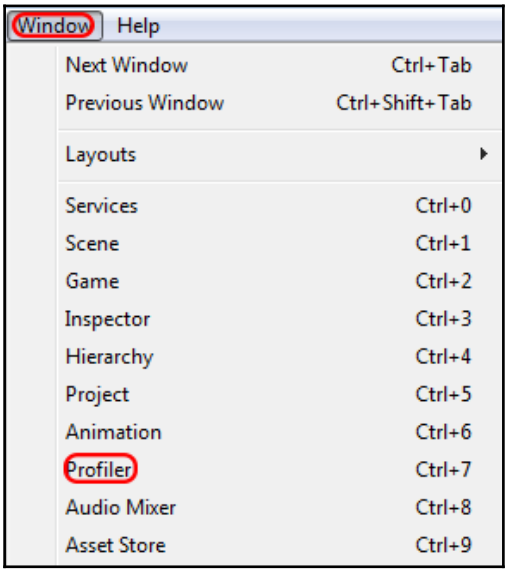
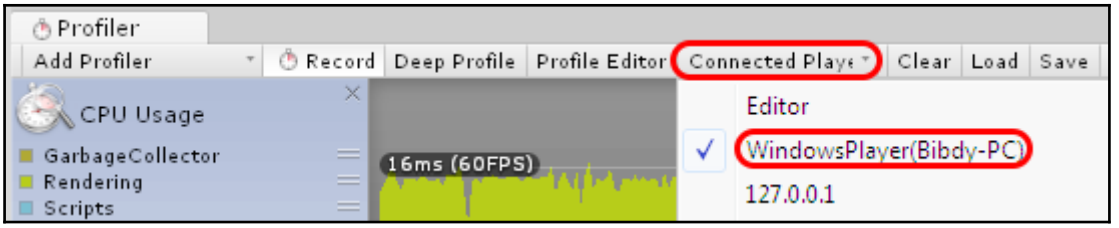
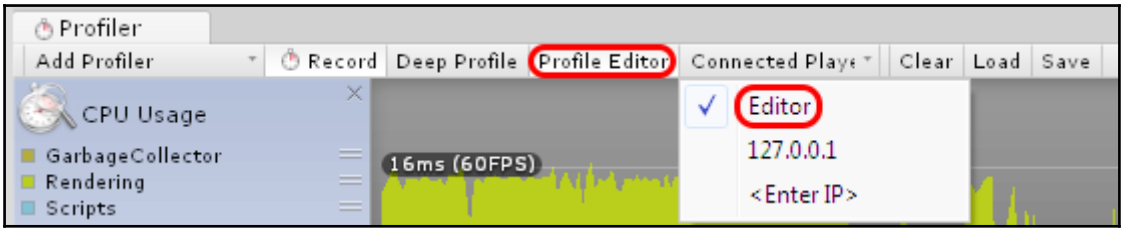
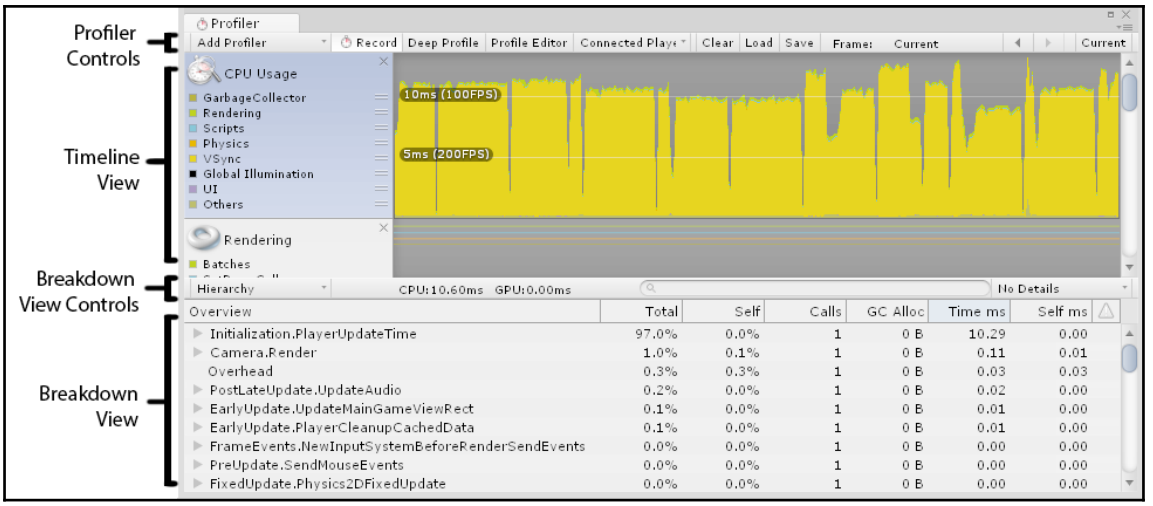
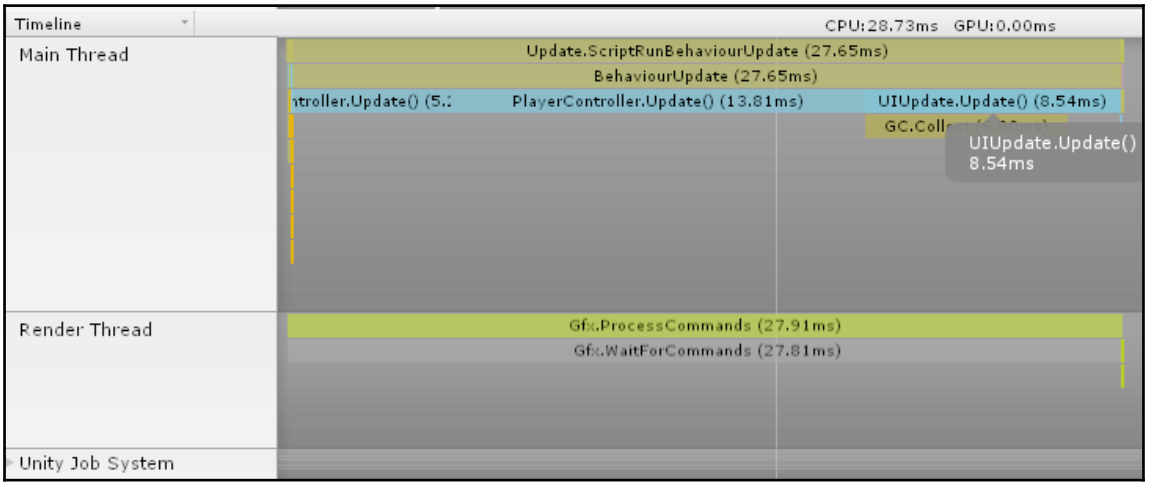
Chapter 1: Pursuing Performance Problems

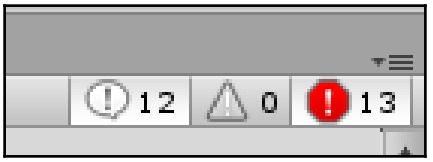


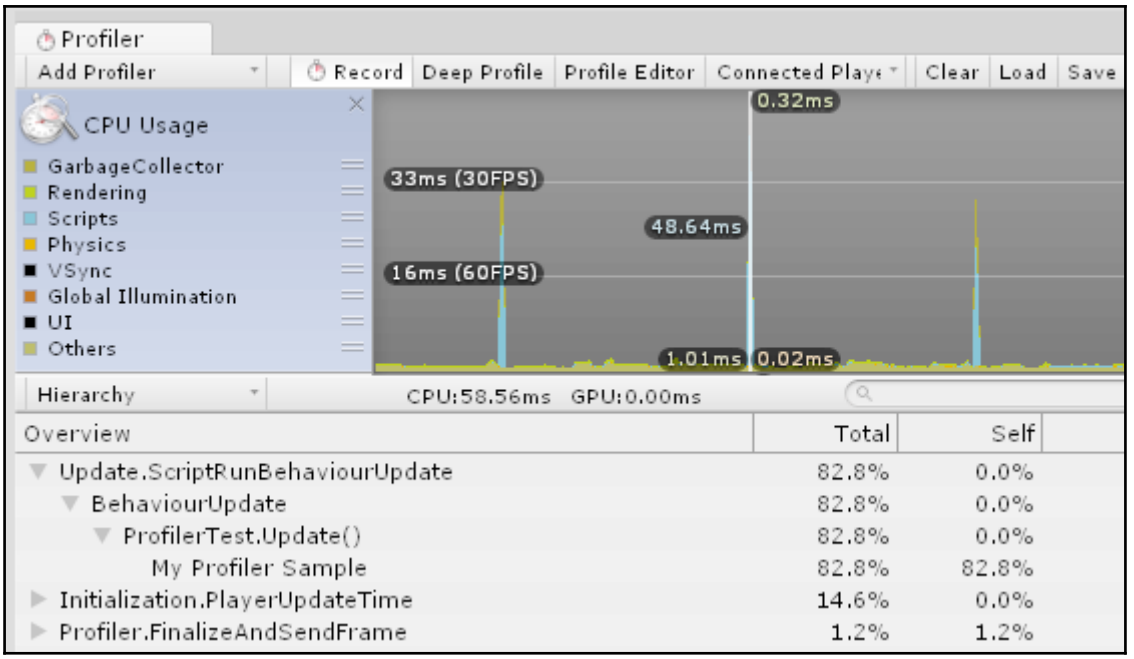





Profiler Controls
Timeline View
Breakdown View Controls
Breakdown View
Profiler
Add Profiler
Record
Deep Profile
Profile Editor
Connected Player
Clear
Load
Save
Frame:
Current
CPU Usage
GarbageCollector
Rendering
Scripts
Physics
VSync
Global Illumination
UI
Others
10ms (100FPS)
5ms (200FPS)
Rendering
Batches
Hierarchy
CPU:10.60ms GPU:0.00ms
No Details
Overview
Total
Self
Calls
GC Alloc
Time ms
Self ms
Initialization.PlayerUpdateTime 97.0% 0.0% 1 0 B 10.29 0.00
Camera.Render 1.0% 0.1% 1 0 B 0.11 0.01
Overhead 0.3% 0.3% 1 0 B 0.03 0.03
PostLateUpdate.UpdateAudio 0.2% 0.0% 1 0 B 0.02 0.00
EarlyUpdate.UpdateMainGameViewRect 0.1% 0.0% 1 0 B 0.01 0.00
EarlyUpdate.PlayerCleanupCachedData 0.1% 0.0% 1 0 B 0.01 0.00
FrameEvents.NewInputSystemBeforeRenderSendEvents 0.0% 0.0% 1 0 B 0.00 0.00
PreUpdate.SendMouseEvents 0.0% 0.0% 1 0 B 0.00 0.00
FixedUpdate.Physics2DFixedUpdate 0.0% 0.0% 1 0 B 0.00 0.00


