This session will be recorded

COMS30020 - Computer Graphics

Introductory Briefing

Dr Simon Lock

Welcome to Computer Graphics

I'm Dr Simon Lock

BSc in Computer Science

PhD in Software Engineering

Background in Digital Arts

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We also have our team of lab assistants !

Aim of unit: Introduce "Computer Graphics" !

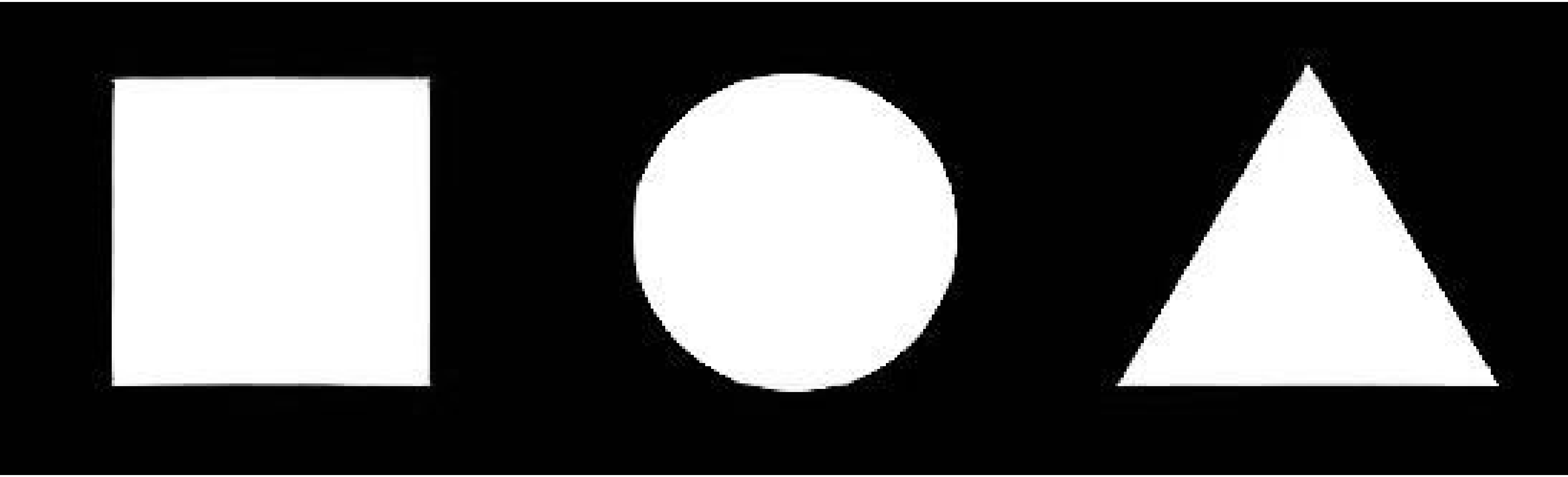
This term means different things to different people
Our perspective on the area will encompass:

