

OpenGL

Open Graphics Library

# OpenGL

Specifications

Not Implementation

# History

# OpenGL 1.0 (1992)

Basic Features for all Graphics Cards

# OpenGL 1.0 (1992)

Want support for your graphics card feature?  
Write Extensions!!!

# OpenGL 1.1 (1997)

## Texture Objects

What is Texture then?

# What is Texture then?





# UV Mapping

Nothing better than christmas chocolates to explain #UVmapping to your kids #CGI #3D #material #texture



# OpenGL 1.2 (1998)

“Image Subset” for image processing

# OpenGL 1.3 (2001)

## More Texturing Features

- Texture Compression
- Multi-Sampling anti-aliasing
- Multitexturing

# Multisampling

MSAA



No MSAA



# Multitexturing



# OpenGL 1.5 (2003)

- GLSL (OpenGL Shading Language)

# OpenGL 2.0(2004)

- C-like GLSL

# OpenGL 3.0 (2008)

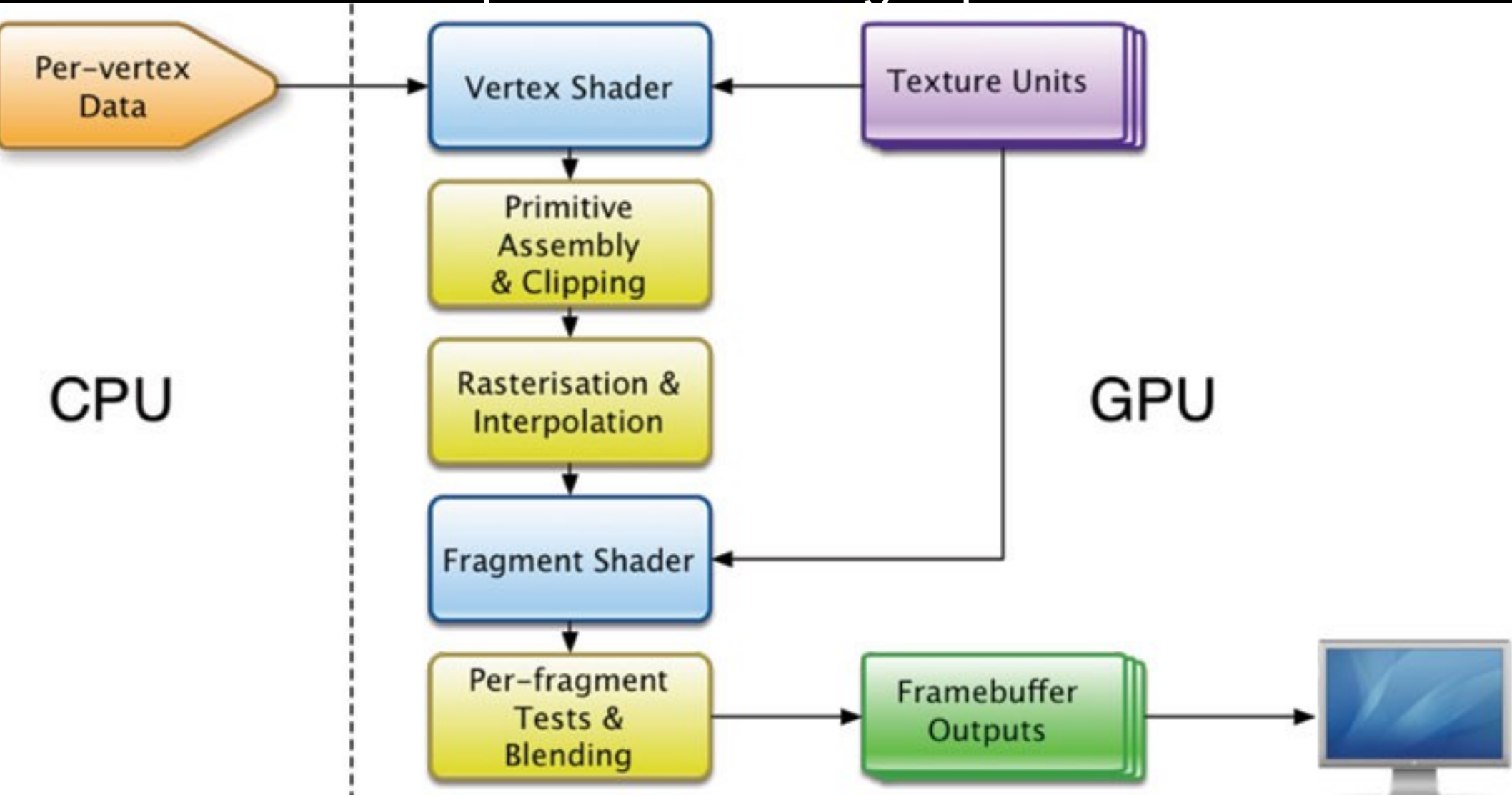
- Deprecating Features
  - Fixed Function Pipeline
  - glBegin and glEnd



