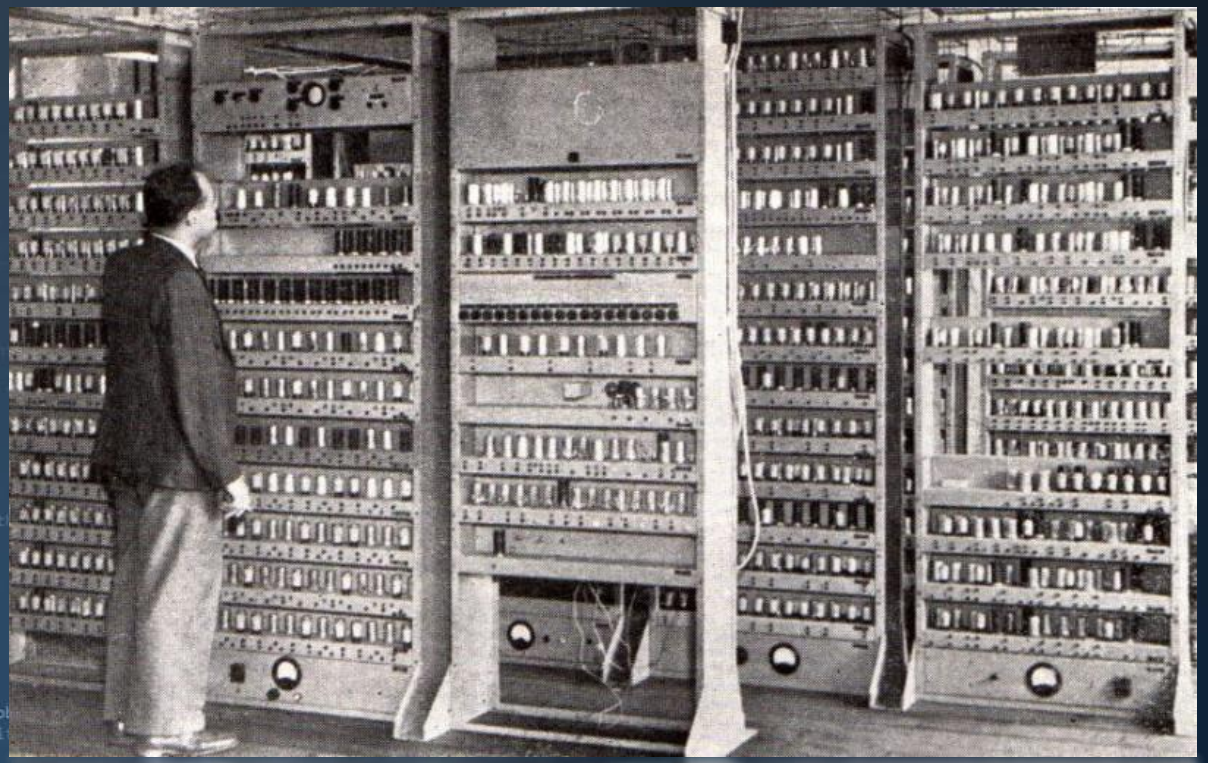
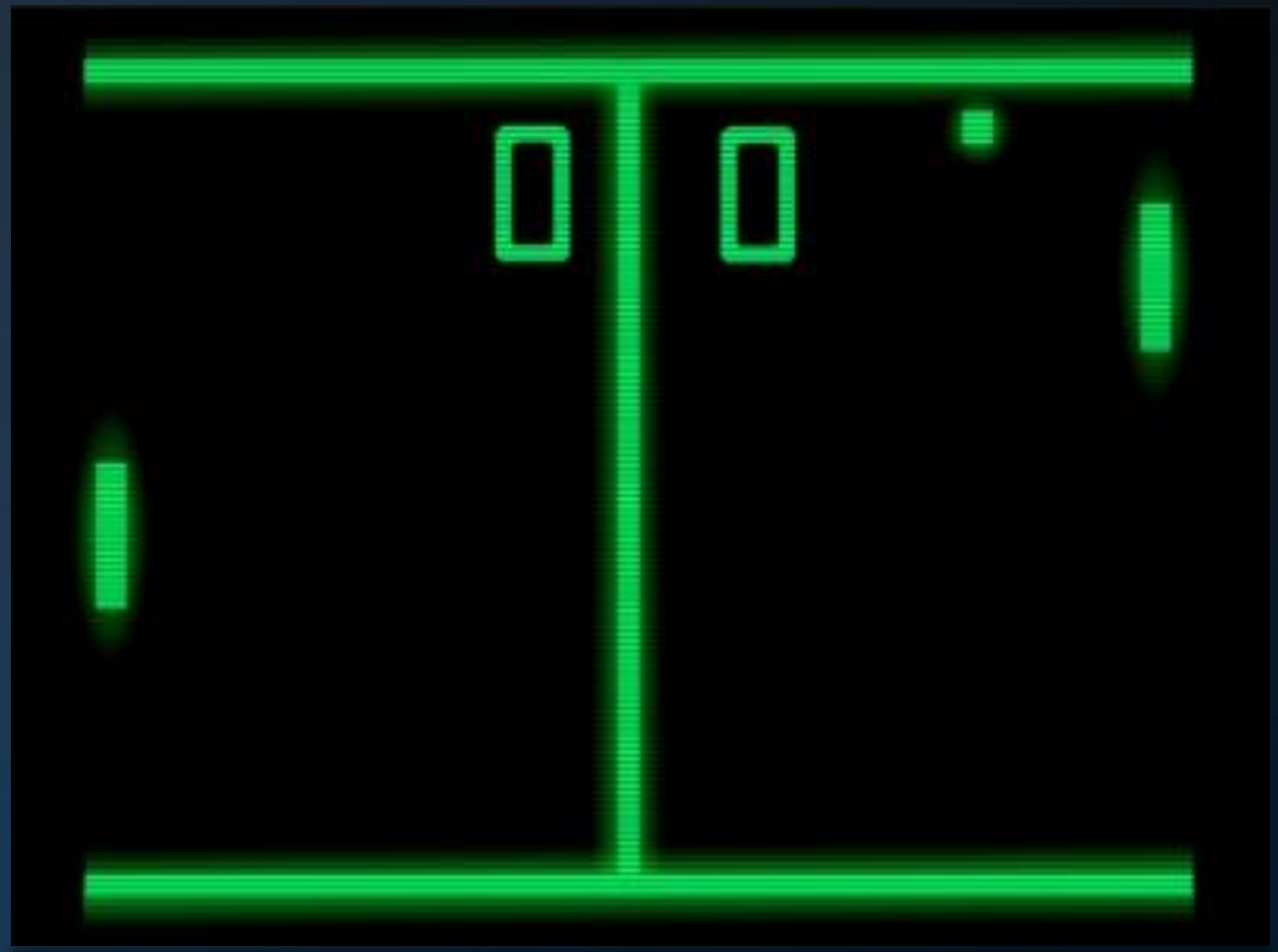
Field Study