Timeline
CPU:28.73ms GPU:0.00ms
Main Thread
Update.ScriptRunBehaviourUpdate (27.65ms)
BehaviourUpdate (27.65ms)
PlayerController.Update() (13.81ms)
UIUpdate.Update() (8.54ms)
UIUpdate.Update()
8.54ms
Render Thread
Gfx.ProcessCommands (27.91ms)
Gfx.WaitForCommands (27.81ms)
Unity Job System


12
0
13

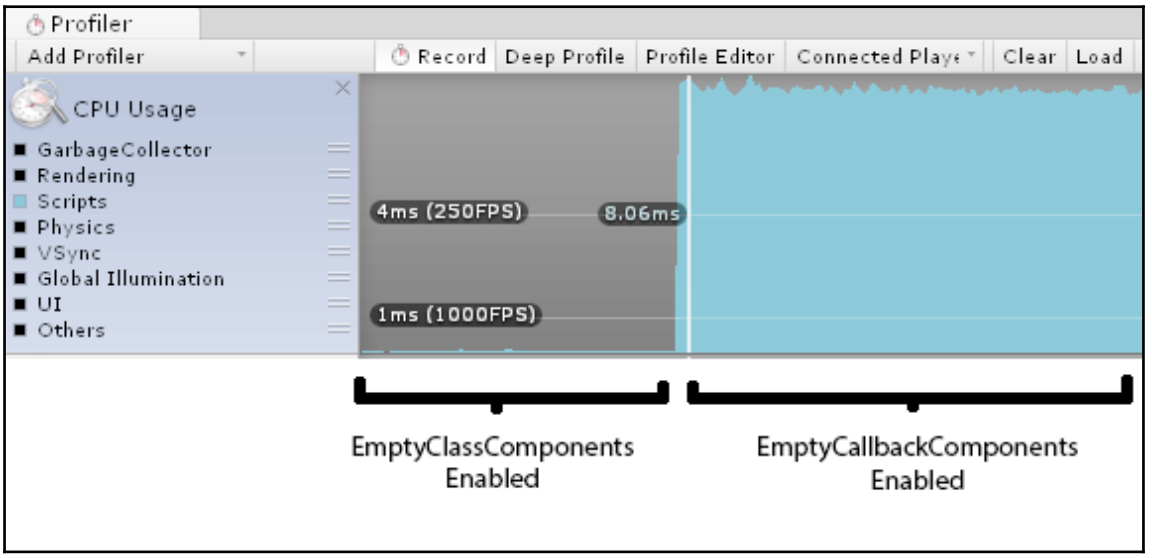

Profiler
Add Profiler
Record
Deep Profile
Profile Editor
Connected Playe
Clear
Load
Save
CPU Usage
GarbageCollector
Rendering
Scripts
Physics
VSync
Global Illumination
UI
Others
0.32ms
33ms (30FPS)
48.64ms
16ms (60FPS)
1.01ms
0.02ms
Hierarchy
CPU:58.56ms GPU:0.00ms
Overview
Total
Self
Update.ScriptRunBehaviourUpdate 82.8% 0.0%
BehaviourUpdate 82.8% 0.0%
ProfilerTest.Update() 82.8% 0.0%
My Profiler Sample 82.8% 82.8%
Initialization.PlayerUpdateTime 14.6% 0.0%
Profiler.FinalizeAndSendFrame 1.2% 1.2%

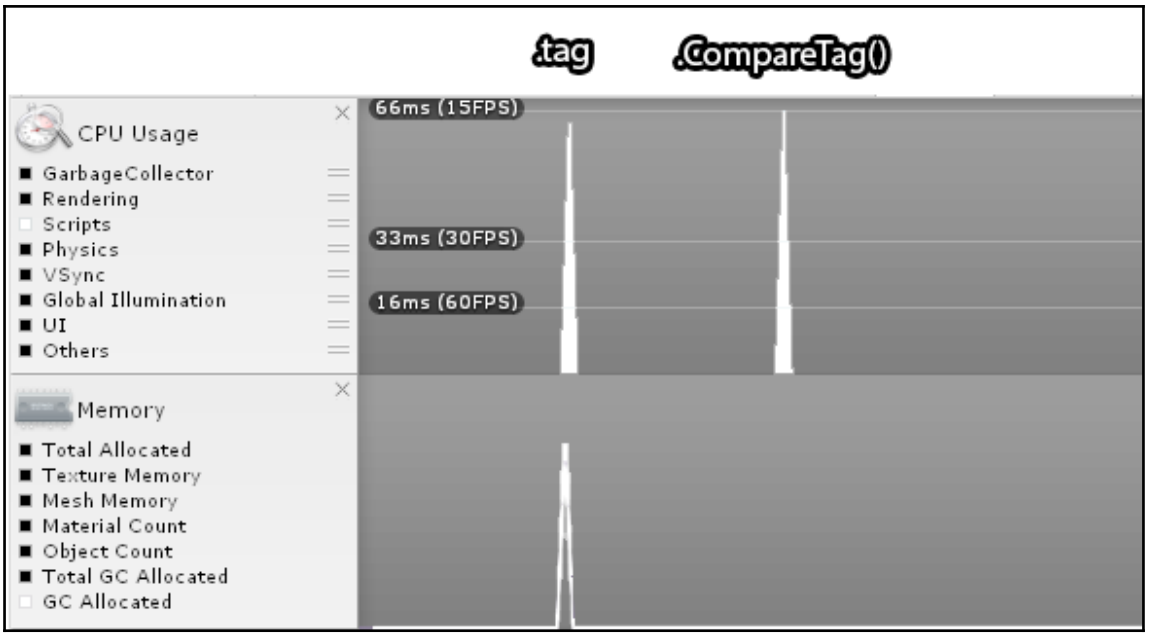
Chapter 2: Scripting Strategies

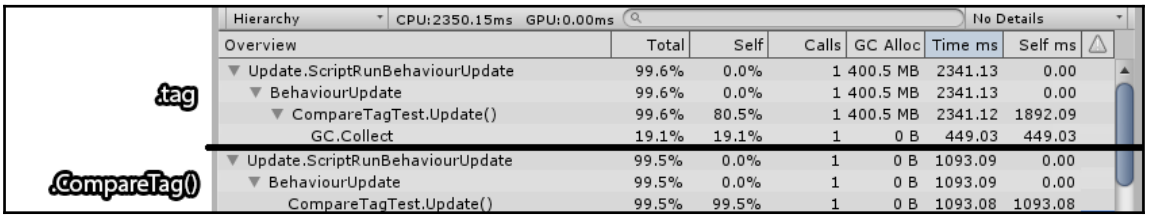
GetComponent(string) finished: 6413.00ms total, 0.006413ms per test for 1000000 tests
UnityEngine.Debug:Log(Object)

GetComponent<ComponentName> finished: 89.00ms total, 0.000089ms per test for 1000000 tests
UnityEngine.Debug:Log(Object)

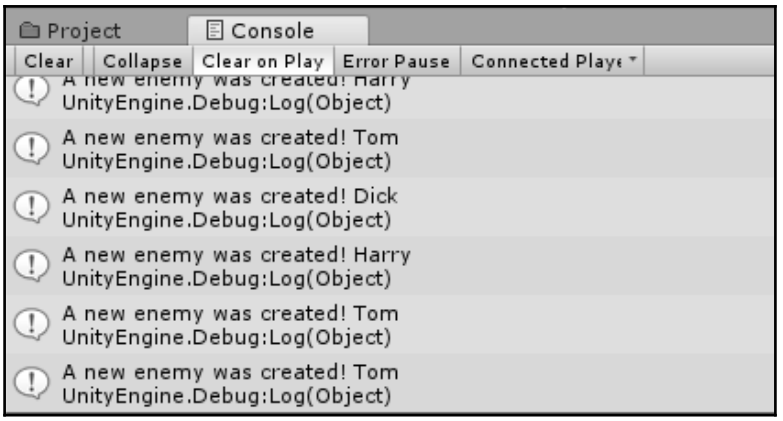
GetComponent(typeof(ComponentName)) finished: 95.00ms total, 0.000095ms per test for 1000000 tests
UnityEngine.Debug:Log(Object)




.tag
.CompareTag()
CPU Usage
GarbageCollector
Rendering
Scripts
Physics
VSync
Global Illumination
UI
Others
66ms (15FPS)
33ms (30FPS)
16ms (60FPS)
Memory
Total Allocated
Texture Memory
Mesh Memory
Material Count
Object Count
Total GC Allocated
GC Allocated

