KAUNO TECHNOLOGIJOS UNIVERSITETAS

FACULTY OF INFORMATICS

T120B166 Development of Computer Games and Interactive Applications

Party Table Game - Saboteur

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Game description

1. **3D or 2D?** 3D
2. **What type is your game?** Board sgame
3. **What genre is your game?** Party game
4. **Platforms:** PC
5. **Scenario description:** In this game action is set in a mine. Players take on the role of dwarves, some are miners, some are saboteurs, but no one knows who is on their side. For miners goal is to get to the gold until the cards run out. For saboteurs the goal is to stop miners from reaching gold. After three rounds the player with the most gold wins.

Laboratory work #2

List of tasks

1. Create a terrain and color it using 5 or more materials.
2. Create 5 trees of your own construction and seed them using terrain tools.
3. Import a unique model and assign it to a third person character controller.
4. Add and animate 5 objects to your game map.
5. Create 5 unique particle effects.
6. Add a custom skybox.
7. Create 5 different physics materials and apply then in your project.
8. Assign an optimum collider based on the shape of the object for all 3D objects imported in the first laboratory work.
9. Add and animate 5 objects using physics, force and triggers to your game map.
10. Set static flag to all immobile objects and measure batching performance.
11. Try deferred vs forward rendering and measure performance for both.
12. Bake a lightmap for your scene and measure performance.
13. Optimize all textures depending on their parameters and measure graphical memory load.
14. Try hard vs soft shadows and measure performance.