A. S. Douglas. Noughts and Crosses. EDSAC, 1952.

Field Study



Field Study

1981

1982

1982

Field Study

1985

1987

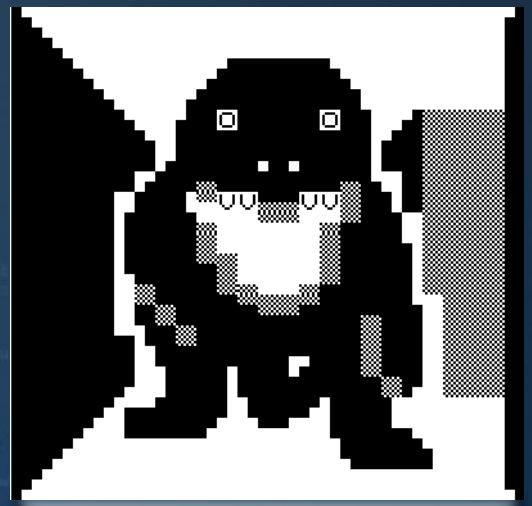
1990

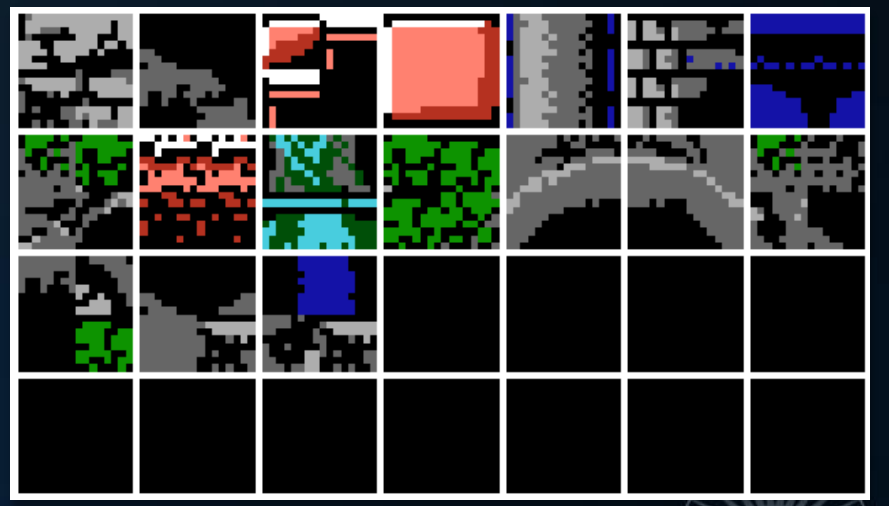
Field Study

Early graphics:

2D, with limitations

- Tiles
- Few colors
- Sprites





Field Study


```
at brdfPdf = EvaluateDiffuse( L, N ) * Pdf();
at3 factor = diffuse * INVPI;
at weight = Mis2( directPdf, brdfPdf );
at cosThetaOut = dot( N, L );
 E * ((weight * cosThetaOut) / directPdf) * (radiance
andom walk - done properly, closely following Smi
vive)
at3 brdf = SampleDiffuse( diffuse, N, r1, r2, &R, &pdf );
urvive;
 pdf;
 = E * brdf * (dot( N, R ) / pdf);
sion = true;
```