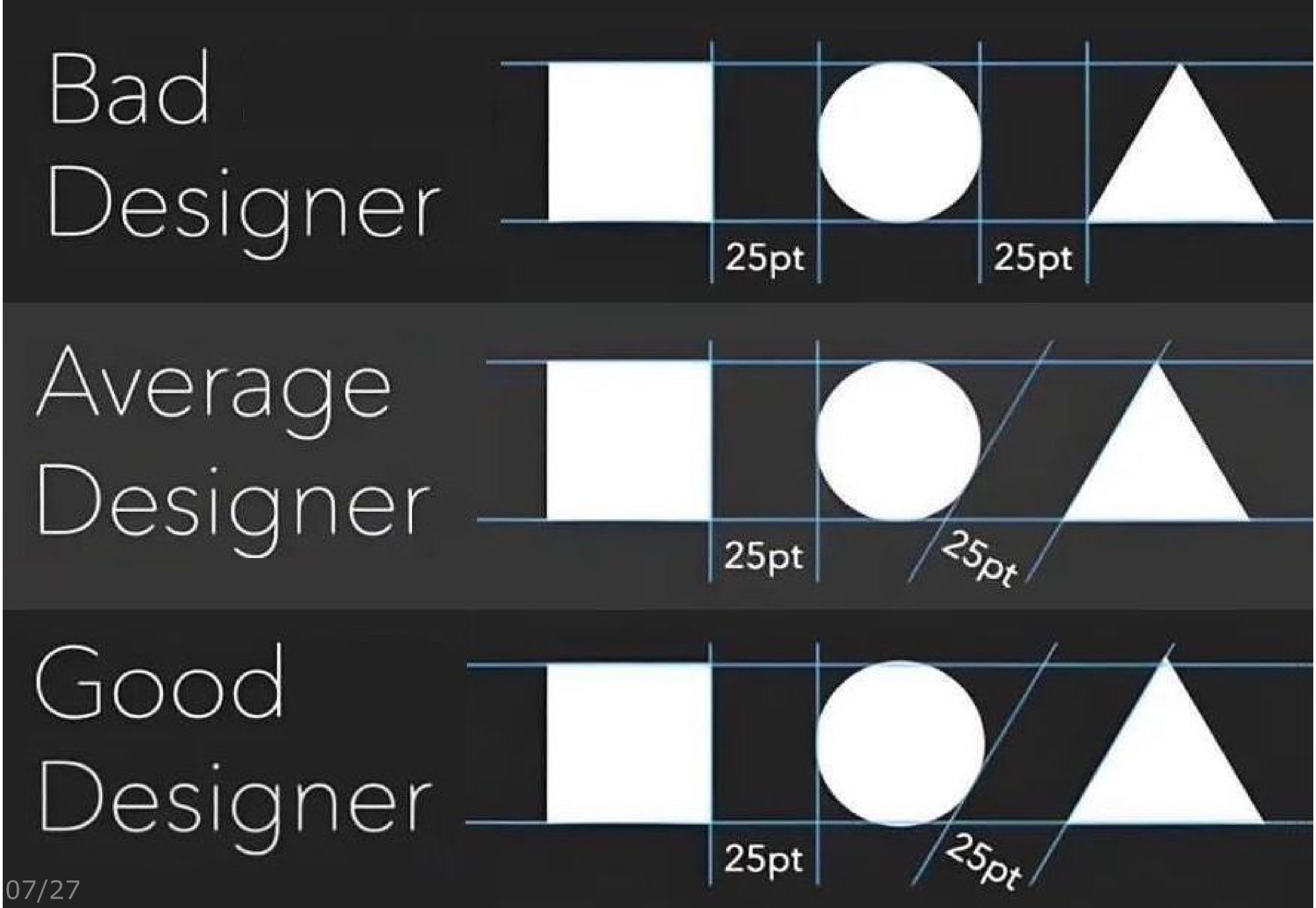
- Low-level "individual pixel" manipulation
- Drawing primitives (lines and triangles)
- 2D and 3D geometry (numerical position data)
- Camera views, movement and navigation
- *Approximating* behaviour of light
- Realistic rendering of various materials

As you might have sensed, it's all pretty low-level...
This is definitely NOT a "Graphic Design" unit !

