Illusion Labs

Agenda

- About Illusion Labs
- Graphics programming for iOS platform
  - General Tips
  - Adjust for hardware
  - Optimization
  - Cheat
  - Tools
  - Demo
  - Shaders

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About me

- My name is Marcus Dawson
- I am a software developer
- Have studied Computer Science @ LTH
- I have worked at Sony Ericsson
- Joined Illusion Labs after the startup

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About Illusion Labs

- Founded in 2007 by Andreas Alptun and Carl Loodberg
- Located in Malmö, Sweden
- 9 employees + 1 freelance artist
- Create games for mobile devices

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How it all began…

tat
THE ASTONISHING TRIBE

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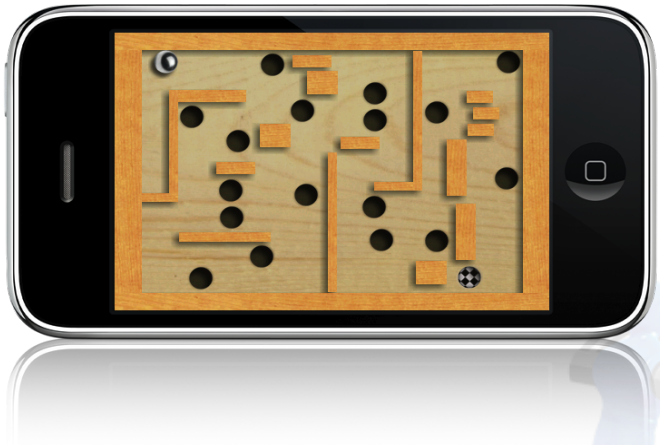
Labyrinth

- First commercial iPhone game
- Before the app store
- Features added along the way



iPint

- Ad app
  - London agency, BMB
  - Cannes Silver Lion Award
  - Most downloaded app in UK

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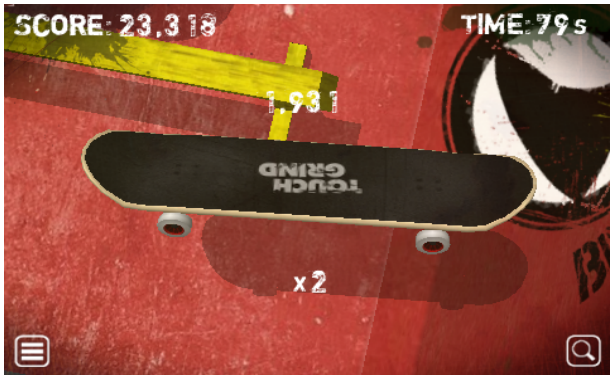
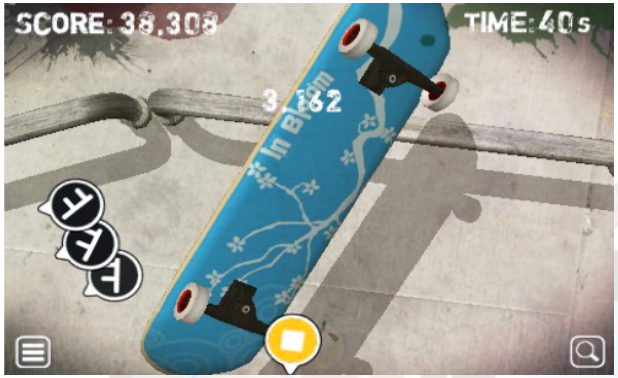
Touchgrind

- Fingerboarding game
- High risk project
- Realistic controls
- Lot of work to get the feeling just right





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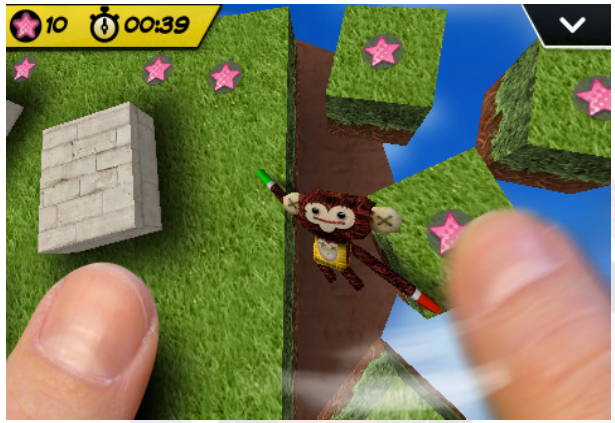
Sway