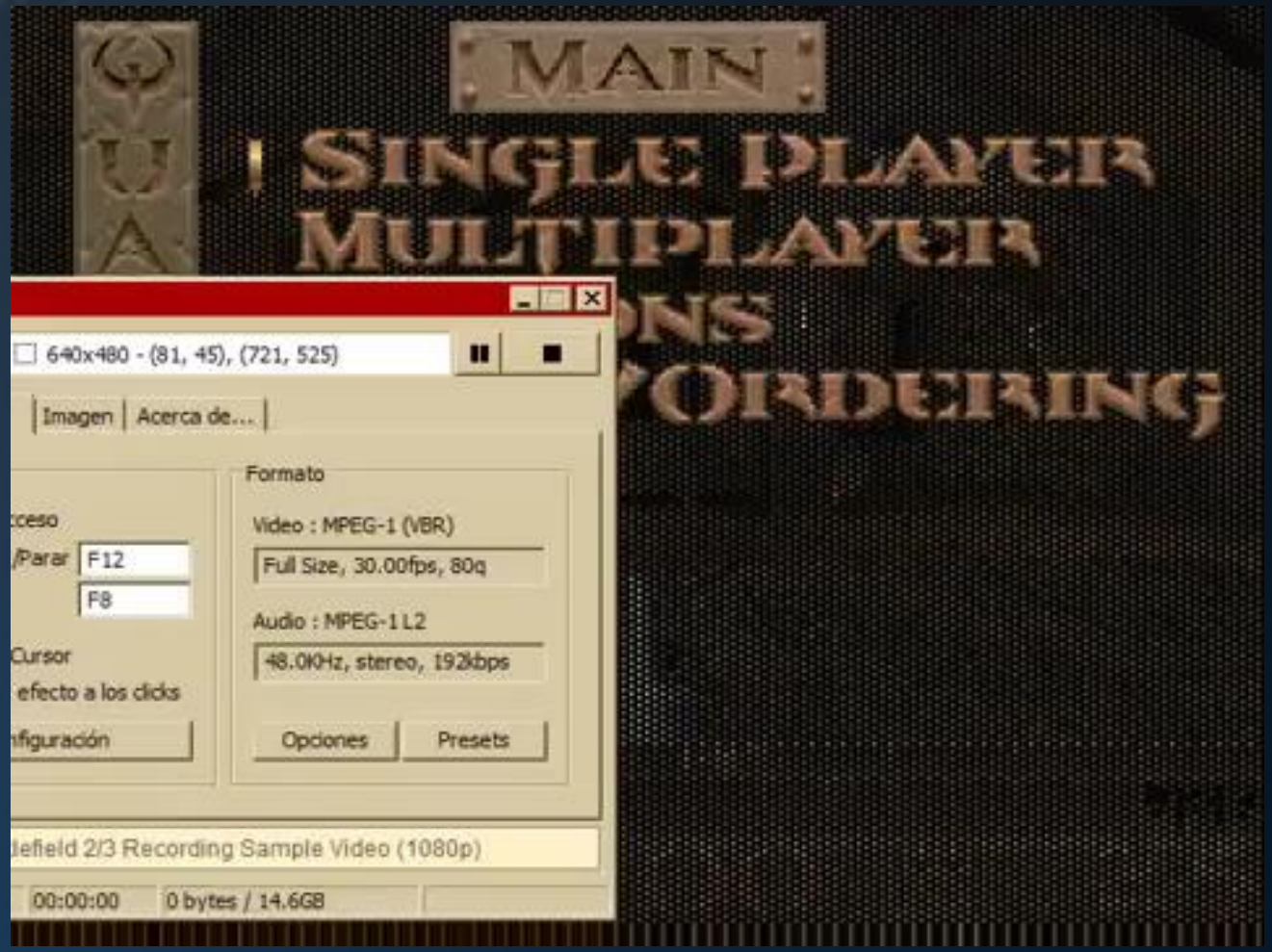
Field Study


THE FLIP Channel
A500
OPERATIONS MANUAL
AMIGA
CAPTURED PRINCESS
EXIT
HIDDEN TREASURE
TODO:
- BUY SHIP
- FIND BIG WHOOP
- DEFEAT LECHUCK
- MARRY ELAINE!
SECTOR 56
GEAR
BRAKES
CHAFF 09 FLARE 09
Commodore 1084X


50
AMMO
100%
HEALTH
2 3 4
5 6 7
ARMS
2%
ARMOR
BULL 50 / 200
SHEL 0 / 50
RCKT 0 / 50
CELL 0 / 300

History of Graphics

History of Graphics




SE
S

Field Study

Game production:

Code
Art

Crysis:

> 1M lines of code; 85k shaders

Unreal 3 engine:

2M lines of code

Frostbite:

“10x Unreal 3”

Minecraft:

< 200k lines of code.

Field Study

History of graphics in games, digest

Initially fast progression:

- from 2D to 3D,
- from monochrome to true-color,
- from wireframe to shaded,
- from sparse to highly detailed.

But also:

- from reasonably efficient to produce to extremely labor-intensive.

State of the Art

Industry example: Unreal Engine 4

- Lights
- Shadows
- Reflections
- Ambient occlusion
- Light shafts
- Indirect lighting cache
- Ray traced soft shadows
- Bump mapping

- Engine Features
  - Graphics
    - Rendering Overview
    - Lighting and Shadows
      - Lighting Quick Start Guide
      - Types of Lights
      - Shadow Casting
      - Light Mobility
        - Movable Lights
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    - Materials
    - Post Process Effects
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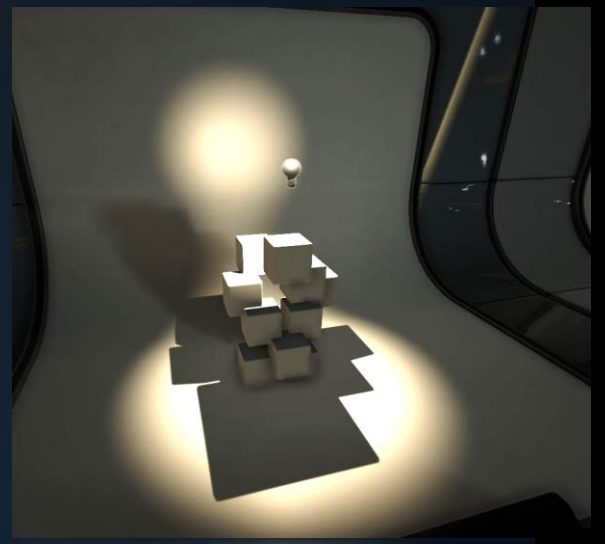