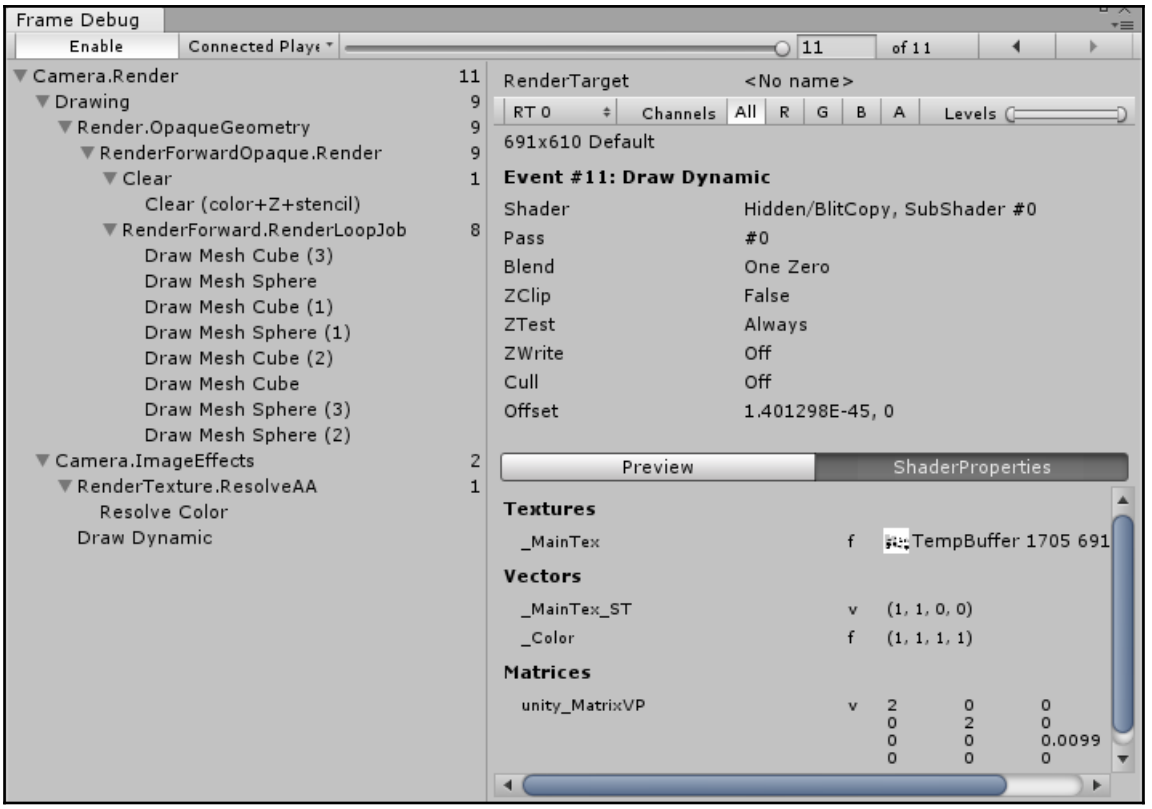

.tag
.CompareTag()
Hierarchy
CPU:2350.15ms GPU:0.00ms
No Details
Overview
Total
Self
Calls
GC Alloc
Time ms
Self ms
Update.ScriptRunBehaviourUpdate 99.6% 0.0% 1 400.5 MB 2341.13 0.00
BehaviourUpdate 99.6% 0.0% 1 400.5 MB 2341.13 0.00
CompareTagTest.Update() 99.6% 80.5% 1 400.5 MB 2341.12 1892.09
GC.Collect 19.1% 19.1% 1 0 B 449.03 449.03
Update.ScriptRunBehaviourUpdate 99.5% 0.0% 1 0 B 1093.09 0.00
BehaviourUpdate 99.5% 0.0% 1 0 B 1093.09 0.00
CompareTagTest.Update() 99.5% 99.5% 1 0 B 1093.08 1093.08


Enemy Spawner Component (Script)
Script
EnemySpawnerComponent
Num Enemies
0
Enemy Prefab
None (Game Object)
Enemy Manager
None (Enemy Manager Component


Project
Console
Clear
Collapse
Clear on Play
Error Pause
Connected Playe
A new enemy was created! Harry
UnityEngine.Debug:Log(Object)
A new enemy was created! Tom
UnityEngine.Debug:Log(Object)
A new enemy was created! Dick
UnityEngine.Debug:Log(Object)
A new enemy was created! Harry
UnityEngine.Debug:Log(Object)
A new enemy was created! Tom
UnityEngine.Debug:Log(Object)
A new enemy was created! Tom
UnityEngine.Debug:Log(Object)

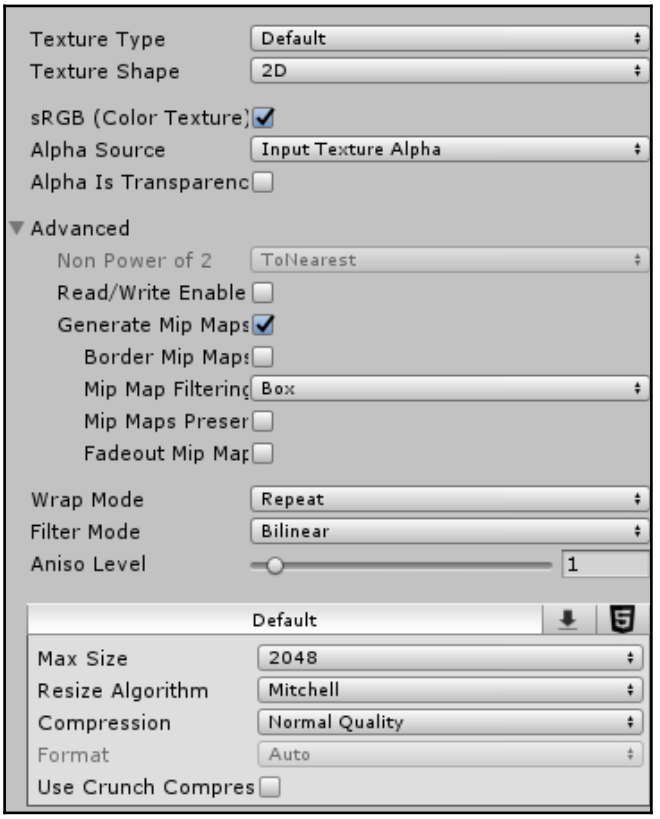
Chapter 3: The Benefits of Batching

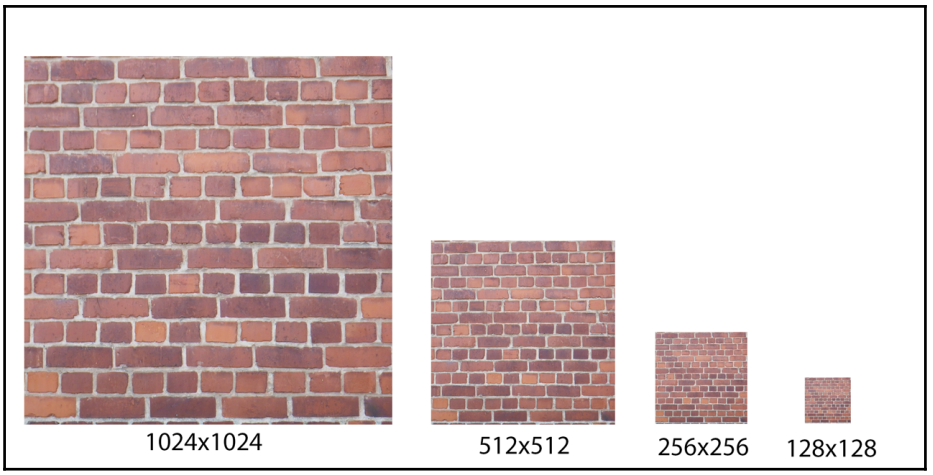

Dynamic Batching
Batches: 9
Statistics
Audio:
Level: -74.8 dB
DSP load: 0.8%
Clipping: 0.0%
Stream load: 0.0%
Graphics:
303.5 FPS (3.3ms)
CPU: main 3.0ms render thread 2.4ms
Batches: 9
Saved by batching: 0
Tris: 3.1k
Verts: 2.2k
Screen: 691x610 - 4.8 MB
SetPass calls: 9
Shadow casters: 0
Visible skinned meshes: 0
Animations: 0
Network: (no players connected)

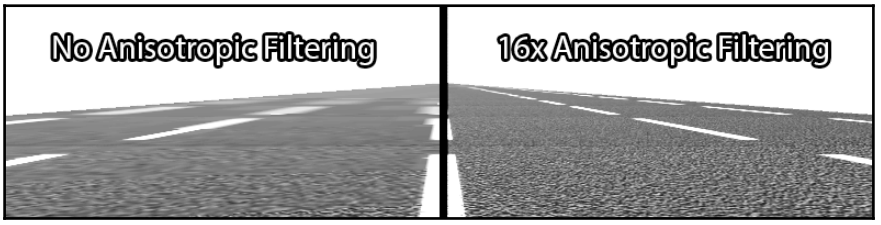

Frame Debug
Enable
Connected Playe
11
of 11
Camera.Render 11
Drawing 9
Render.OpaqueGeometry 9
RenderForwardOpaque.Render 9
Clear 1
Clear (color+Z+stencil)
RenderForward.RenderLoopJob 8
Draw Mesh Cube (3)
Draw Mesh Sphere
Draw Mesh Cube (1)
Draw Mesh Sphere (1)
Draw Mesh Cube (2)
Draw Mesh Cube
Draw Mesh Sphere (3)
Draw Mesh Sphere (2)
Camera.ImageEffects 2
RenderTexture.ResolveAA 1
Resolve Color
Draw Dynamic
RenderTarget
<No name>
RT 0
Channels
All
R
G
B
A
Levels
691x610 Default
Event #11: Draw Dynamic
Shader
Hidden/BlitCopy, SubShader #0
Pass
#0
Blend
One Zero
ZClip
False
ZTest
Always
ZWrite
Off
Cull
Off
Offset
1.401298E-45, 0
Preview
ShaderProperties
Textures
_MainTex
f
TempBuffer 1705 691
Vectors
_MainTex_ST
v
(1, 1, 0, 0)
_Color
f
(1, 1, 1, 1)
Matrices
unity_MatrixVP
v
2 0 0
0 2 0
0 0 0.0099
0 0 0