- Platform game
- Cute graphics
- Innovative controls
- Ragdoll physics



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Labyrinth for Android

- Top 5 on Android Market for a long time
- Full and Lite version
- Many variations off hardware

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Labyrinth 2

- Added all the fun things we could think of
- Clones
- Multiplayer, Online editor
- Level community

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Labyrinth 2 HD / Touchgrind HD

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Labyrinth 2 HD / Touchgrind HD

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Foosball / Foosball HD

- Pocket sized table soccer
- Using OpenGL ES 2
- Launch at the same time as World Cup

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Touchgrind BMX

- Built our own graphics engine
- Much more 3D graphics than before
- Added support for generating videos on device and YouTube post

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Blast A Way

- Completely destructible levels
- Advanced animation system
- Ambient occlusion

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About Illusion Labs

- Focus on quality and innovation
- We do a lot of prototyping
- Good ideas are not created under pressure

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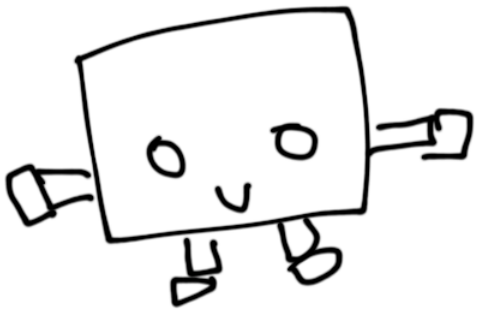
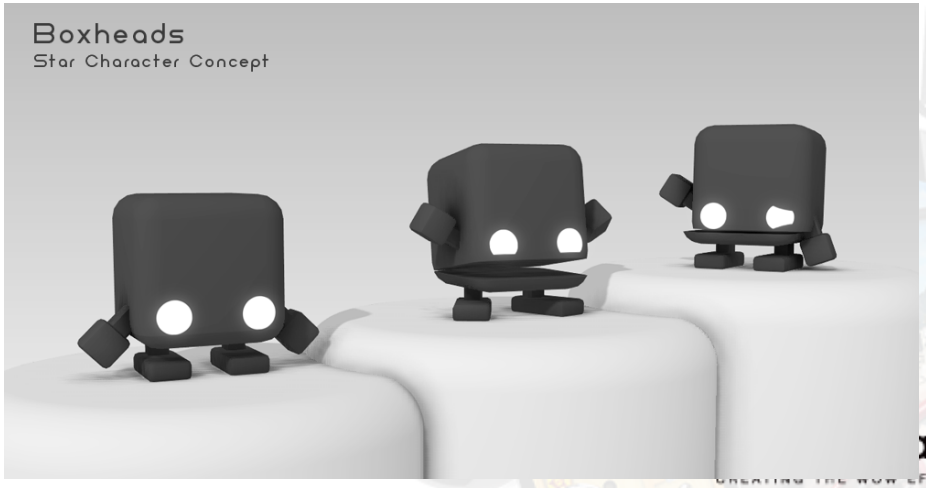
Graphics programming for iOS platform

General tips

You are not a Graphics Artist

- Many developers (me included) think they can draw...
- … but not all can.
- Big difference to have a professional graphics designer.





General tips

Framerate

- Make sure you keep the appropriate framerate
- More important than any graphics effect
- At least 30 FPS, 60 FPS recommended

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General tips

Use UIKit

- No big performance impact to use Cocoa on-top of GL
- UIKit is good for menus or debugging info
- Gives more time to focus on graphics

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General tips

Save battery

- Draw only when needed
- Limit frame rate when appropriate
- Stop drawing for a scene that's not changing

Adjust for hardware

GL Kit

iOS 5.0 introduced GL Kit

- Wraps setting up GL
- Easier than ever to start using GL
- Automatic support for Multi-sampling and more
- Pre-created shaders

Note: Will only work on devices with iOS 5.0 and later

Adjust for hardware

Fragmentation?