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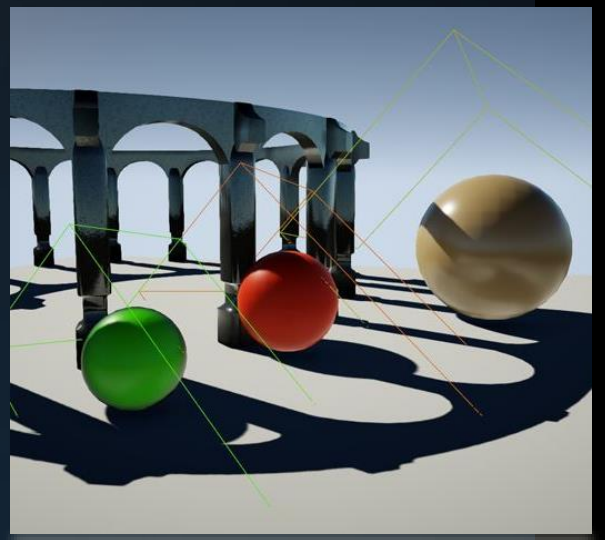

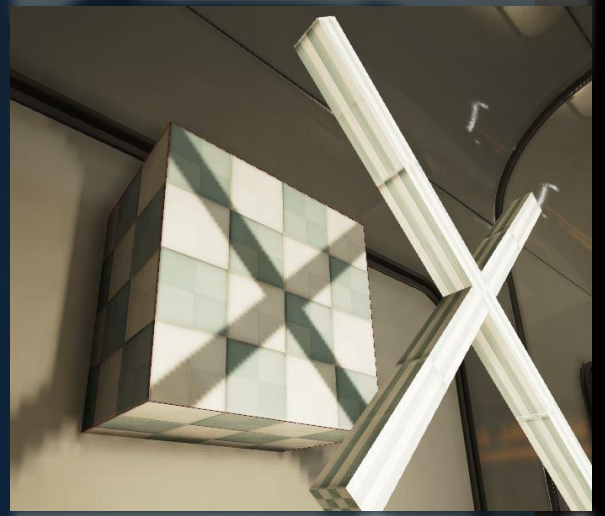

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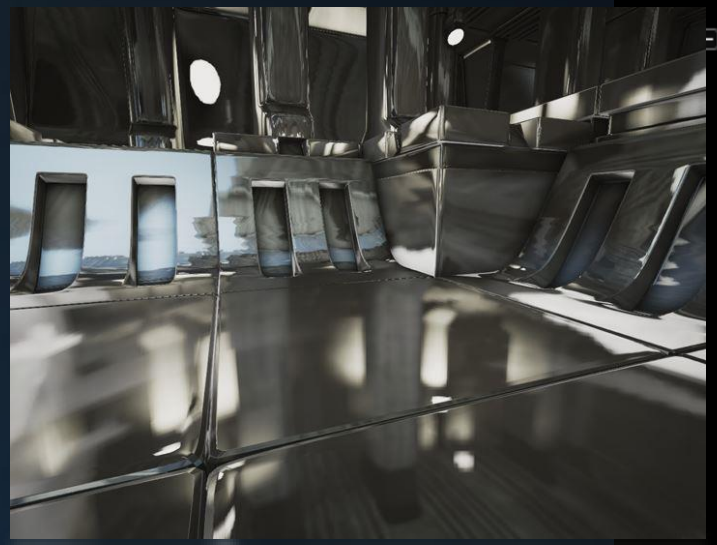

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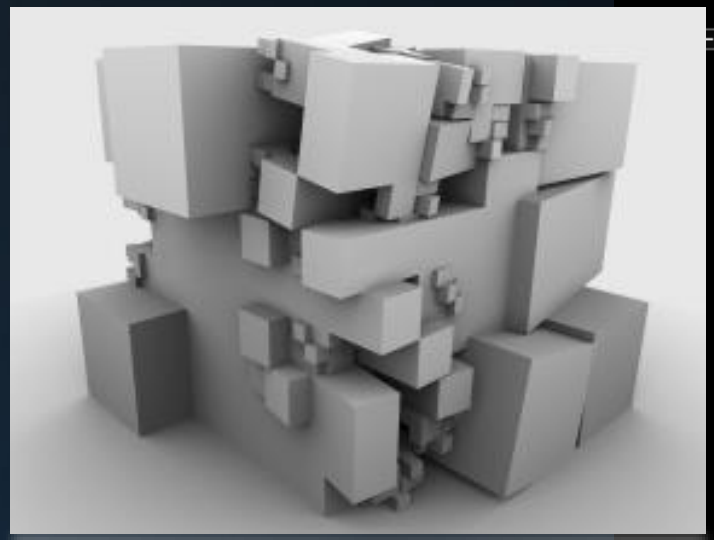