The Discipline of Graphic Design

Simple task: layout these shapes




Bad Designer
25pt
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Average Designer
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Good Designer
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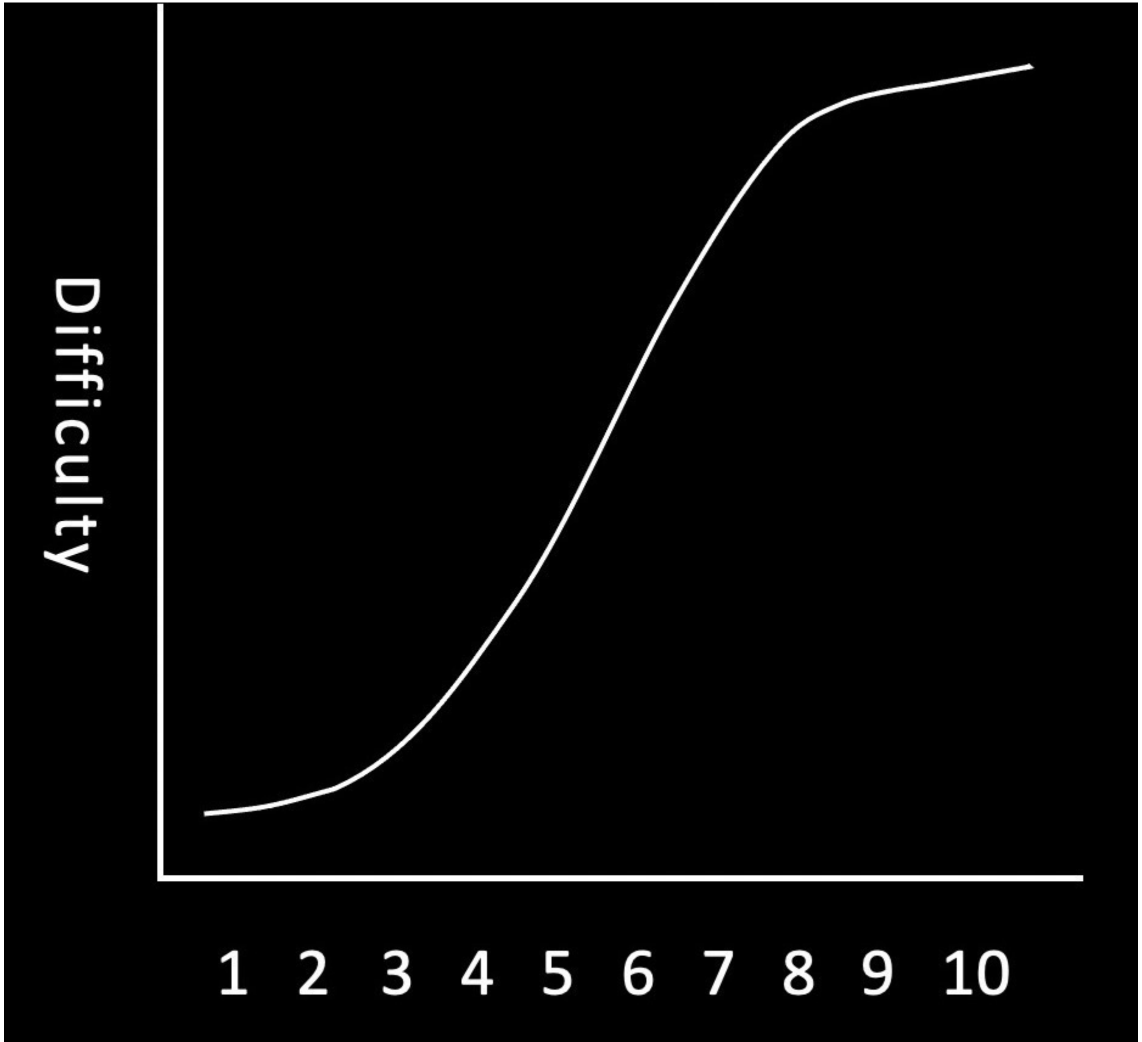
A Word of Warning !