- Which hardware (iPad, iPhone, iPod)
- Which os versions (iOS 3.0 → iOS 6.0.1)
- Which hardware gen. (iPhone 4S, iPhone 5 etc)
- Which display size

Library support
Hardware performance
Hardware (for example: accelerometer, gyro)

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Adjust for hardware

Adjust to device

- Newer devices can use same techniques as a non-mobile device
  - Multisampling
  - Advanced shaders
  - Shadows
  - etc

- Adjust graphics after device limitations
  - Important that your game looks good (Good PR)
  - Important that you support many devices

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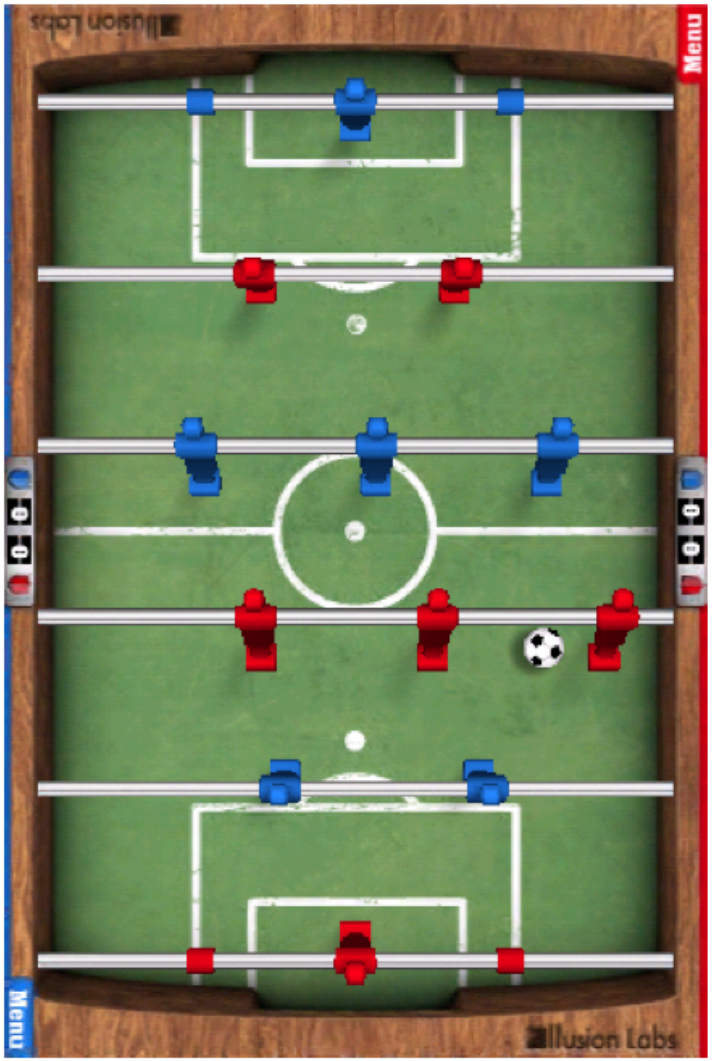
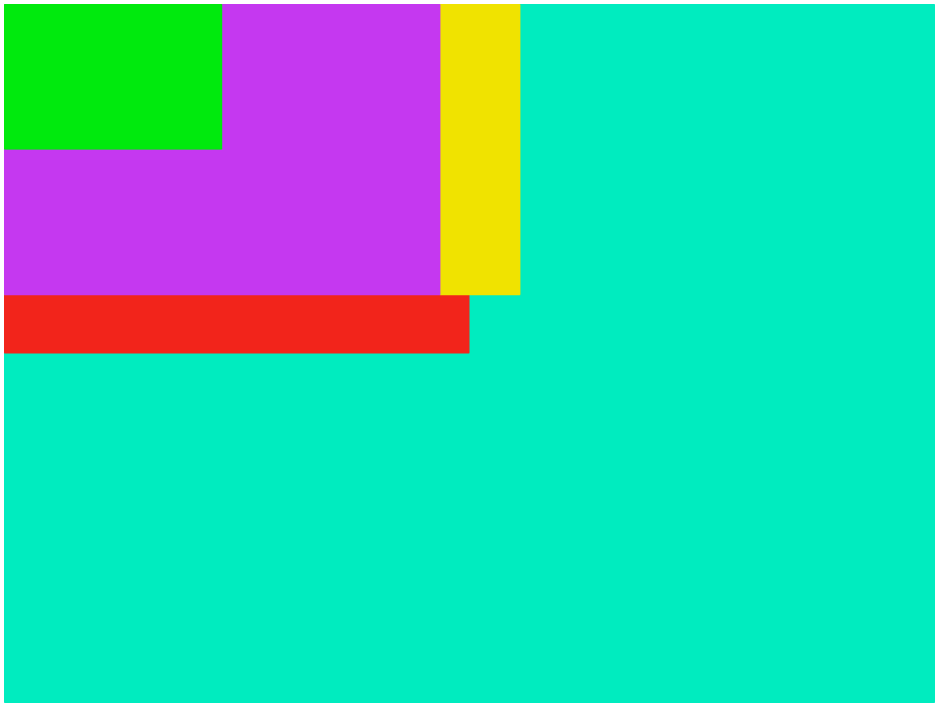