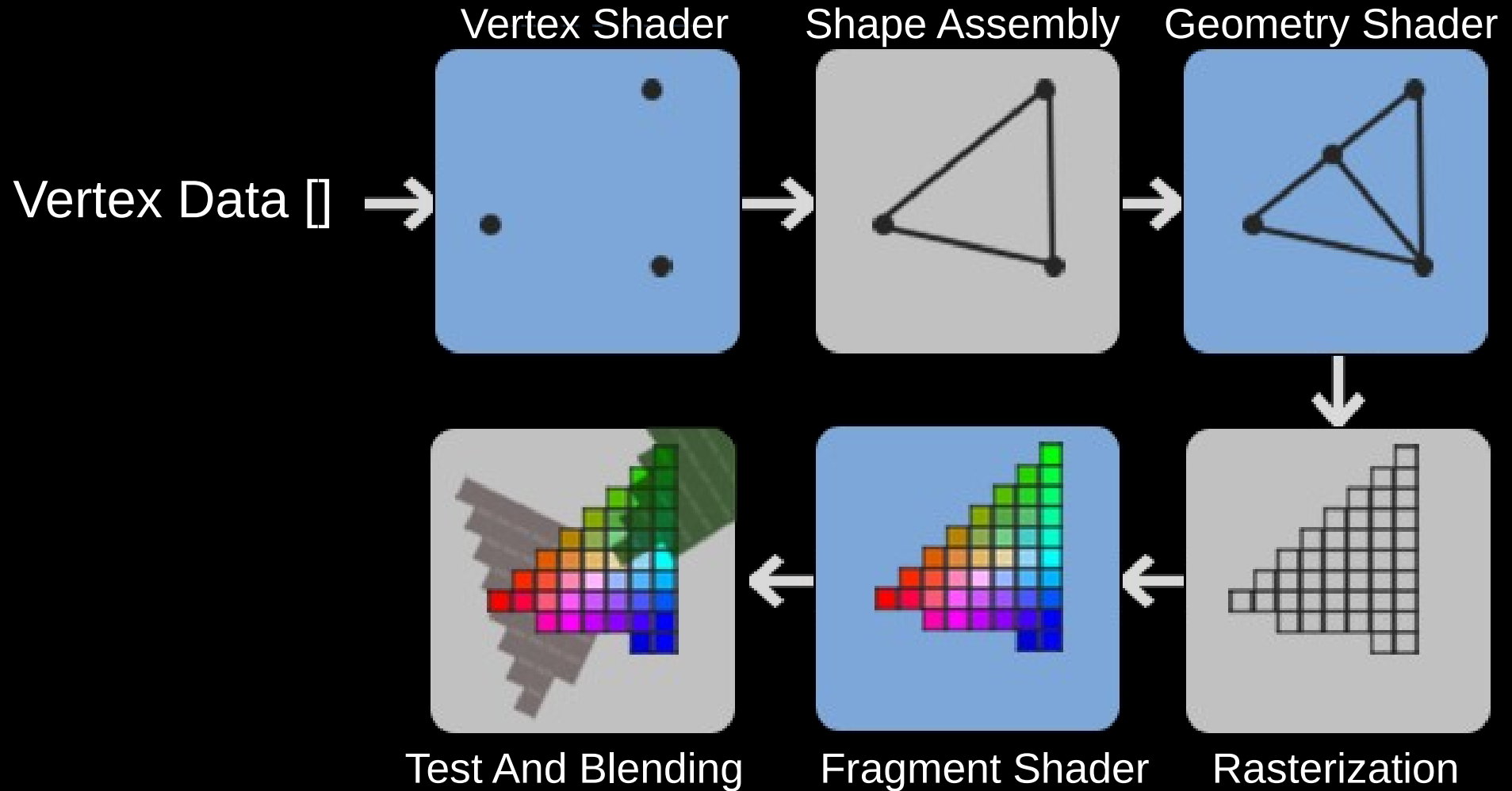
# older <- 3.0 VS 3.1 -> newer

- Traditional (Fixed 😞)
  - 1. glBegin
  - 2. Give data to GPU
  - 3. glEnd
- NEW! (programmable)
  - VAO & VBO
  - Vertex Shader!!!!
  - Fragment Shader!!!!
  - And So much Fun!

# Graphics Rendering Pipeline



# Graphics Rendering Pipeline



# Demo Time!

<https://www.shadertoy.com>

# Basic Shader Tutorial

<https://thebookofshaders.com/>

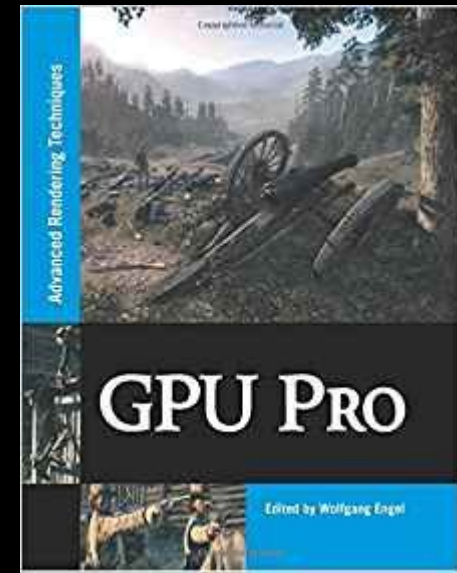
# Are you book worm?

## For Shaders!!

Advanced Rendering Techniques



GPU Pro<sup>2</sup>



GPU Pro



Edited by Wolfgang Engel



Advanced Rendering Techniques

GPU Pro<sup>4</sup>



Advanced Rendering Techniques



Advanced Rendering Techniques



GPU Pro<sup>6</sup>



Edited by Wolfgang Engel



GPU Pro<sup>7</sup>

Edited by Wolfgang Engel



Not related to OpenGL

What is Mingw ?

Not related to OpenGL

What is Mingw ?

Minimalist GNU for Windows



Not related to OpenGL

What is Mingw ?

Minimalist GNU for Windows

Gnu is Not Unix

So I can only do OpenGL stuffs  
in Mingw(C/C++)?

# Language Bindings for OpenGL

- Ada
- Common Lisp
- C#
- Delphi/Free Pascal (Object Pascal)
- Fortran
- FreeBASIC
- Haskell
- Visual Basic
- Lua