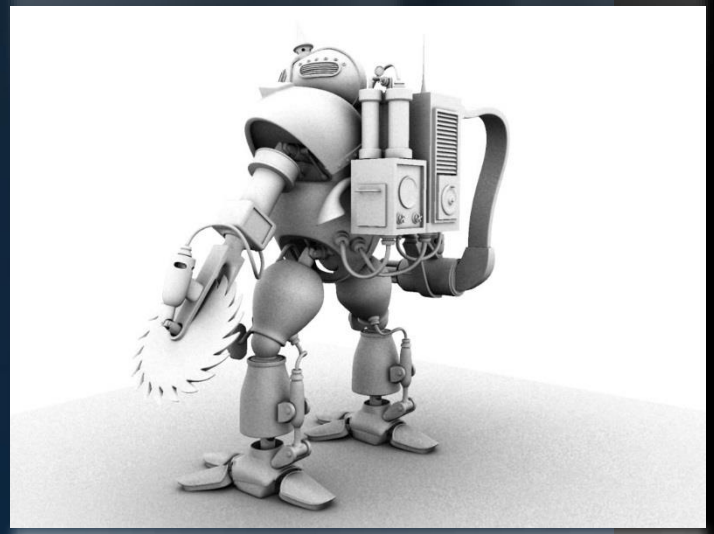

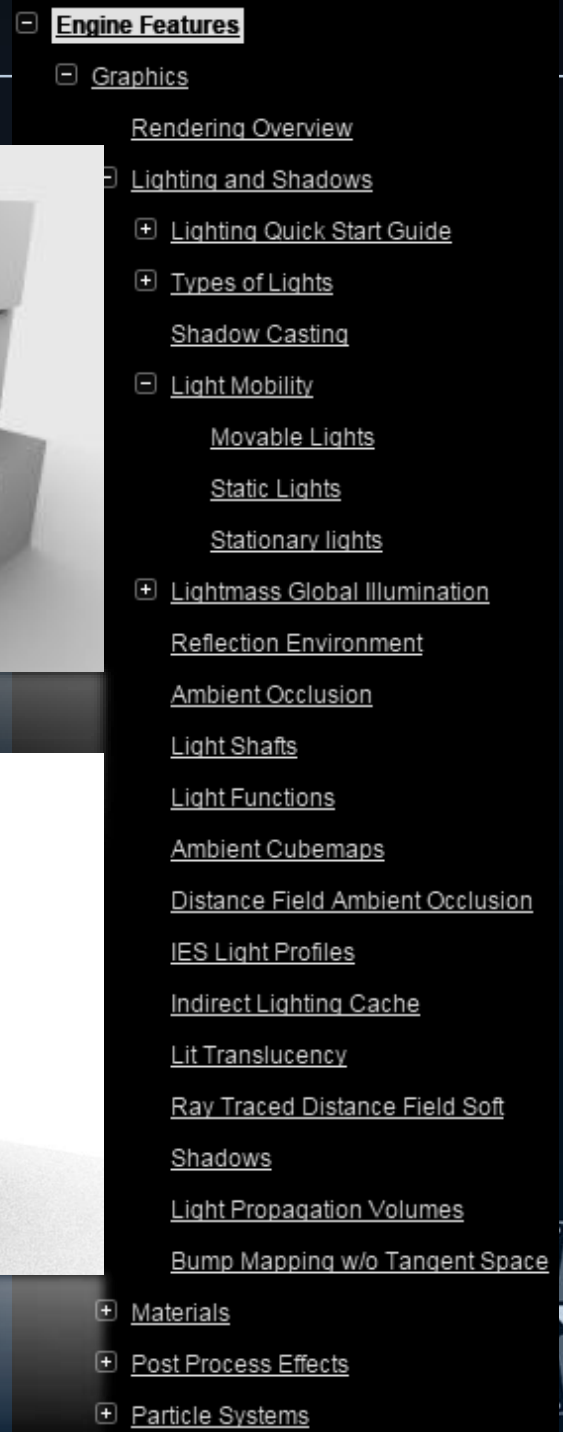

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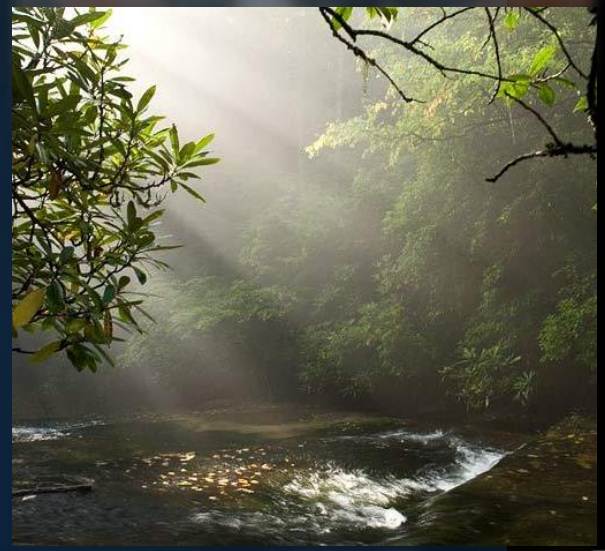

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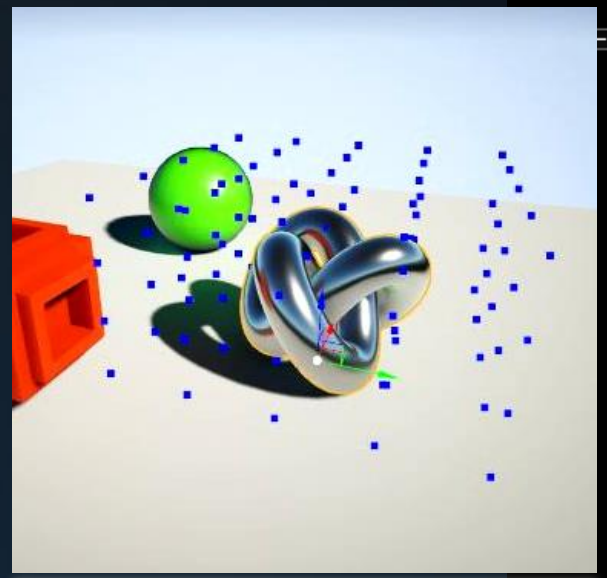