OpenGL ES1

OpenGL ES2

Adjust for hardware
Screensizes



480 x 320 px – iPhone 3GS
960 x 640 px – iPhone 4 & 4S
1136 x 640 px – iPhone 5
1024 x 768 px – iPad 2 & Mini
2048 x 1536 px – iPad 3 & 4

Tv Out?

Adjust for hardware
Screensizes

Retina vs Non-retina

UIView.contentScaleFactor = 1 → 320 x 480
UIView.contentScaleFactor = 2 → 640 x 960
UIView.contentScaleFactor = 1.5 → 480 x 720

iPad vs iPhone

UI_USER_INTERFACE_IDIOM() == UIUserInterfaceIdiomPad

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Cheat

- Cheat as much as you can get away with
- You don't always need real lighting, real 3D or real physics.
- As long as it feels real its real.
  - But make sure it feels real.

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Cheat

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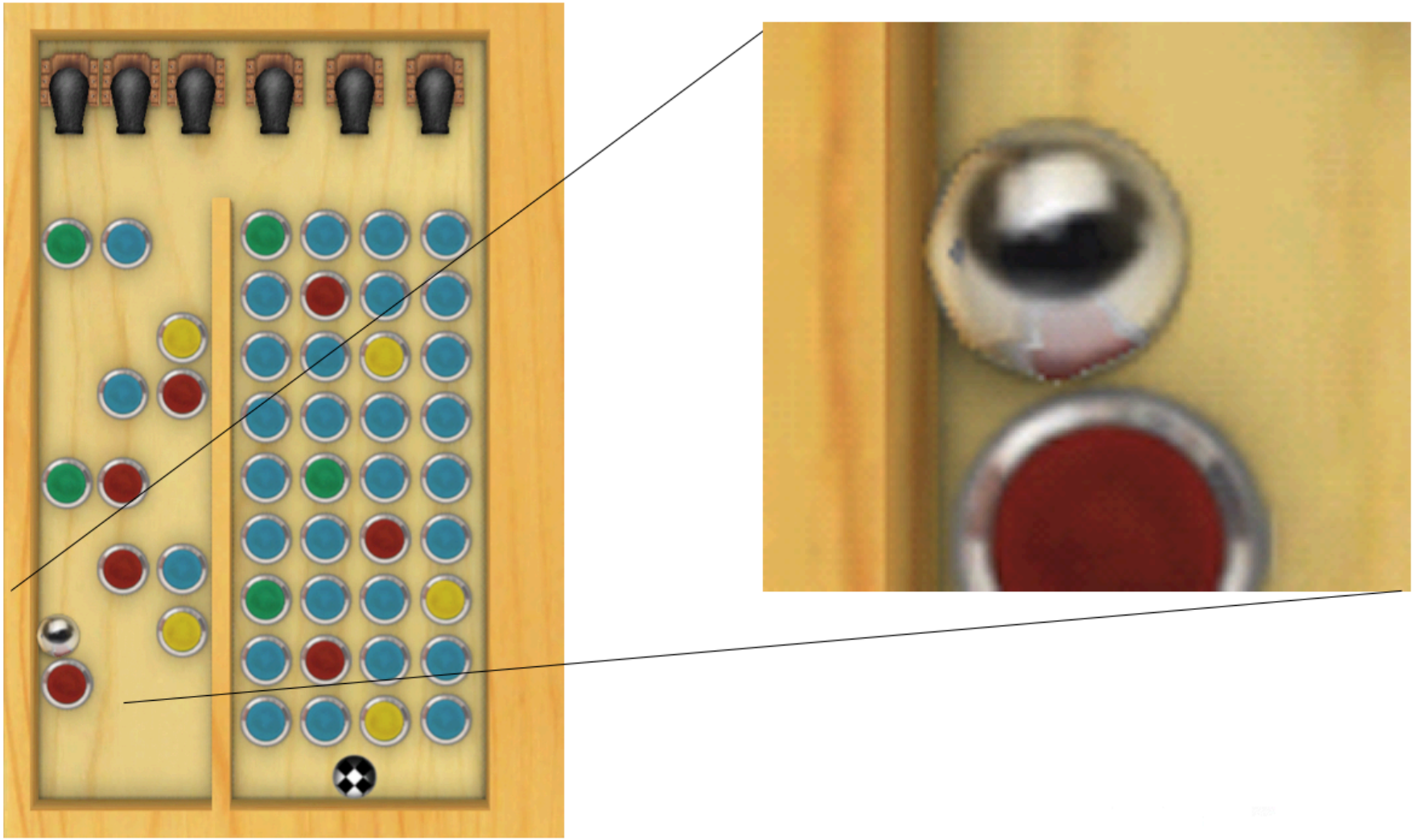
Cheat



Cheat

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Cheat


BLAST AWAY
Wood Wonders
Levels 16/16
Boxies 48
Team
How to
Our games
Out now!
Labs

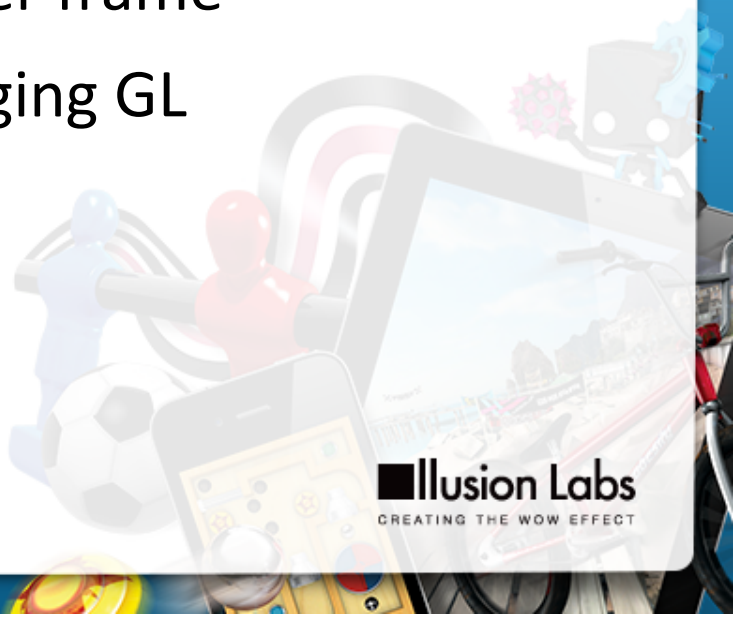
Tools

Shark - Profiling

Instruments - Memory leaks, Allocations etc.