[https://www.khronos.org/opengl/wiki/Language\\_bindings](https://www.khronos.org/opengl/wiki/Language_bindings)

# Language Bindings for OpenGL

- OCaml
- Perl
- Pike
- PowerBASIC
- Python
- Racket
- Ruby
- Java

[https://www.khronos.org/opengl/wiki/Language\\_bindings](https://www.khronos.org/opengl/wiki/Language_bindings)

# GUI Systems

- Win32 (legacy)
- QT Framework (has nice features)
- GTK+
- GLUT or FreeGLUT
- GLFW and GLEW
- SDL

What about Android and IOS?

OpenGL ES!!! ( GLES )

# GL ES 1.0 (2003)

- It only supports Fixed Function Pipeline
- Features are same as Desktop's OpenGL 1.3



# GL ES 2.0 (2007)

- Same features as Desktop's OpenGL 2.0
- But with Programmable Pipeline
  - Vertex Shader
  - Fragment Shader

# GL ES 3 (2012-2014-2015)

- Acceleration for advanced visual effects
- Ericsson Texture Compression (ETC2)
- Enhanced Texturing
- Easier to write portable applications
- Geometry and Tessellation Shaders
- Compute Shaders (GL ES 3.1)
- Single Codebase for all Platforms

# Which one is better?

GL ES 2 VS GL ES 3





## Maintenance release: Godot 3.0.2

By: Hein-Pieter van Braam Mar 04 - 2018

We've found some regressions in Godot 3.0.1. This maintenance release addresses these and also adds some features for our C# users.