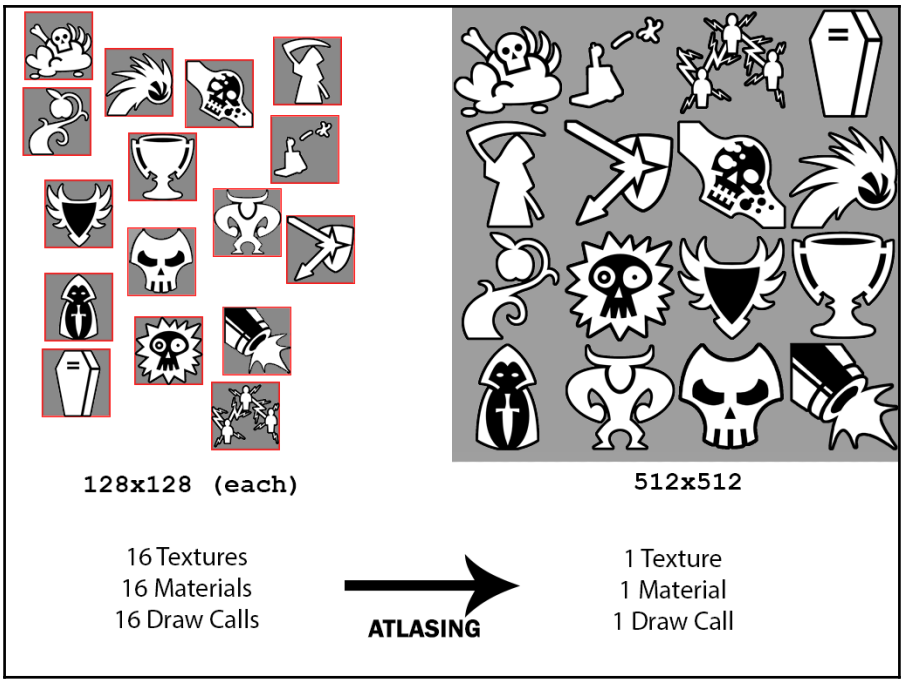

Dynamic Batching
Batches: 6
Statistics
Audio:
Level: -74.8 dB
DSP load: 0.8%
Clipping: 0.0%
Stream load: 0.0%
Graphics:
138.9 FPS (7.2ms)
CPU: main 6.8ms render thread 1.1ms
Batches: 6
Saved by batching: 3
Tris: 3.1k
Verts: 2.2k
Screen: 693x608 - 4.8 MB
SetPass calls: 2
Shadow casters: 0
Visible skinned meshes: 0
Animations: 0
Network: (no players connected)
Drawing 6
Render.OpaqueGeometry 6
RenderForwardOpaque.Render 6
Clear 1
Clear (color+Z+stencil)
RenderForward.RenderLoopJob 5
Draw Mesh Sphere
Draw Mesh Sphere (2)
Draw Mesh Sphere (1)
Draw Mesh Sphere (3)
Dynamic Batch

Chapter 4: Kickstart Your Art

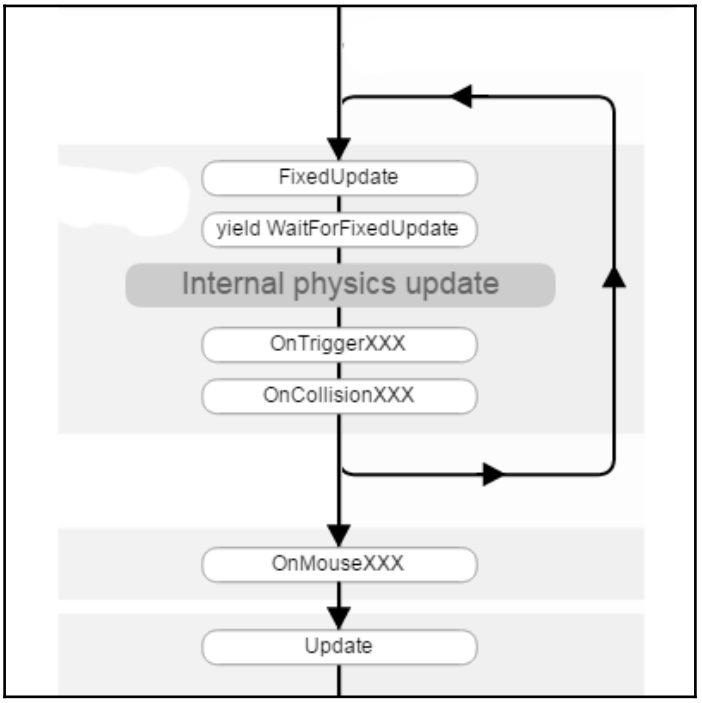


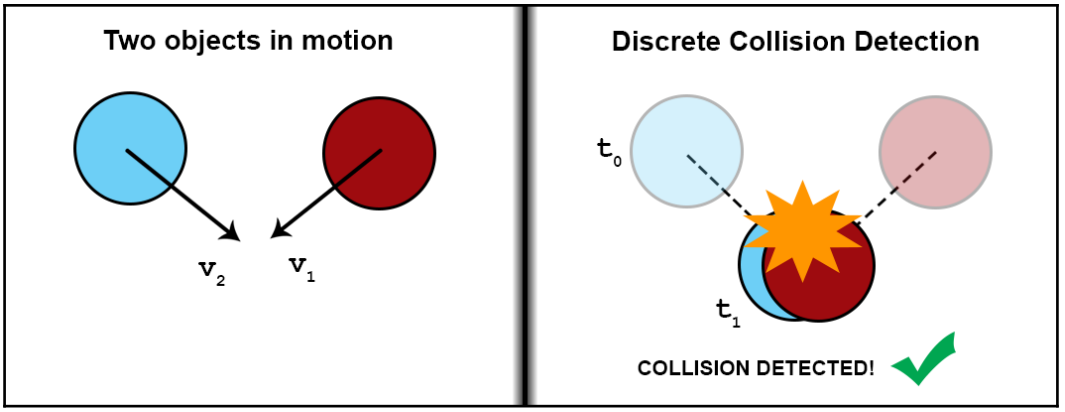

1024x1024
512x512
256x256
128x128

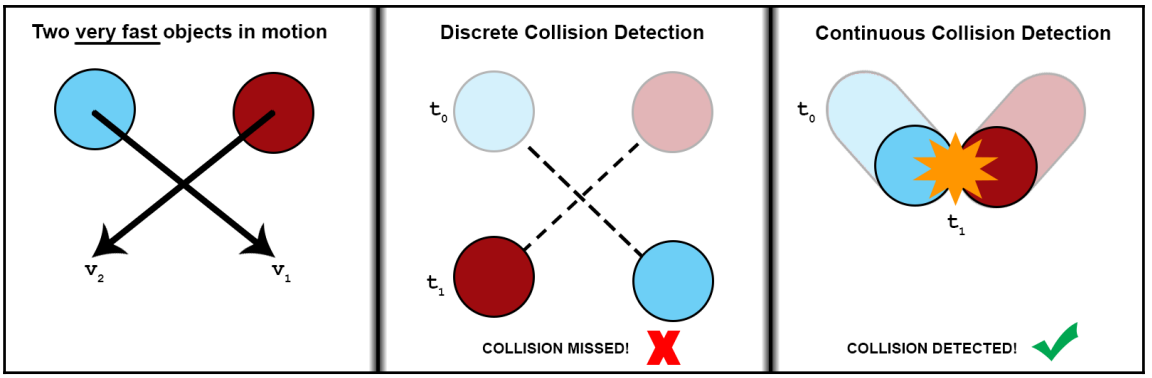

No Anisotropic Filtering
16x Anisotropic Filtering

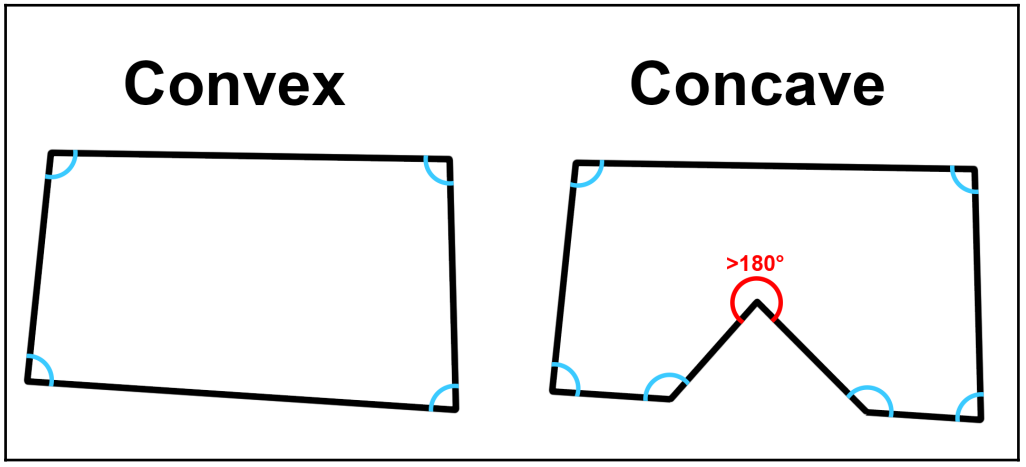

128x128 (each)
512x512
16 Textures
16 Materials
16 Draw Calls
ATLASING
1 Texture
1 Material
1 Draw Call