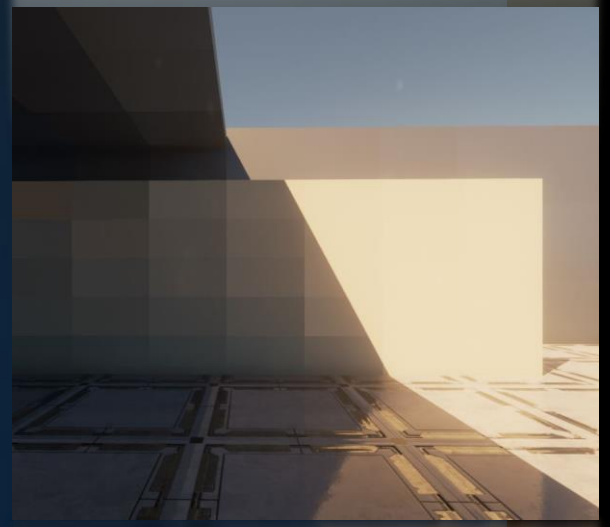

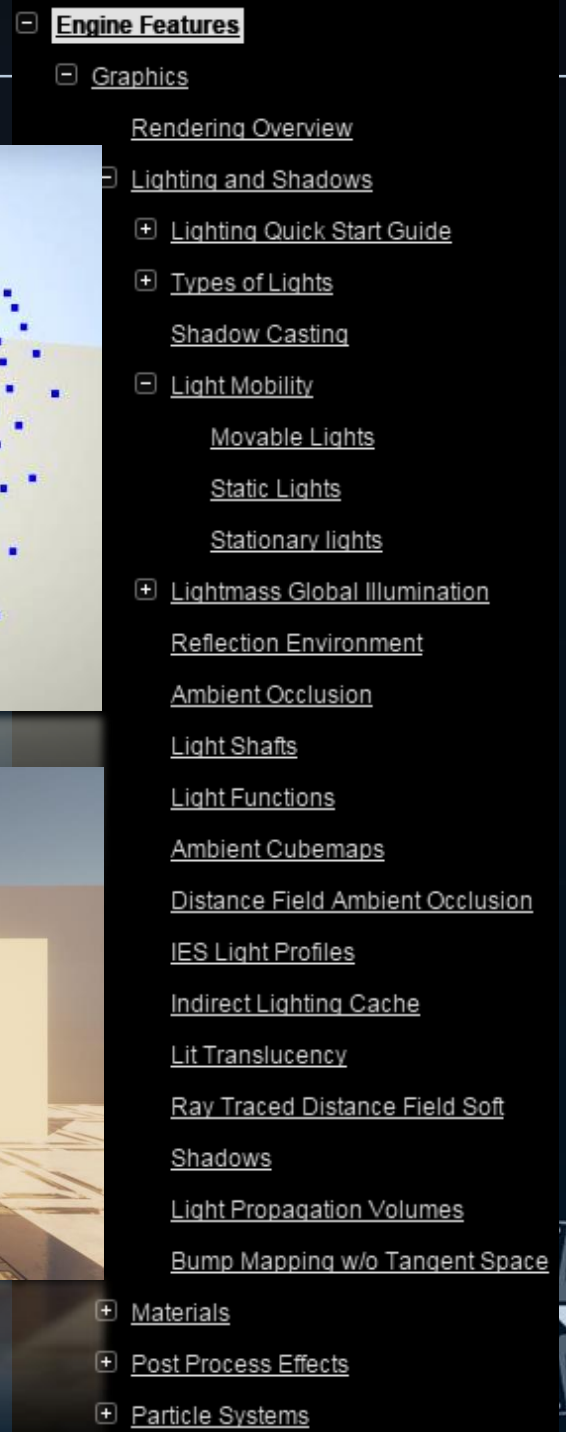

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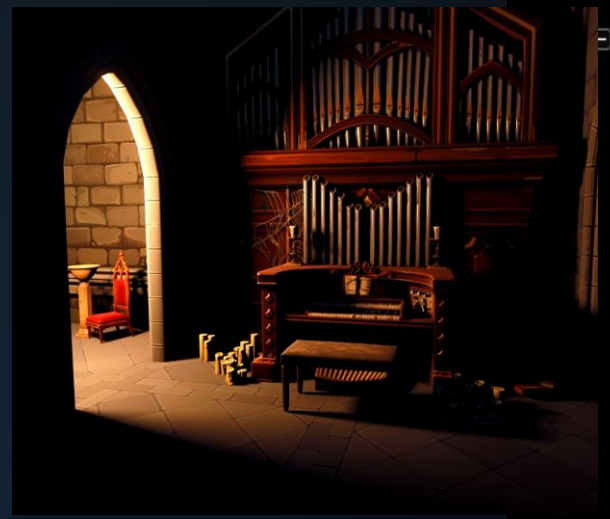