## Moving to Vulkan (and ES 2.0) instead of OpenGL ES 3.0

By: Juan Linietsky Feb 26 - 2018

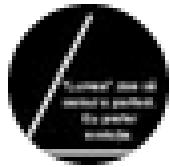
The rationale for the OpenGL ES 3 renderer was having a single codebase for targeting all platforms. This sounds really good in theory and we could say it \*almost\* works, but...



## Maintenance release: Godot 3.0.1

# GL ES 3

- Bad Implementations
- Not Optimized
- Poor mobile support (drivers)



**Radu Bolovan**

January 6 at 8:10 AM

Testing 3.1 alpha 5:

3D project exported to Android with GLES 3.

The project contains:

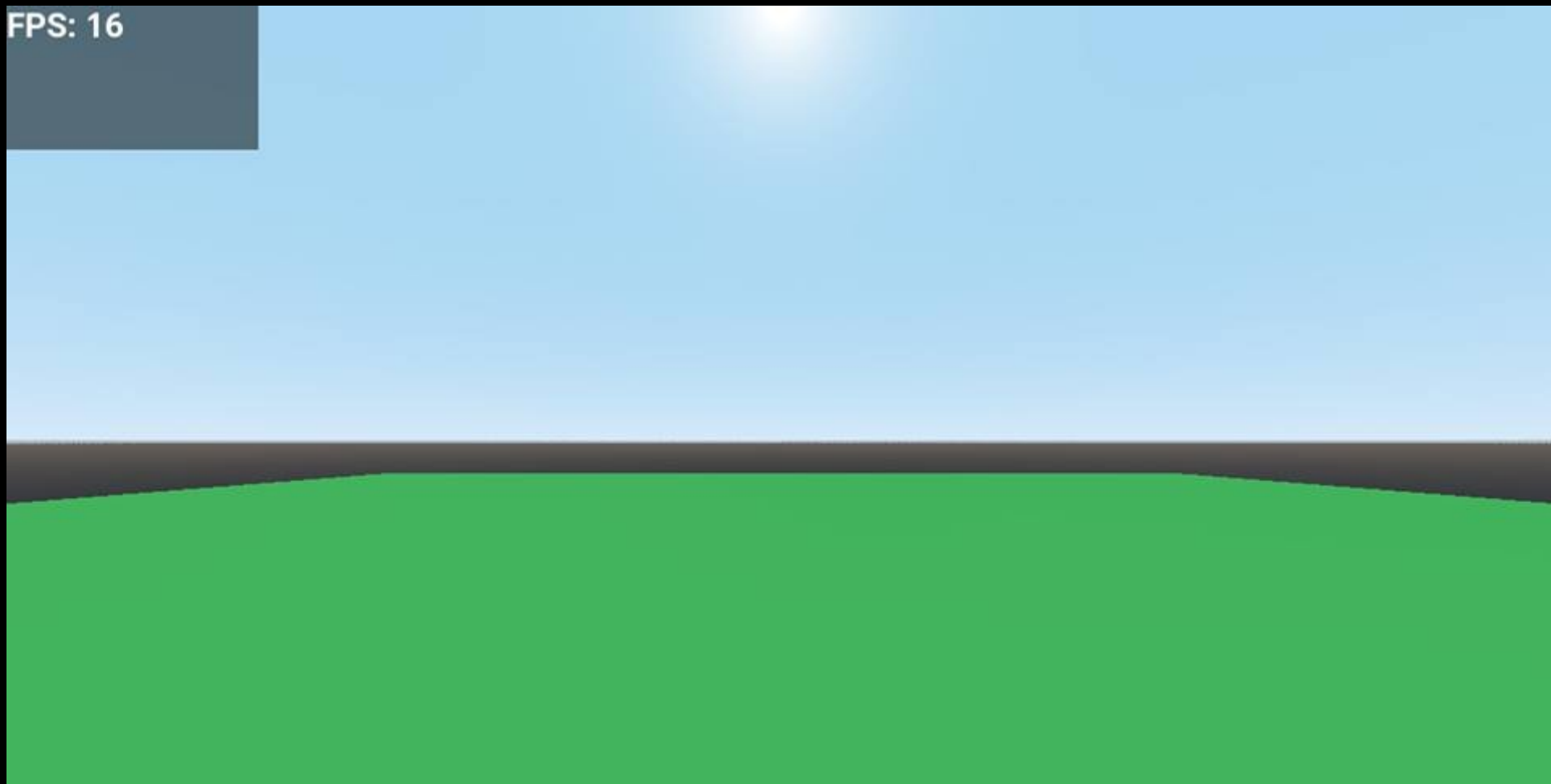
- a plane
- a camera
- a directional light with shadows enabled
- a sprite + a label as debug info