This unit starts off very slowly and gently :o)
(to make sure that everyone is "on board")

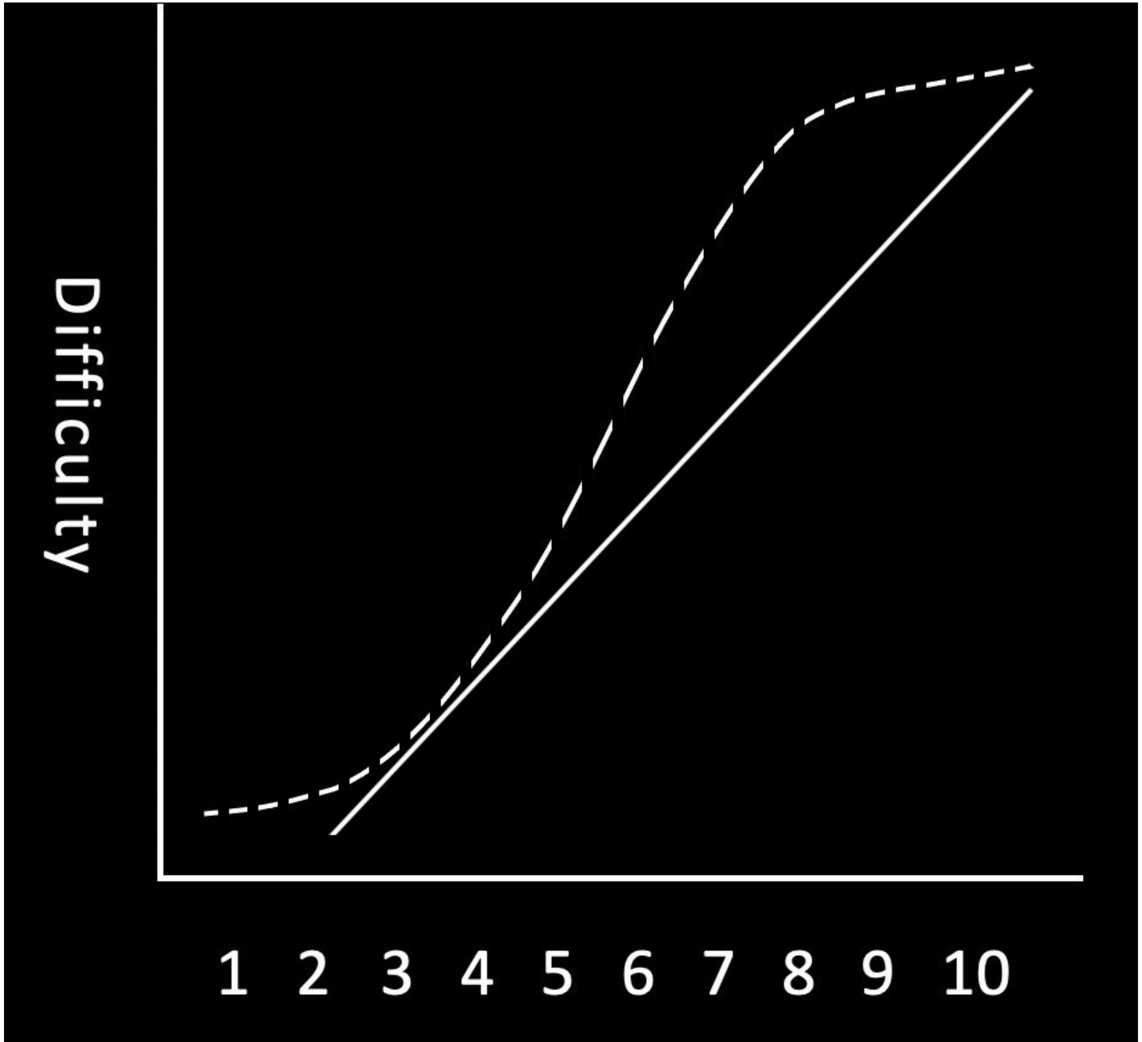
BUT it will speed up incrementally as we progress
DON'T get left behind - keep your eye on the ball !

It is not particularly hard to pass the unit
But every year there are a bunch of fails/resits !!!