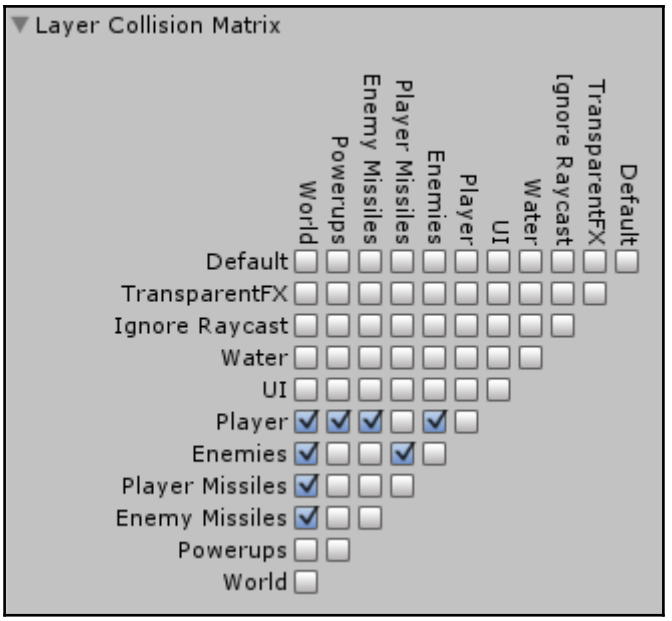
Chapter 5: Faster Physics

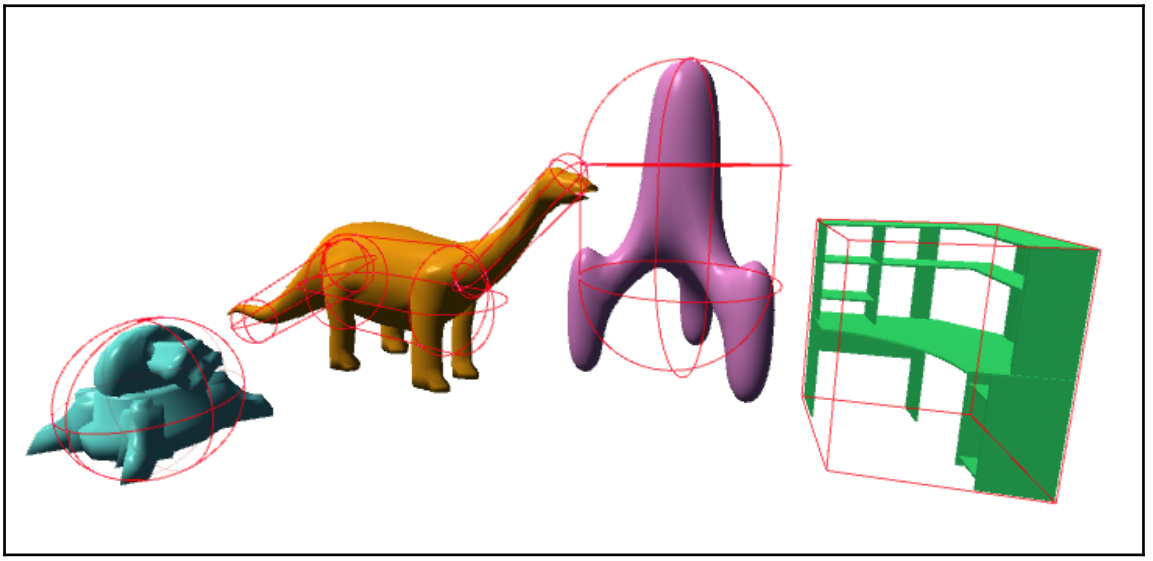


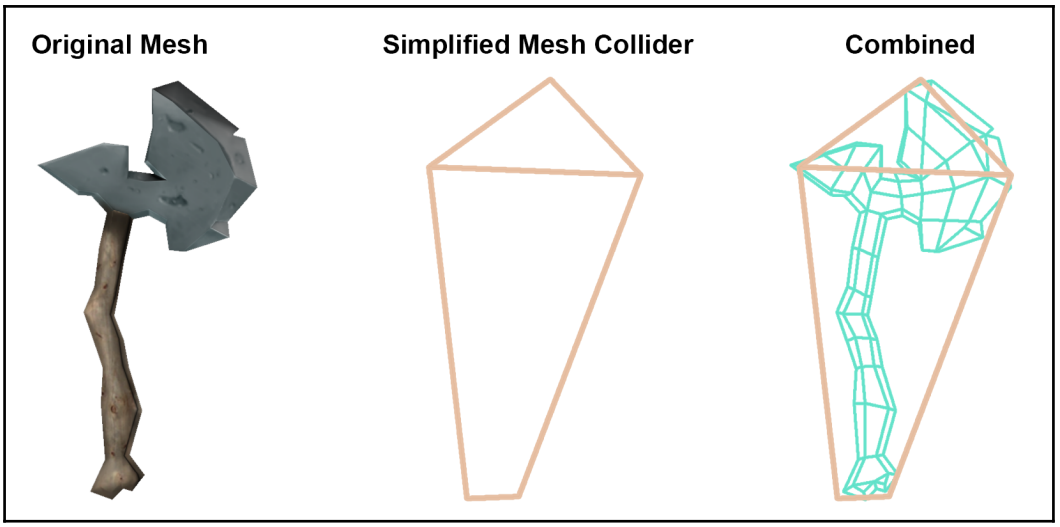



Two very fast objects in motion
v2
v1
Discrete Collision Detection
t0
t1
COLLISION MISSED!
Continuous Collision Detection
t0
t1
COLLISION DETECTED!

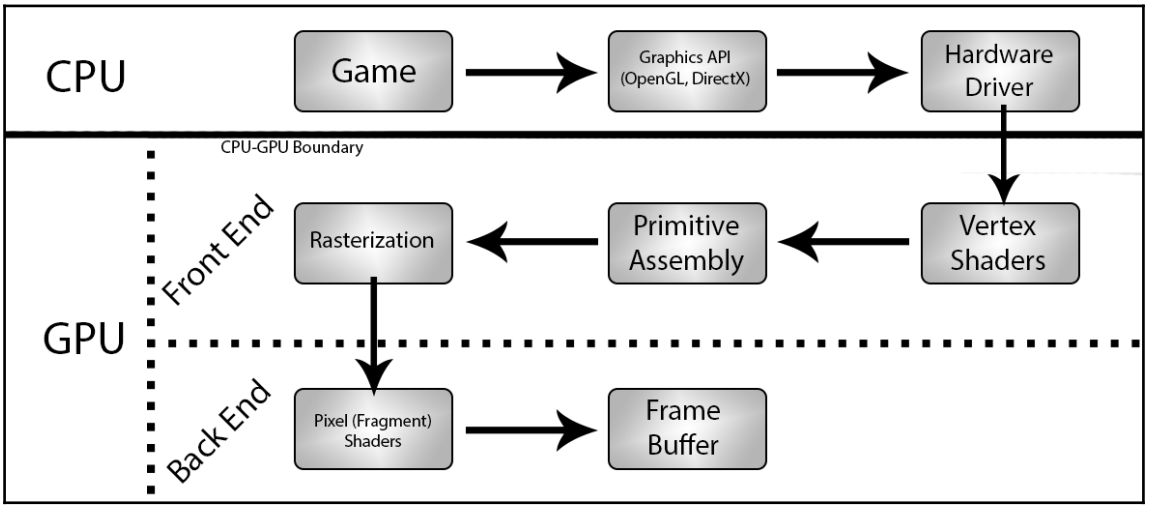

Convex
Concave
>180°

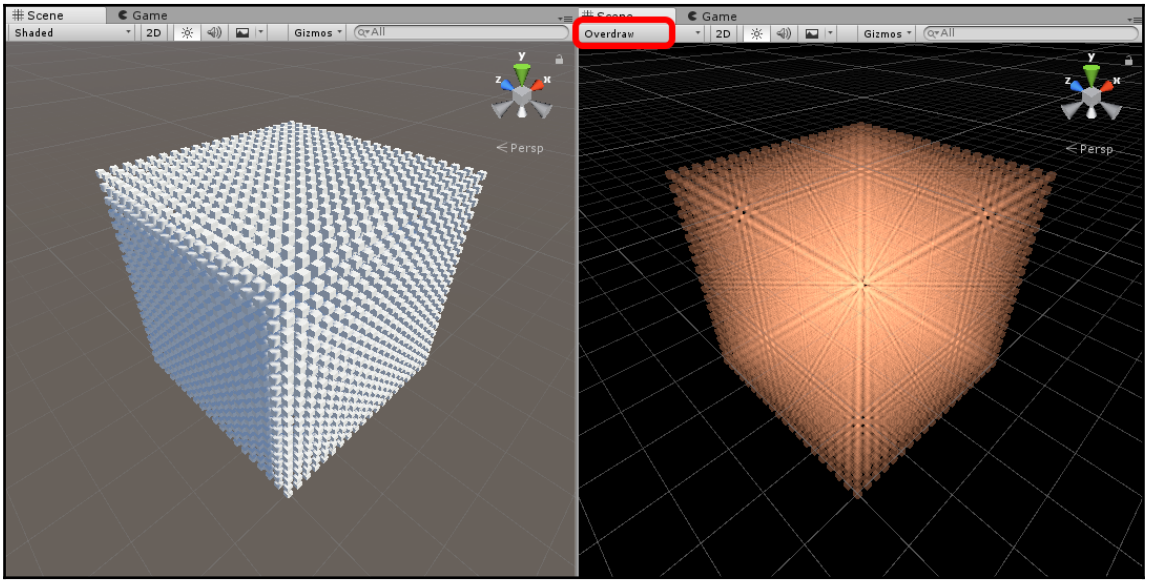

Layer Collision Matrix
Default
TransparentFX
Ignore Raycast
Water
UI
Player
Enemies
Player Missiles
Enemy Missiles
Powerups
World