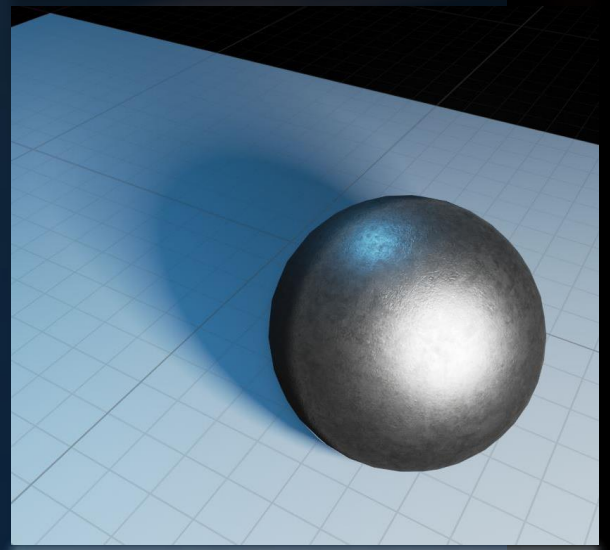
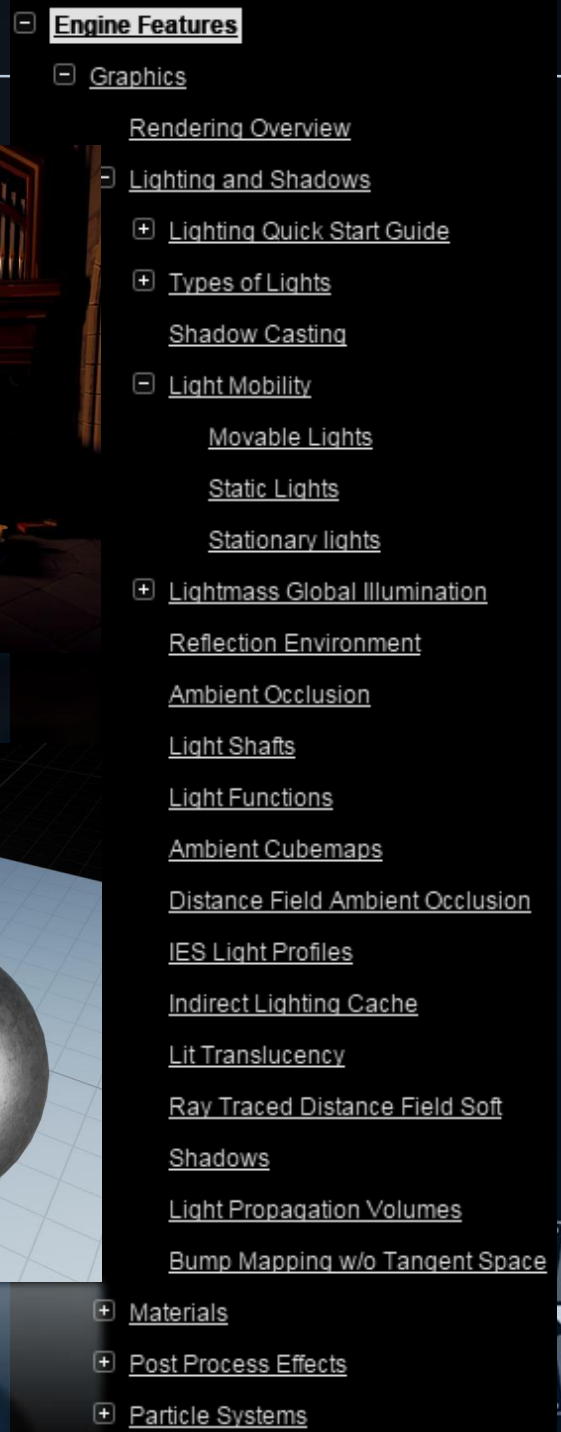
- Light shafts
- Indirect lighting cache
- **Ray traced soft shadows**
- Bump mapping