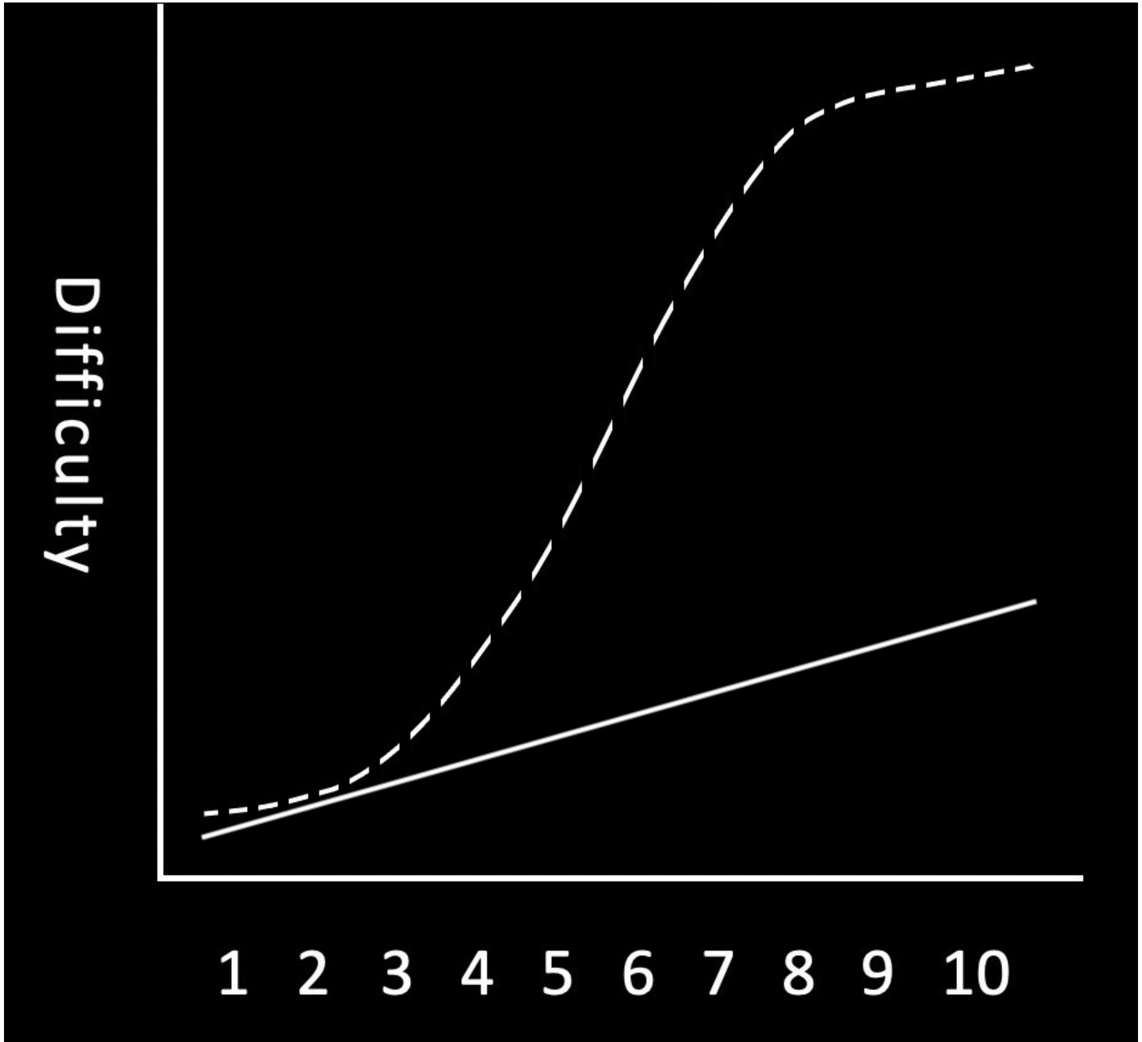
Learning Curve



What people usually do



What NOT to do



Weekly Activities

Each week we'll release a "workbook" of activities
We will discuss these in more detail in later slides !