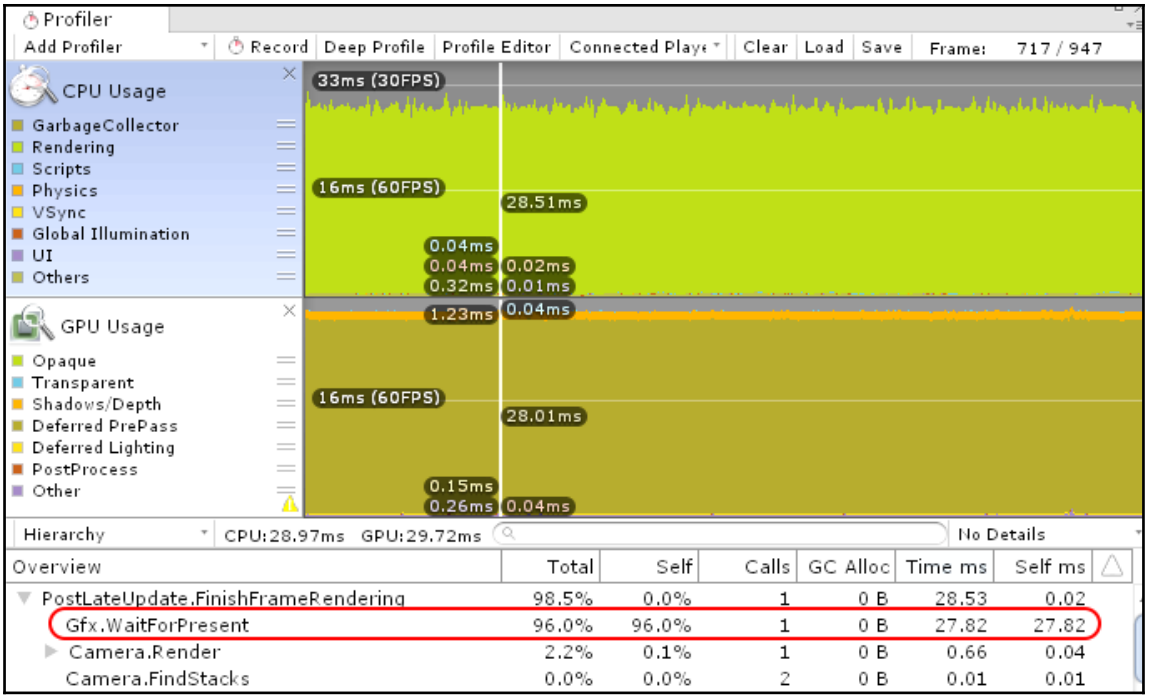

Original Mesh
Simplified Mesh Collider
Combined

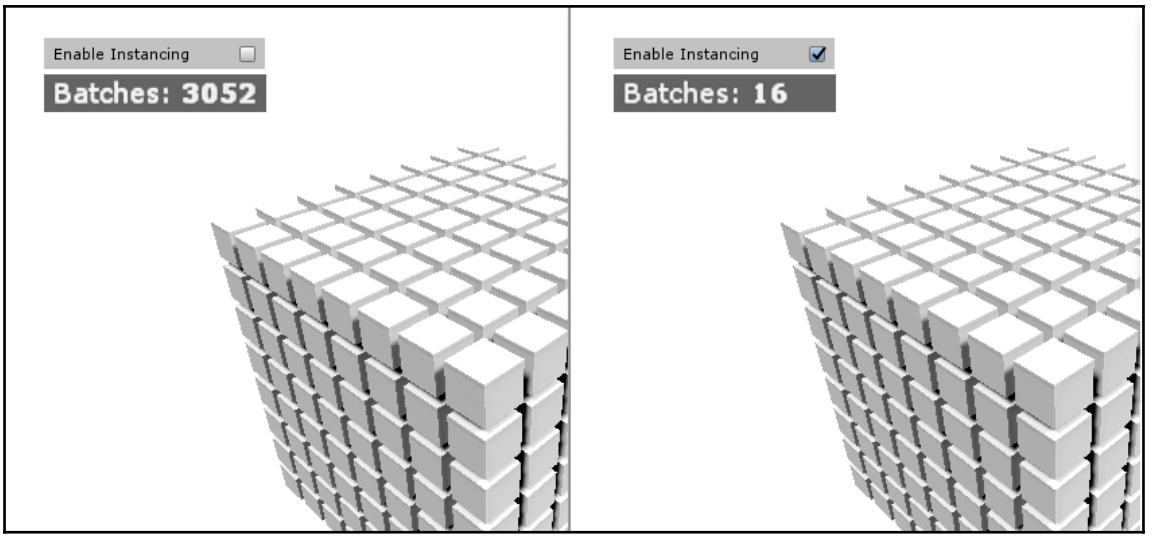
Chapter 6: Dynamic Graphics

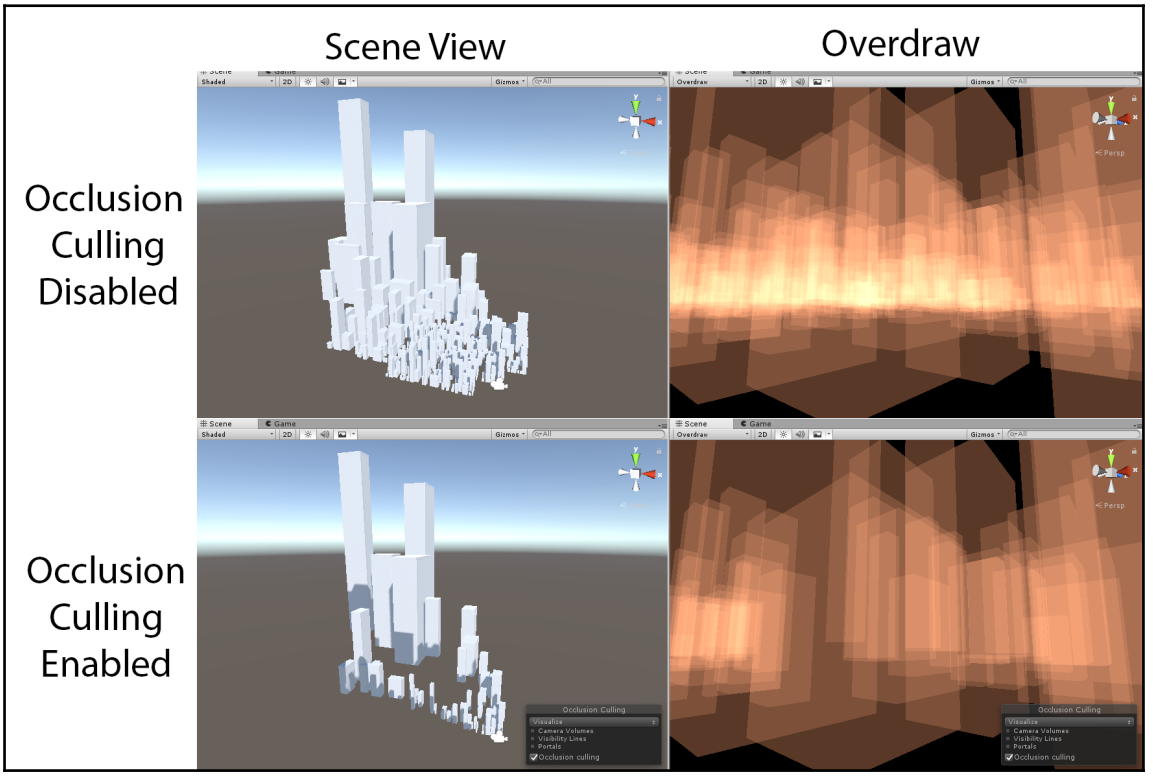


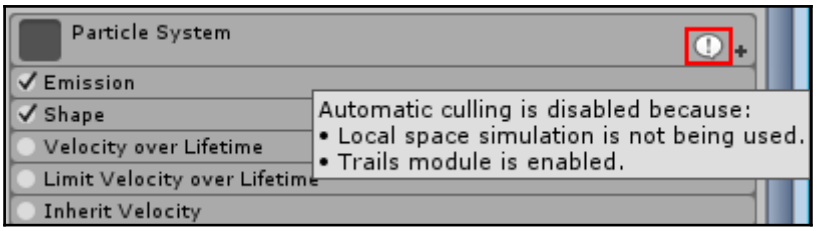



Profiler
Add Profiler
Record
Deep Profile
Profile Editor
Connected Playe
Clear
Load
Save
Frame: 1936 / 2097
CPU Usage
GarbageCollector
Rendering
Scripts
Physics
VSync
Global Illumination
UI
Others
33ms (30FPS)
16ms (60FPS)
25.41ms
0.02ms
0.01ms
0.01ms
0.00ms
10.53ms
GPU Usage
Opaque
Transparent
Shadows/Depth
Deferred PrePass
Deferred Lighting
PostProcess
Other
4ms (250FPS)
3.78ms
1ms (1000FPS)
0.02ms
0.07ms
0.24ms
0.05ms
Hierarchy
CPU: 36.01ms GPU: 4.15ms
No Details

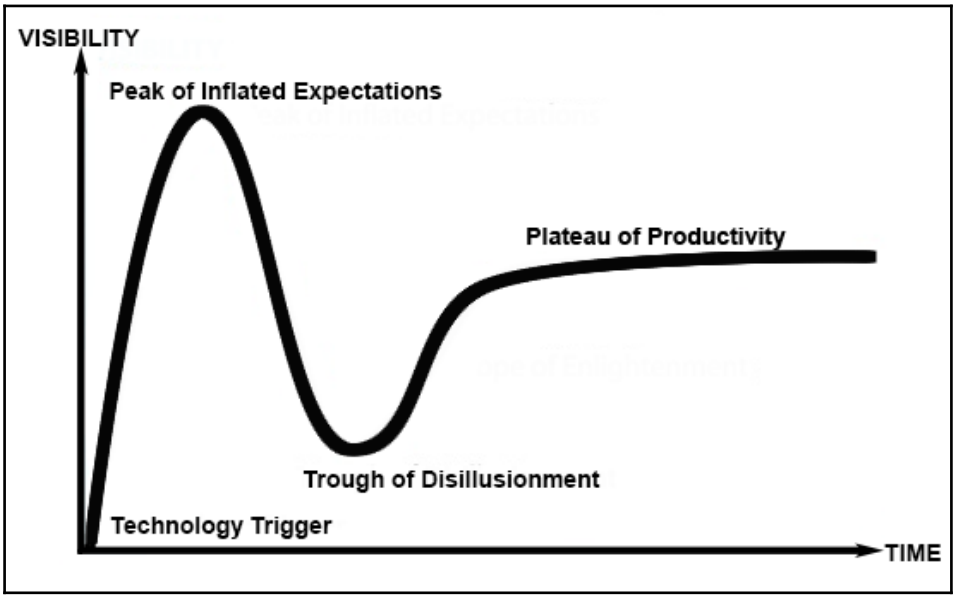

Profiler
Add Profiler
Record
Deep Profile
Profile Editor
Connected Playe
Clear
Load
Save
Frame: 717 / 947
CPU Usage
GarbageCollector
Rendering
Scripts
Physics
VSync
Global Illumination
UI
Others
33ms (30FPS)
16ms (60FPS)
28.51ms
0.04ms
0.04ms
0.02ms
0.32ms
0.01ms
GPU Usage
Opaque
Transparent
Shadows/Depth
Deferred PrePass
Deferred Lighting
PostProcess
Other
1.23ms
0.04ms
16ms (60FPS)
28.01ms
0.15ms
0.26ms
0.04ms
Hierarchy
CPU: 28.97ms GPU: 29.72ms
No Details
Overview
Total
Self
Calls
GC Alloc
Time ms
Self ms
PostLateUpdate.FinishFrameRendering 98.5% 0.0% 1 0 B 28.53 0.02
Gfx.WaitForPresent 96.0% 96.0% 1 0 B 27.82 27.82
Camera.Render 2.2% 0.1% 1 0 B 0.66 0.04
Camera.FindStacks 0.0% 0.0% 2 0 B 0.01 0.01