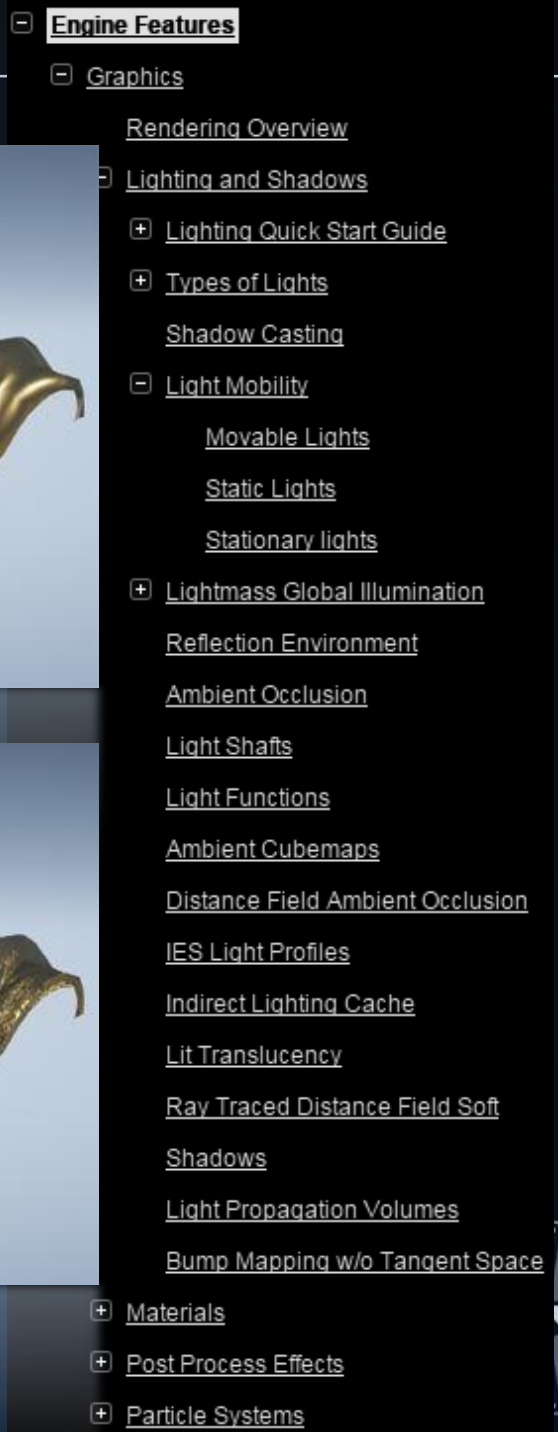




State of the Art

Industry example: Unreal Engine 4

- Lights
- Shadows
- Reflections
- Ambient occlusion
- Light shafts
- Indirect lighting cache
- Ray traced soft shadows
- **Bump mapping**



State of the Art

Modern rendering in games:

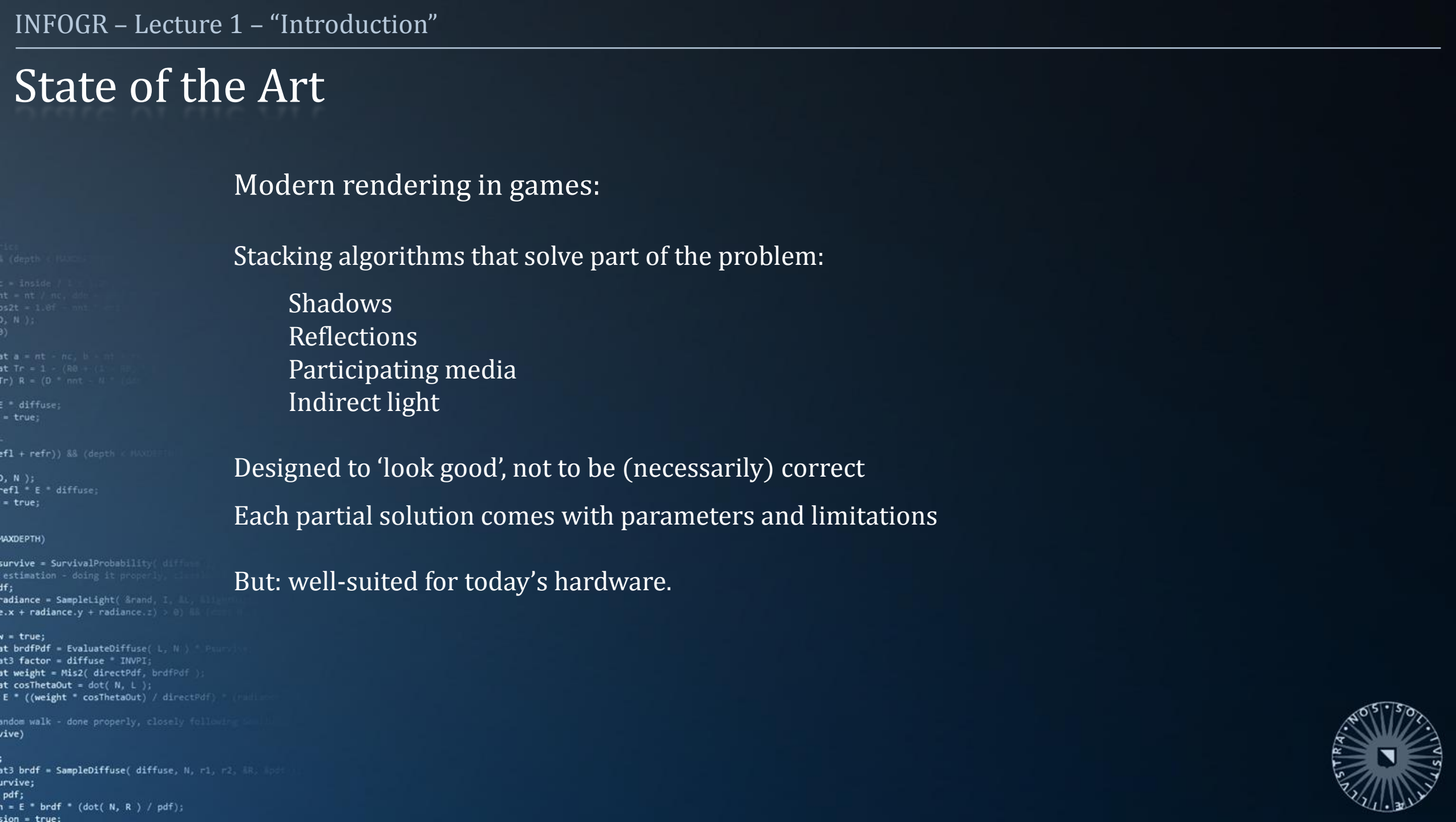
Stacking algorithms that solve part of the problem:

- Shadows
- Reflections
- Participating media
- Indirect light

Designed to ‘look good’, not to be (necessarily) correct

Each partial solution comes with parameters and limitations

But: well-suited for today’s hardware.



Next week:

Foundation

INFOGR – Computer Graphics

Jacco Bikker - April-July 2016 - Lecture 1: “Introduction”

END of “Introduction”

next lecture: “Graphics Fundamentals”