Phone details: LG K10 (2017), Android 8.1.0, 2GB RAM, OpenGL ES 3.2.

The result: 15-17 FPS. Please see screenshot for details. Is this normal?


<https://www.facebook.com/groups/godotengine/permalink/1455540687915854/>

FPS: 16



FPS: 28



**Dylan Warlus** Use GLES2  1

Like · Reply · 1w



**Radu Bolovan** On it!

Like · Reply · 1w



**Radu Bolovan** I got 25-30 FPS with GLES 2. Waiting for the Beta and re-test this.



Like · Reply · 1w · Edited

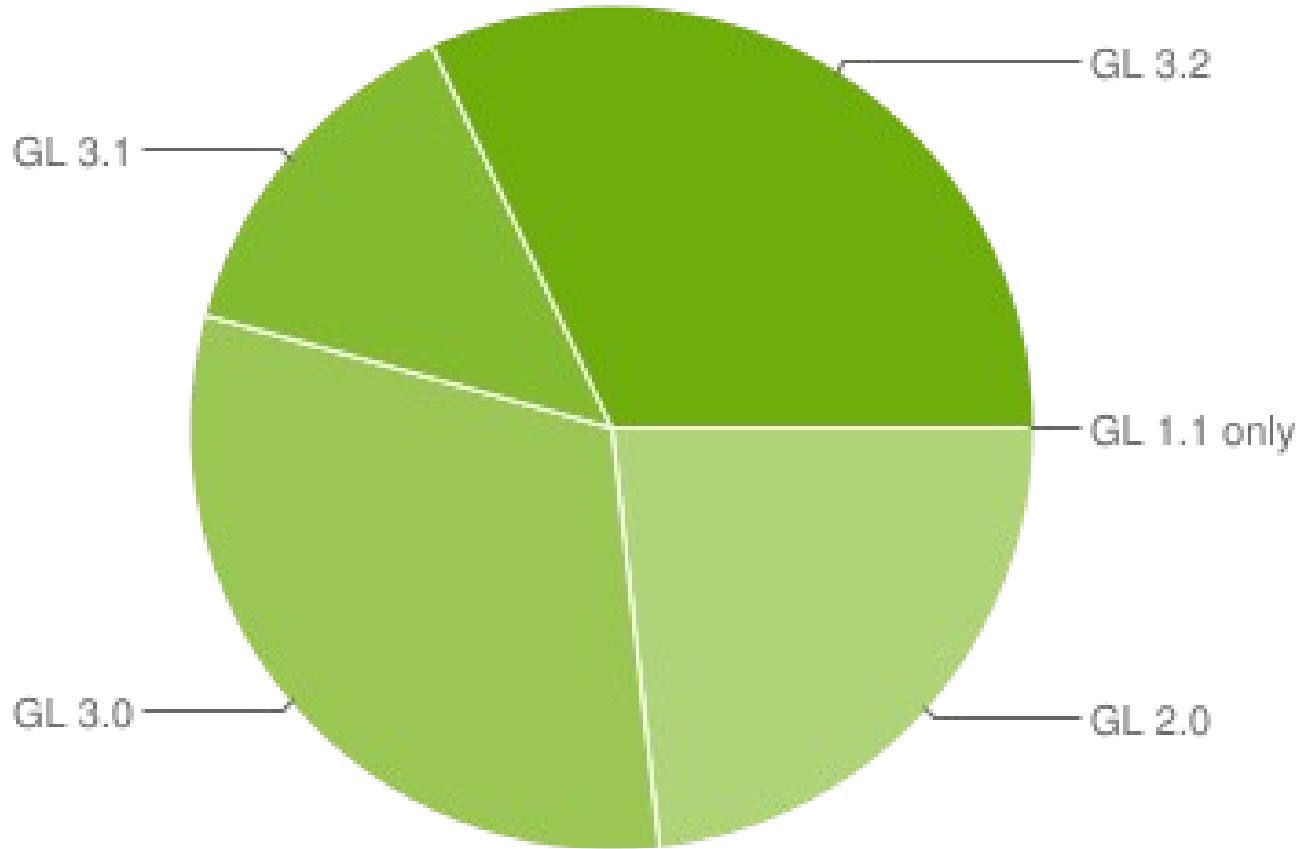


| Write a reply...





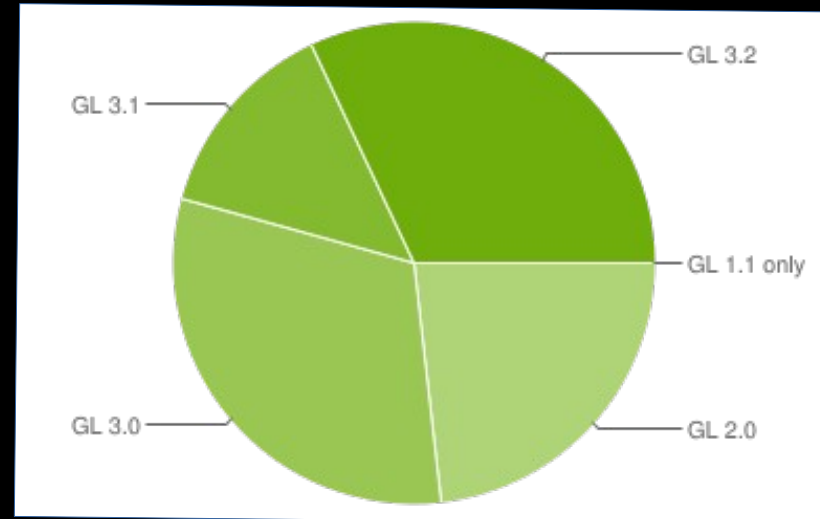
# OpenGL ES for Android



<https://developer.android.com/about/dashboards/#OpenGL>

# OpenGL ES 3.\* for Android

- Supported but barely runnable
- Can be run only on a handful of high-end devices.