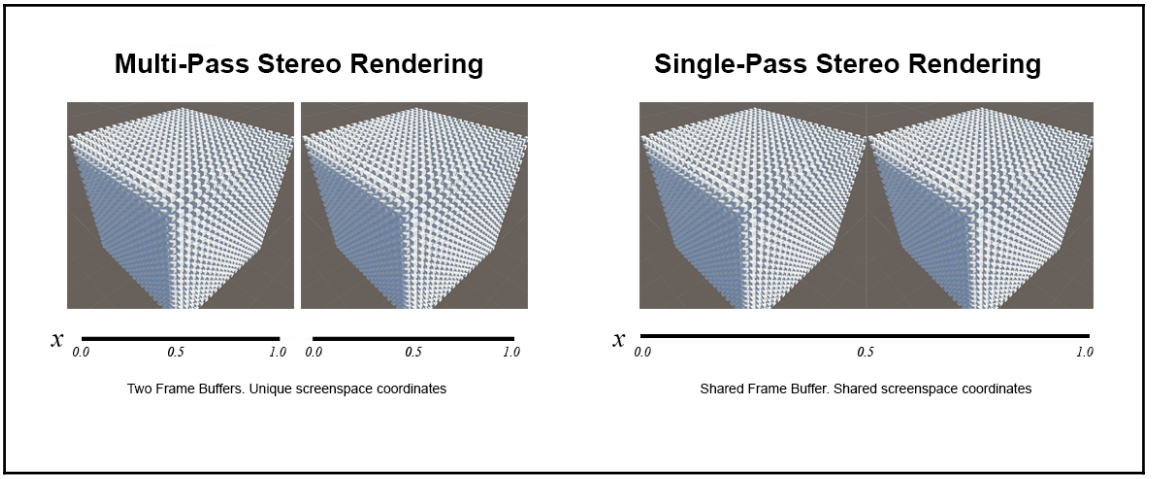

Enable Instancing
Batches: 3052
Enable Instancing
Batches: 16


Scene View
Overdraw
Occlusion Culling Disabled
Occlusion Culling Enabled

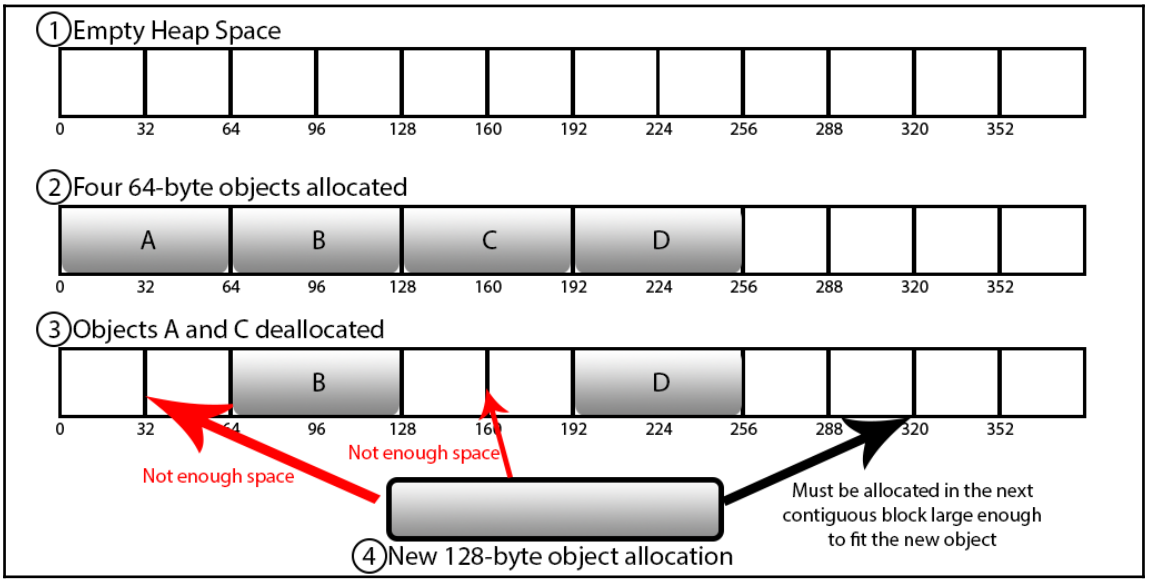

Particle System
Emission
Shape
Velocity over Lifetime
Limit Velocity over Lifetime
Inherit Velocity
Automatic culling is disabled because:
• Local space simulation is not being used.
• Trails module is enabled.

Chapter 7:
Virtual Velocity and Augmented Acceleration





Chapter 8: Masterful Memory Management

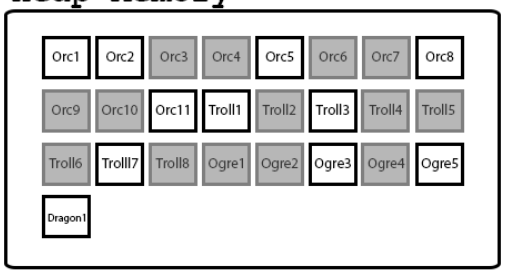



```
Used Total: 101.2 MB  Unity: 68.1 MB  Mono: 7.8 MB  GfxDriver: 15.8 MB  FMOD: 1.3 MB  Video: 224 B  Profiler: 9.5 MB
Reserved Total: 241.4 MB  Unity: 199.0 MB  Mono: 10.7 MB  GfxDriver: 15.8 MB  FMOD: 1.3 MB  Video: 224 B  Profiler: 16.0 MB
Total System Memory Usage: 0.78 GB
```

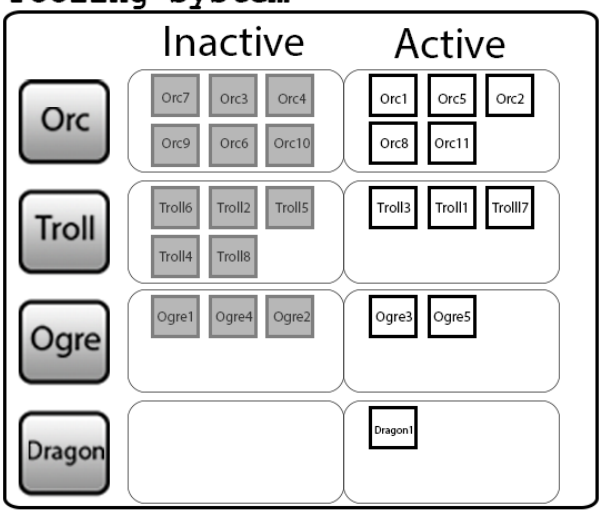
```
Used Total: 101.2 MB  Unity: 68.1 MB  Mono: 7.8 MB  GfxDriver: 15.8 MB  FMOD: 1.3 MB  Video: 224 B  Profiler: 9.5 MB
Reserved Total: 241.4 MB  Unity: 199.0 MB  Mono: 10.7 MB  GfxDriver: 15.8 MB  FMOD: 1.3 MB  Video: 224 B  Profiler: 16.0 MB
Total System Memory Usage: 0.78 GB
```

11 Orcs (5 active, 6 inactive)
8 Trolls (3 active, 5 inactive)
5 Ogres (2 active, 3 inactive)
1 Dragon (1 active)

Heap Memory



Pooling System



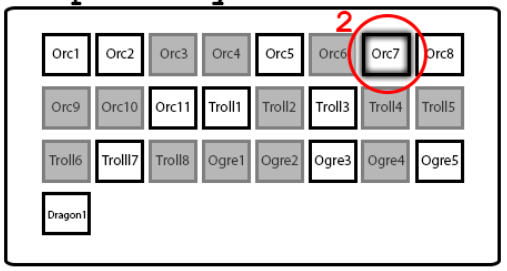
New Orc is spawned

1. Determine which Pool corresponds to the given Prefab

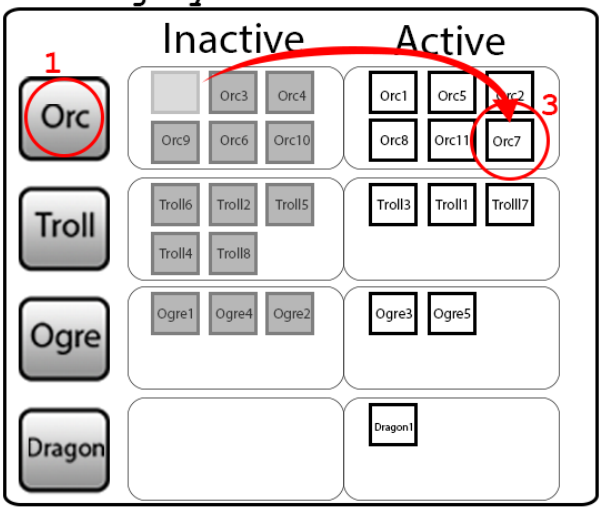
2. The first inactive Orc in the Inactive Group (Orc7) is activated - the corresponding object in the Heap is therefore activated