Practical session to support completing workbook
Tuesday 11am-1pm in MVB 2.11 (this session !)

Lecture briefing to introduce following week's topics
Friday at 10am in Queens Building 1.15 (SLT)

Asynchronous support via Teams discussion forum
There is a link to this on the unit Blackboard page

Weekly Workbooks

Each workbook contains a set of tasks to complete
Lead you step-by-step towards a practical end-goal

Key concepts introduced with rich-media materials:

- Written slides and descriptions
- Recorded audio narration
- 2D and 3D images and diagrams
- Graphical animations (using 3D to teach 3D !)

Workbooks are made available via GitHub
(For ease of upload and download !)

Importance of Weekly Workbooks

It is ESSENTIAL that you keep up with practical tasks

NOT a "cruise during lectures; then work at end" unit

You will need to work steadily throughout the term

Workbooks are the backbone of the teaching materials

An integrated bundle of theoretical concepts & activities

Must complete them, even if doing "exam only" variant

Assessment

MAJORS [20 Credits]
Closed-book on-paper in-class written test
(in the first practical session after reading week)

Practical coursework assignment (weeks 9, 10, 11)

MINORS [50% of 20 Credits]
Closed-book on-paper exam (Dec exam period)

A very practical topic, naturally suited to coursework
Exam variant provided for students with CP constraints