GL Analyser – GL info per frame

GL Debugger – Debugging GL



Tools

DEMO

GL Debugger

Optimizations

Minimize redundant state changes

Group and draw by state:

set state 1

draw some objects

set state 2

draw some other objects etc

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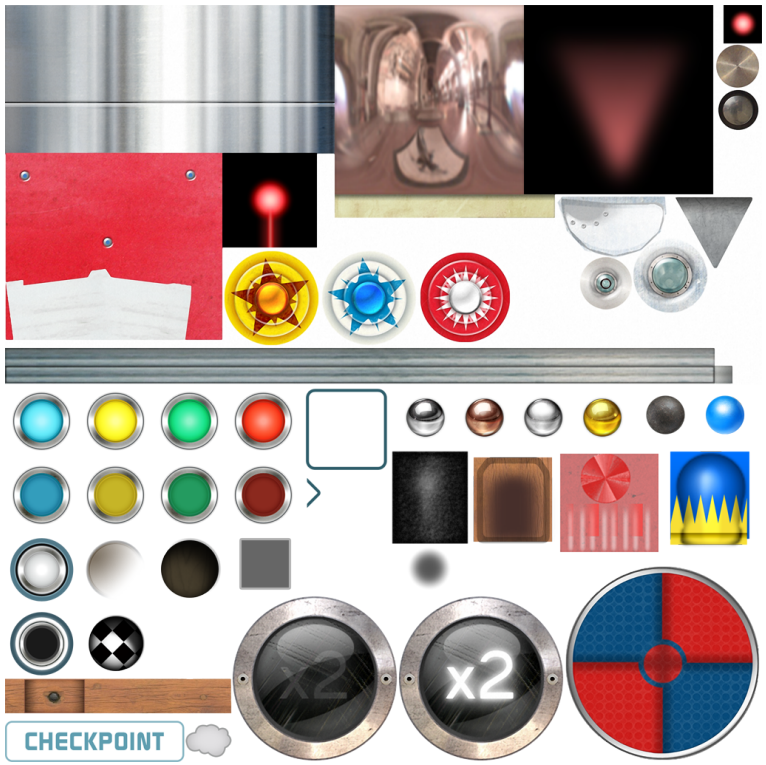
Optimizations

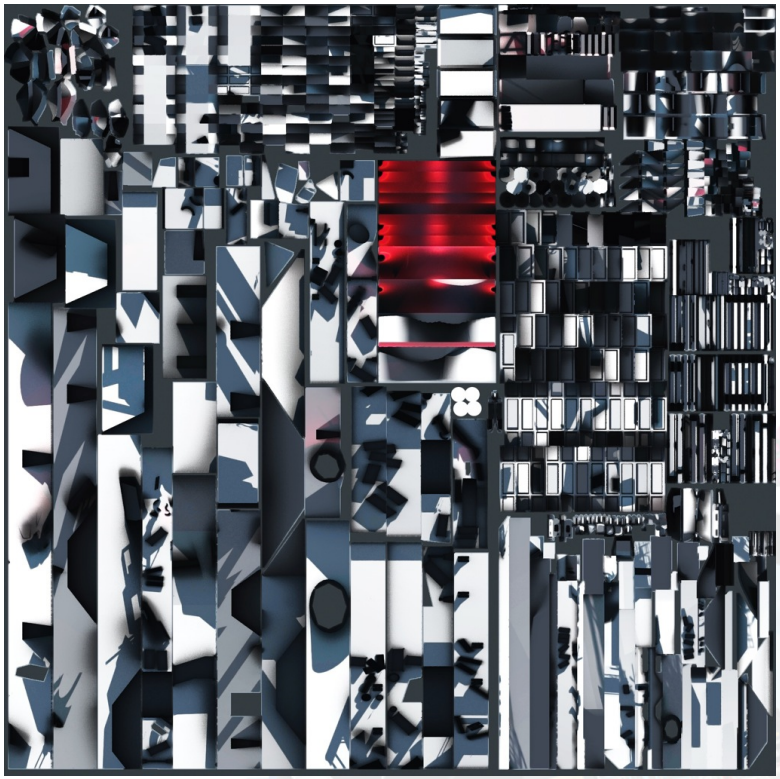
Batch draw calls

- Keep number of draw calls down
  - Prepare on CPU (batch etc)
  - Pre-calculated or per-frame
- Avoid unnecessary texture binds, use texture atlas
- Use VBO:s
  - Primarily for static data