3. Newly-spawned Orc is moved to Active group

Heap Memory



Pooling System



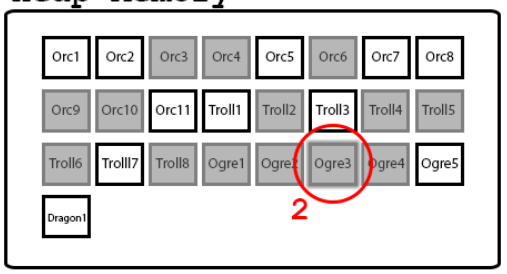
Ogre3 is despawned

1. Determine which Pool corresponds to the given Object

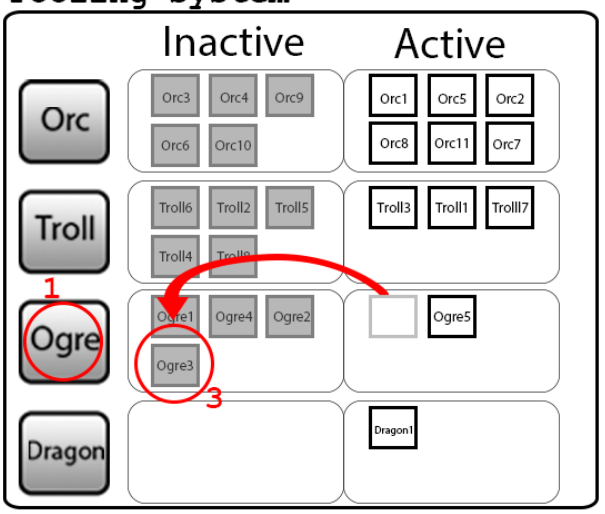
2. Deactivate Ogre3 - the corresponding object in the Heap is therefore deactivated

3. Move Ogre3 to Inactive group

Heap Memory



Pooling System



New Dragon is spawned

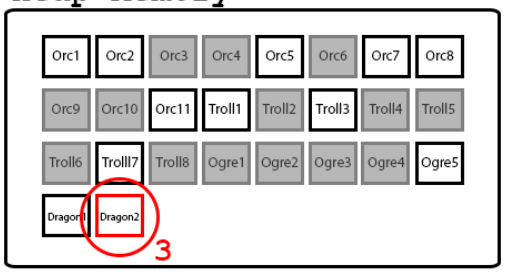
1. Determine which Pool corresponds to the given Prefab

2. Inactive group is empty, so a new Instance of Dragon must be created

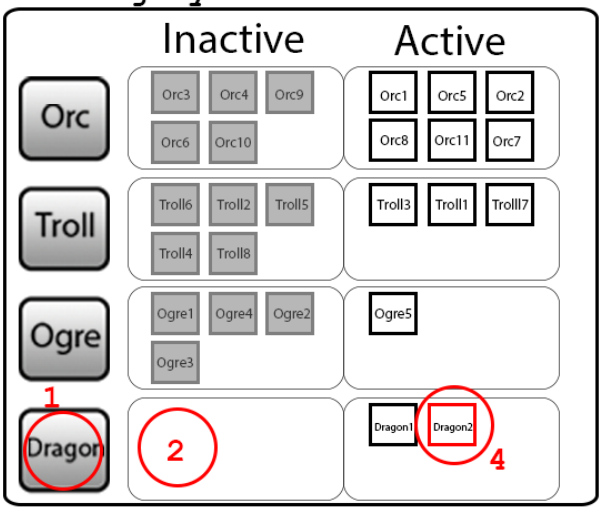
3. Instantiate a new Dragon from the Prefab on the heap

4. Add the newly -created Dragon to the Active list

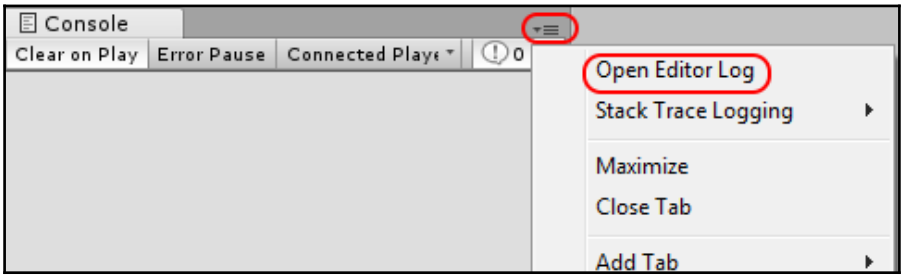
Heap Memory

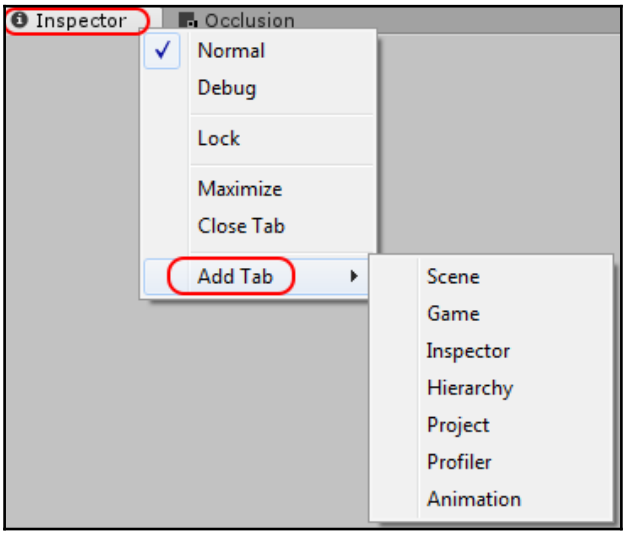


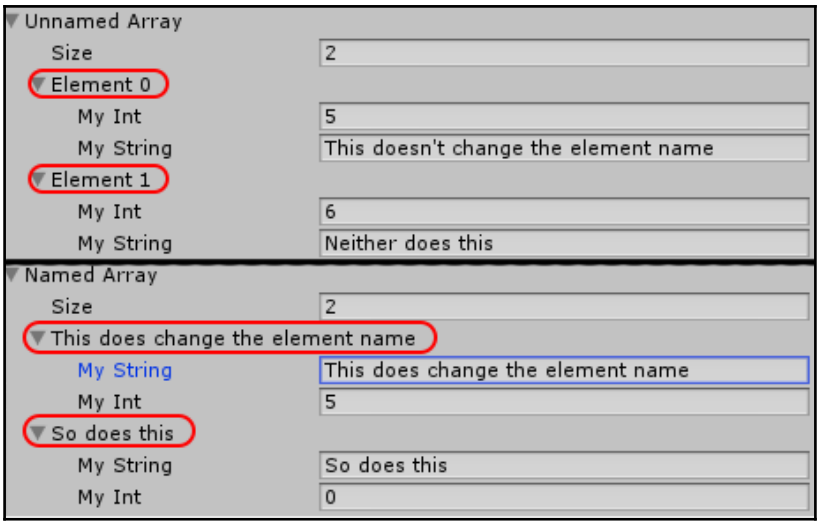
Pooling System

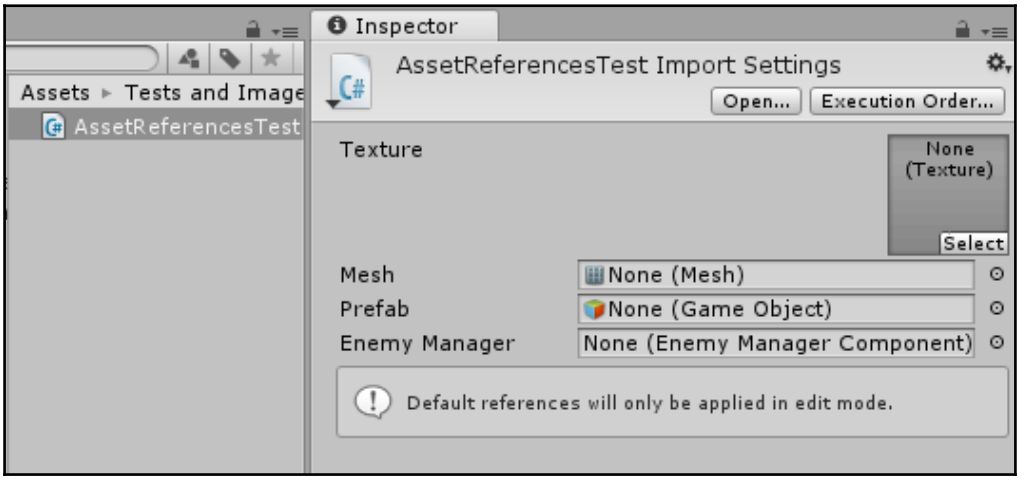


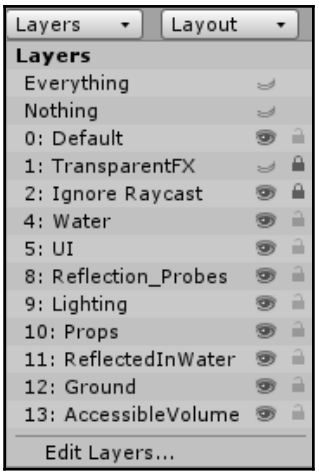
Chapter 9: Tactical Tips and Tricks






Unnamed Array
Size
2
Element 0
My Int
5
My String
This doesn't change the element name
Element 1
My Int
6
My String
Neither does this
Named Array
Size
2
This does change the element name
My String
This does change the element name
My Int
5
So does this
My String
So does this
My Int
0


Inspector
Assets ▸ Tests and Image
AssetReferencesTest
AssetReferencesTest Import Settings
Open...
Execution Order...
Texture
None (Texture)
Select
Mesh
None (Mesh)
Prefab
None (Game Object)
Enemy Manager
None (Enemy Manager Component)
Default references will only be applied in edit mode.


Layers
Layout
Layers
Everything
Nothing
0: Default
1: TransparentFX
2: Ignore Raycast
4: Water
5: UI
8: Reflection_Probes
9: Lighting
10: Props
11: ReflectedInWater
12: Ground
13: AccessibleVolume
Edit Layers...


[ERROR]This is a very specific kind of log message