Solution

Task #1 and #2. Create a terrain, color it, seed trees of your own construction
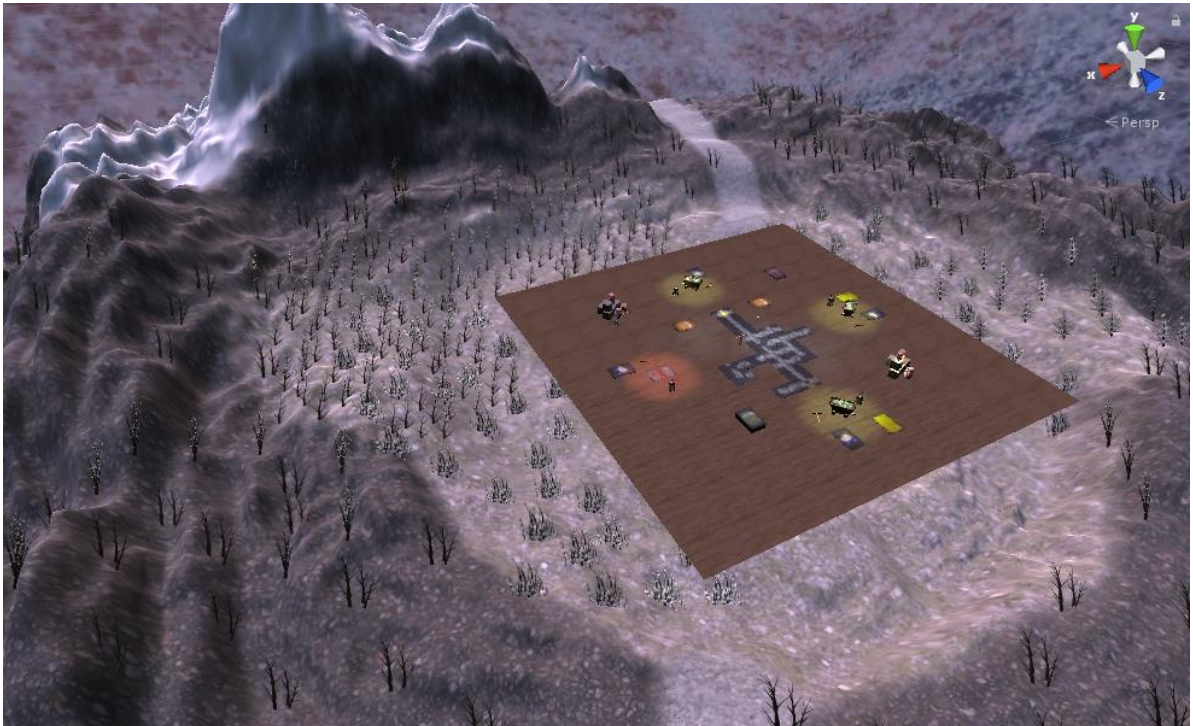