Optimizations

Texture Atlas





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Optimizations

Draw only what is needed

- Use culling
- Depth sort on a correct abstraction level
  - Don't sort on triangle level
  - Recommend a sorting structure
  - Blended objects should be drawn last

Optimizations

Adjust data for usage

- Adjust texture size after where it is used
- Adjust vertex count after where it is used

Automatic algorithms (e.g. mipmapping, LOD) are good.

  – But it is even more important to analyse your data manually

Shaders

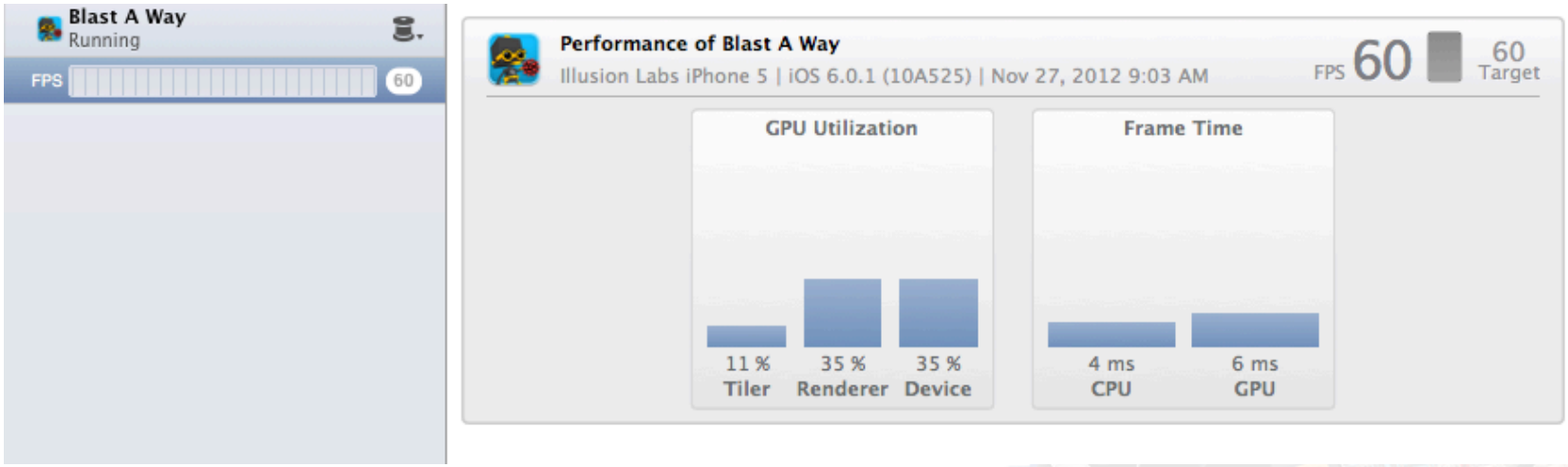
GPU vs CPU

- CPU encodes rendering command for GPU
- GPU (Vertex Shader) reads and processes vertices
- GPU (Fragment Shader) shades fragments for primitives
- Core Animation composites rendered results to framebuffer

Shaders

GPU vs CPU

- These stages take different amount of time
- Most of them can run in parallel
- The slowest stage determines how long your frame takes



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Shaders

Shader precisions

- Specific to GLSL ES not in GLSL
- Precisions can differ between vertex and fragment stages
- Appropriate precision choices are important for good performance

Shaders

Shader precisions

- highp for positions and vectors
- mediump for texture if < 512
- lowp for color, normal [-2,+2]
- Minimize conversions between precisions
- Precision keyword is a hint only

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Shaders

Shader computation

- How to do your computations
  - Use GLSL build in functions, ex:
    - BAD: C = (1-t)*A + t*B;
    - GOOD: C = mix(A, B, t);

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Thank you for listening!

Any Questions?

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