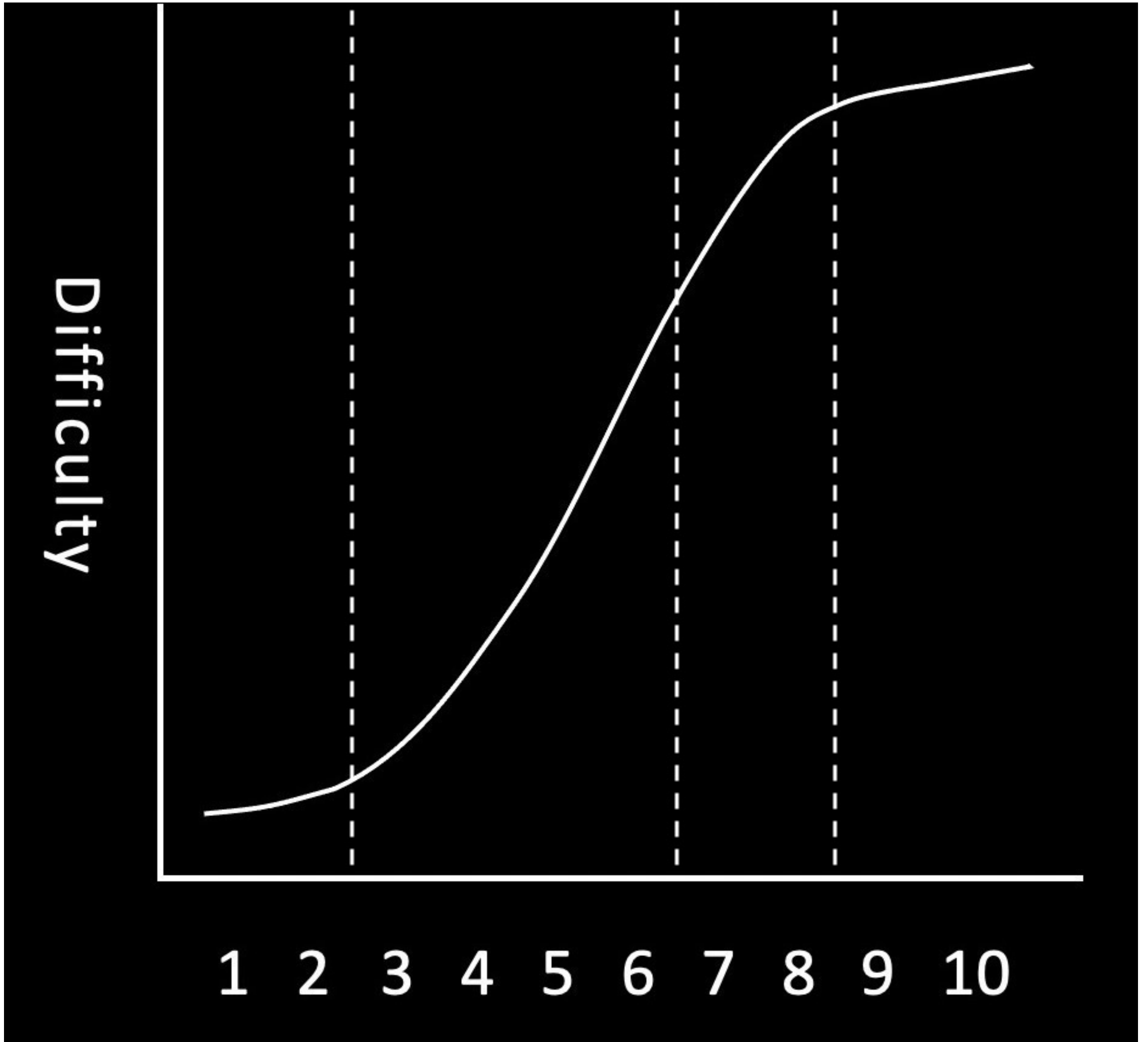
Nature of In-Class Test and Exam

These will both be fairly mathematical in nature
Applying principles of Computer Graphics "on paper"

Essential to complete workbooks and practical task
(to gain deep understanding of all the techniques)

There won't be a big TA resource during revision
(neither during reading week or in run-up to exam)
So don't just leave the workbooks until the end !

Key Weeks



Blackboard

We will use Blackboard as a set of bookmarks
Pointing to other platforms (GitHub, Teams etc.)

Note that there are 2 pages for this unit !
("Teaching" page, MAJOR Unit Page)
They generally have identical information on them
(apart from the "Assessment" page !)

Implementation

We will be using C++ for implementation
(Pretty much the standard for low-level graphics)

For drawing to the screen, we will use "SDL2"
Platform independent graphics library, used to:

- Create windows to show on the screen
- Manipulate individual screen pixels
- Allow user interaction via keys and mouse

Everything else YOU will build on top of this !
(Although we'll use some Maths functions from GLM)

Suggested Textbooks

Basic introduction to topics covered in unit:
Computer Graphics from Scratch
by Gabriel Gambetta
(ebook available via UoB library)

More detailed coverage and advanced rendering:
https://www.scratchapixel.com/

You might need to do some additional reading
(especially for coursework "extended" topics)

Questions ?

Why not teach an existing framework ?

One difficulty is choosing which one to teach !
DirectX, OpenGL, Vulkan or proprietary framework ?

Better to teach the fundamental concepts
(Which make it easy to pick up any framework)

Besides, "fundamentals" are much more BSc/MEng
We don't like to focus a unit around a single API

Can I use <insert_language>

Soz, no !

C++ is a well-established standard in the area

All templates/examples are written in C++

Teaching assistants are all skilled in C++

It's hard to mark an unfamiliar language

Need to maintain a level playing field !