Figure 1 Colored terrain with seeded trees
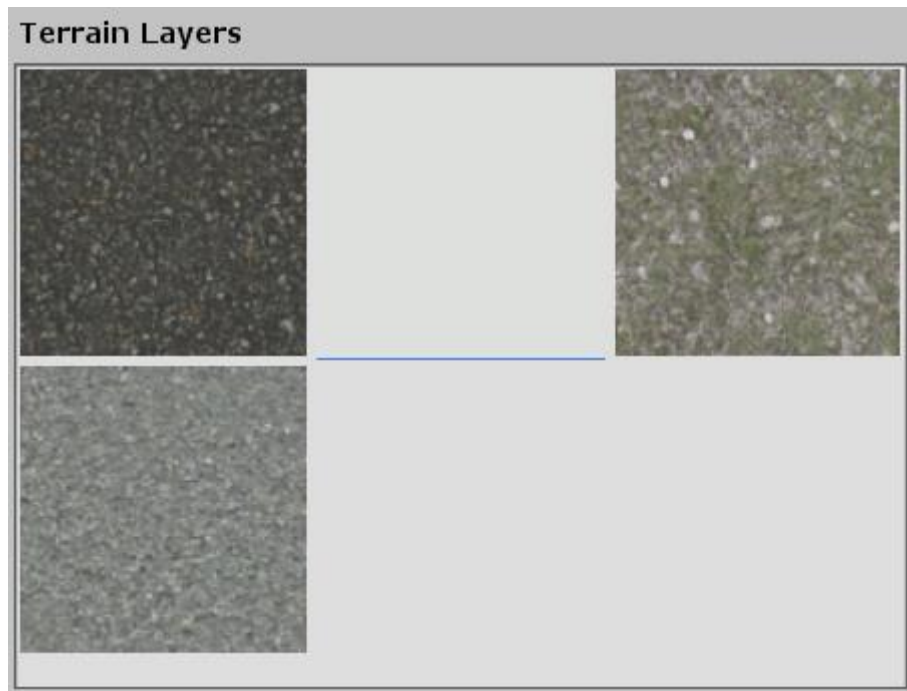
Figure 2 Different terrain layers
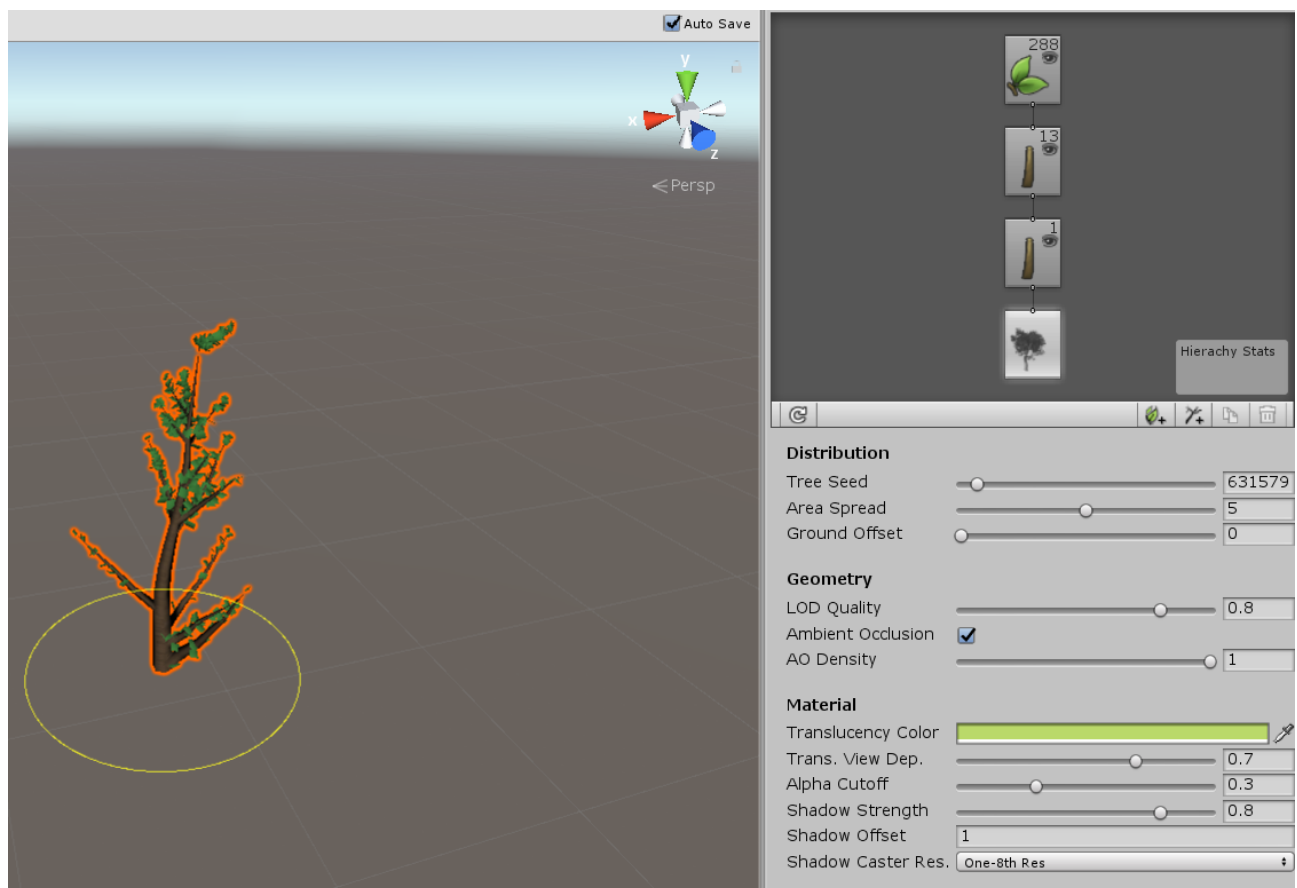