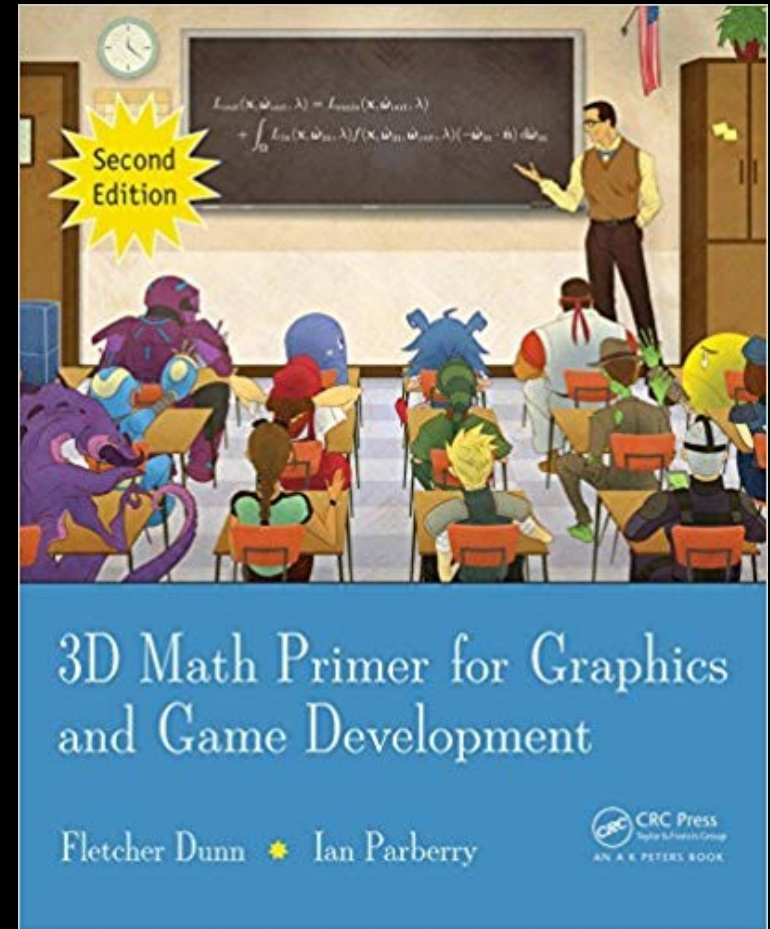
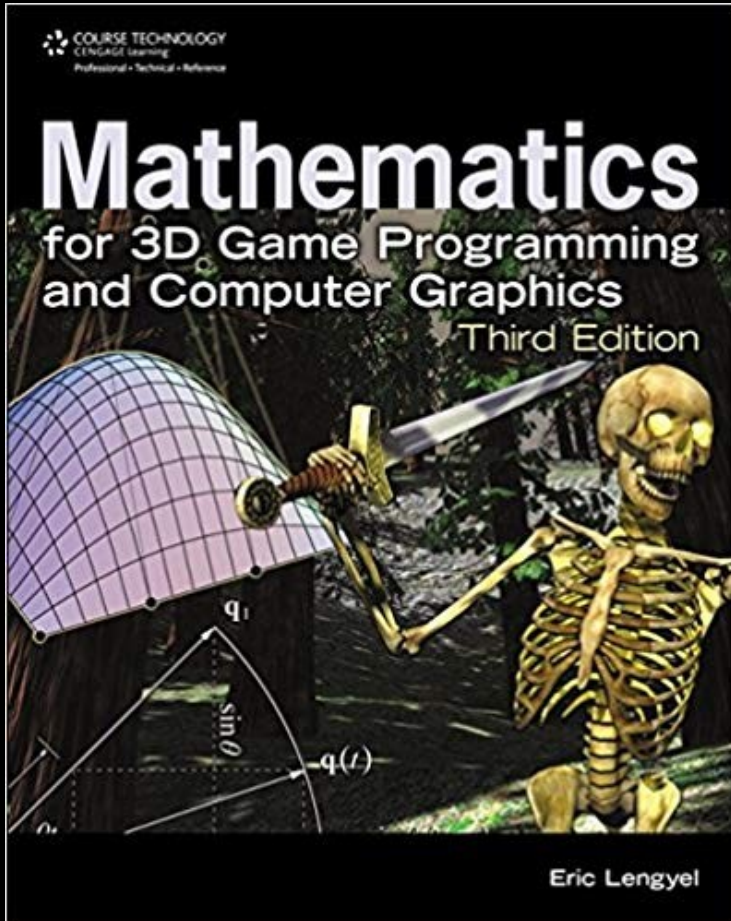


# Alternatives To OpenGL

- DirectX (Only Windows and Xbox.... Not really)
  - <https://store.steampowered.com/linux>
  - <https://store.steampowered.com/steamos>
- Metal (Apple)
- Vulkan (new)

# Are you book worm?

Beginner



# Are you book worm?

Advanced!!

Matt Pharr, Wenzel Jakob, Greg Humphreys

## PHYSICALLY BASED RENDERING

From Theory to Implementation

Third Edition



SECOND EDITION

## Advanced Global Illumination



Philip Dutré  
Kavita Bala  
Philippe Bekaert

With a foreword by Peter Shirley

# We are .....

- Satt Paing Phyoe
- Si Thu Myo
- Lin Htet Moe
- Khant Myat Min
- Phone Pyae Kyaw
- Tun Nanda Aung
- Myat Kaung Khant

# Thanks

Now go make some cool stuffs

And also WebGL and WebGL 2.0

<https://github.com/sithumyo1998/Uni-Presentations>