Aim of the first workbook

The aim of the first practical session is simple:
To compile and run the "RedNoise" project
(the base template for all practical exercises)

The deeper purpose is more serious:
Find a "workable" way to compile and run SDL code
The order of preference is as follow:
Native OS / WSL+X11 / Virt Machine / Lab Machine

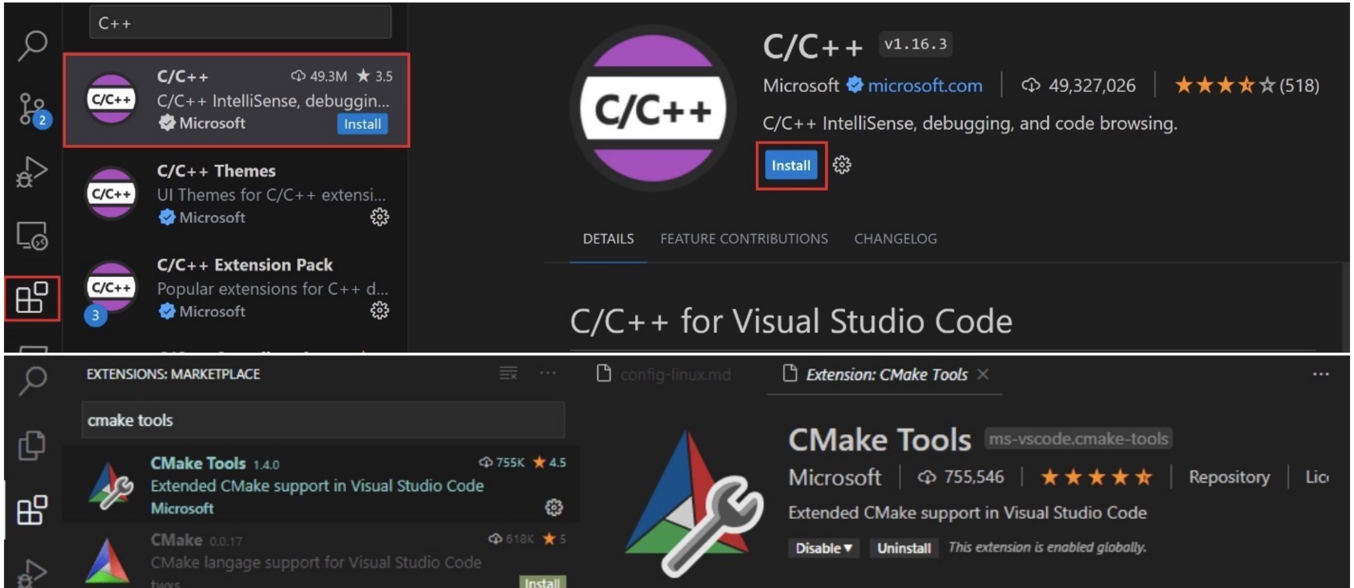
Using IDEs

CLion seems to work well as an IDE for RedNoise

(it can easily open CMakeLists.txt file as a project)

Some of you may prefer to use VSCode instead

However you will need to install some extensions...


C++
C/C++ 49.3M ★ 3.5
C/C++ IntelliSense, debuggin...
Microsoft
Install
C/C++ Themes
UI Themes for C/C++ extensi...
Microsoft
C/C++ Extension Pack
Popular extensions for C++ d...
Microsoft
C/C++ v1.16.3
Microsoft microsoft.com | 49,327,026 | ★★★★☆ (518)
C/C++ IntelliSense, debugging, and code browsing.
Install
DETAILS
FEATURE CONTRIBUTIONS
CHANGELOG
C/C++ for Visual Studio Code
EXTENSIONS: MARKETPLACE
cmake tools
CMake Tools 1.4.0 755K ★ 4.5
Extended CMake support in Visual Studio Code
Microsoft
CMake 0.0.17 618K ★ 5
CMake langage support for Visual Studio Code
twxs
Install
config-linux.md
Extension: CMake Tools
CMake Tools ms-vscode.cmake-tools
Microsoft | 755,546 | ★★★★★ | Repository | Lic
Extended CMake support in Visual Studio Code
Disable ▾
Uninstall
This extension is enabled globally.

More details can be found here:

https://code.visualstudio.com/docs/cpp/cmake-linux

(some useful information for all platforms)

Let's take look at that first workbook...

https://github.com/COMS30020/CG2024