Figure 3 Tree #1
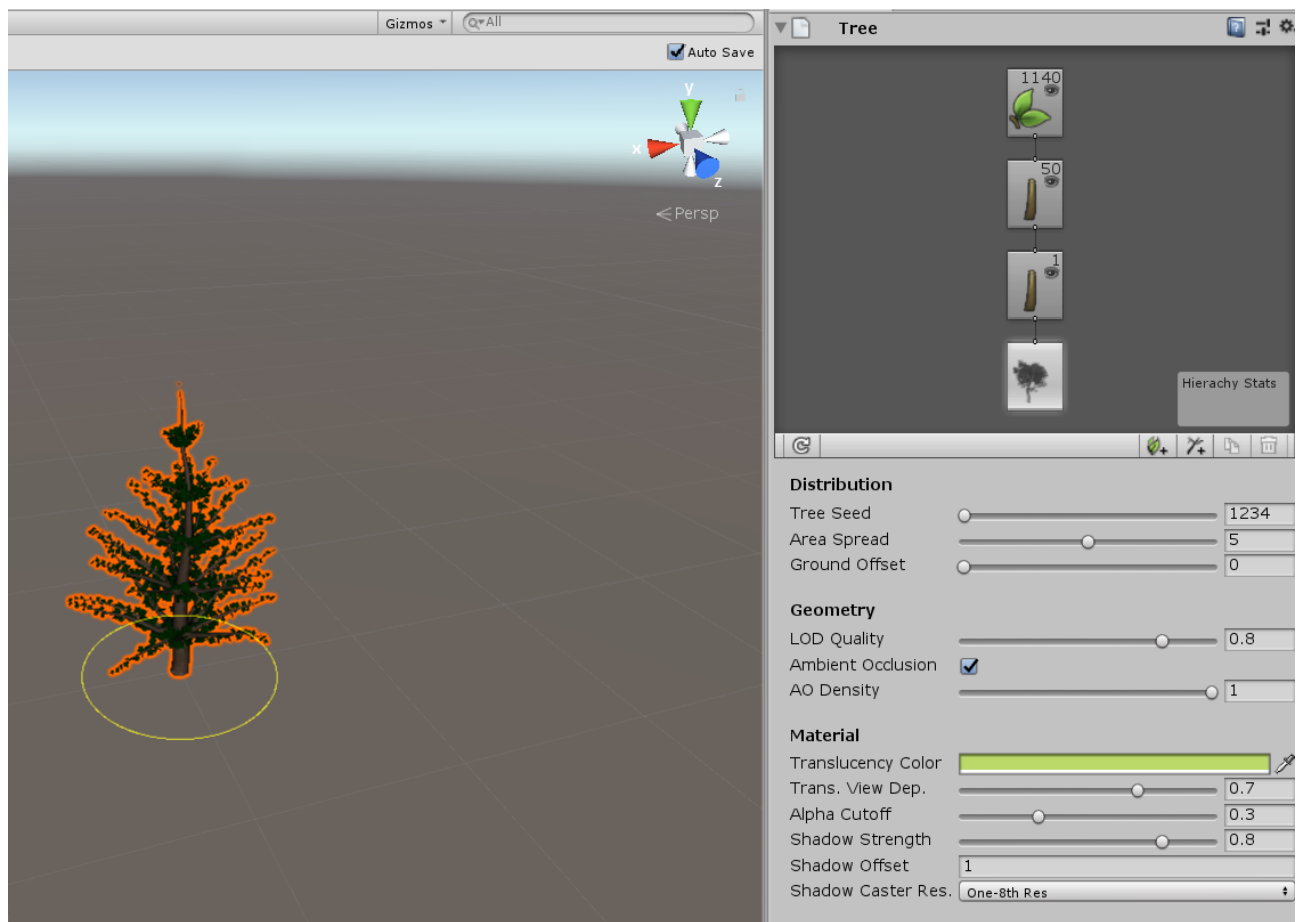
Figure 4 Tree #2
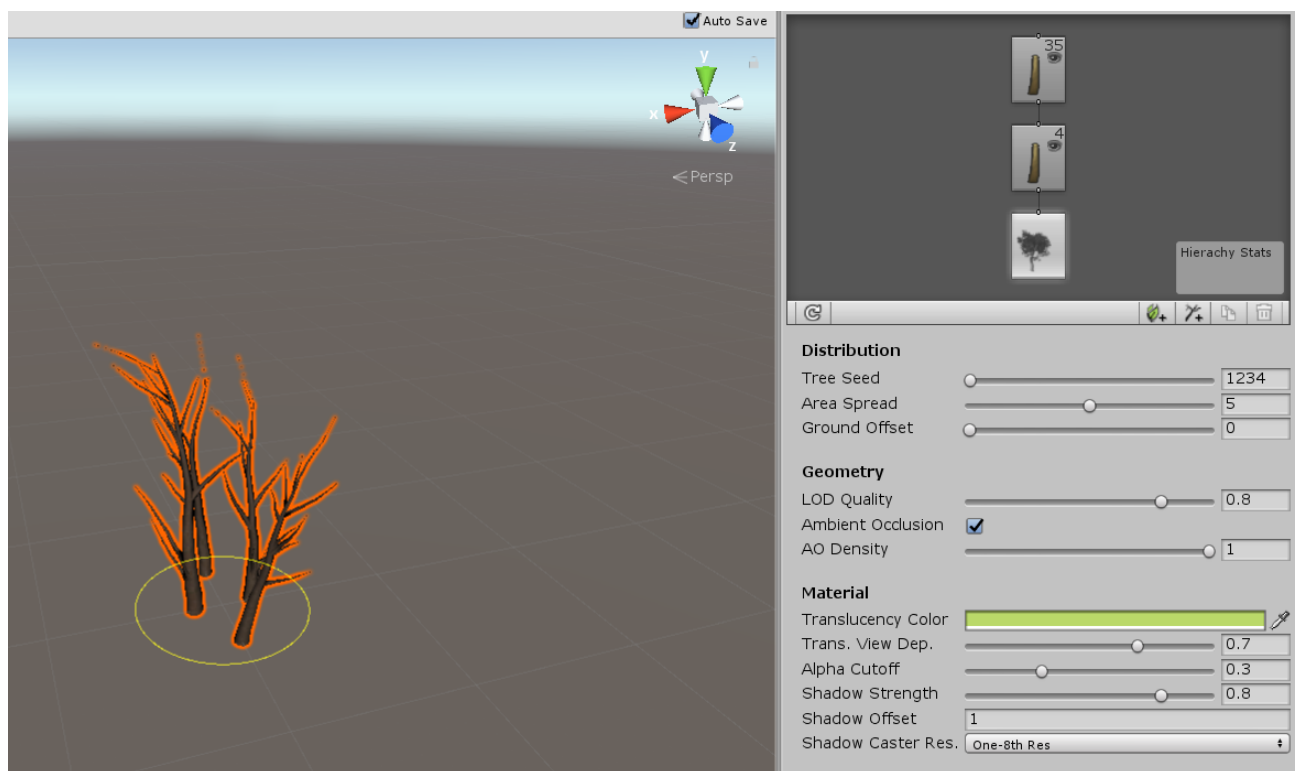
Figure 5 Tree #3
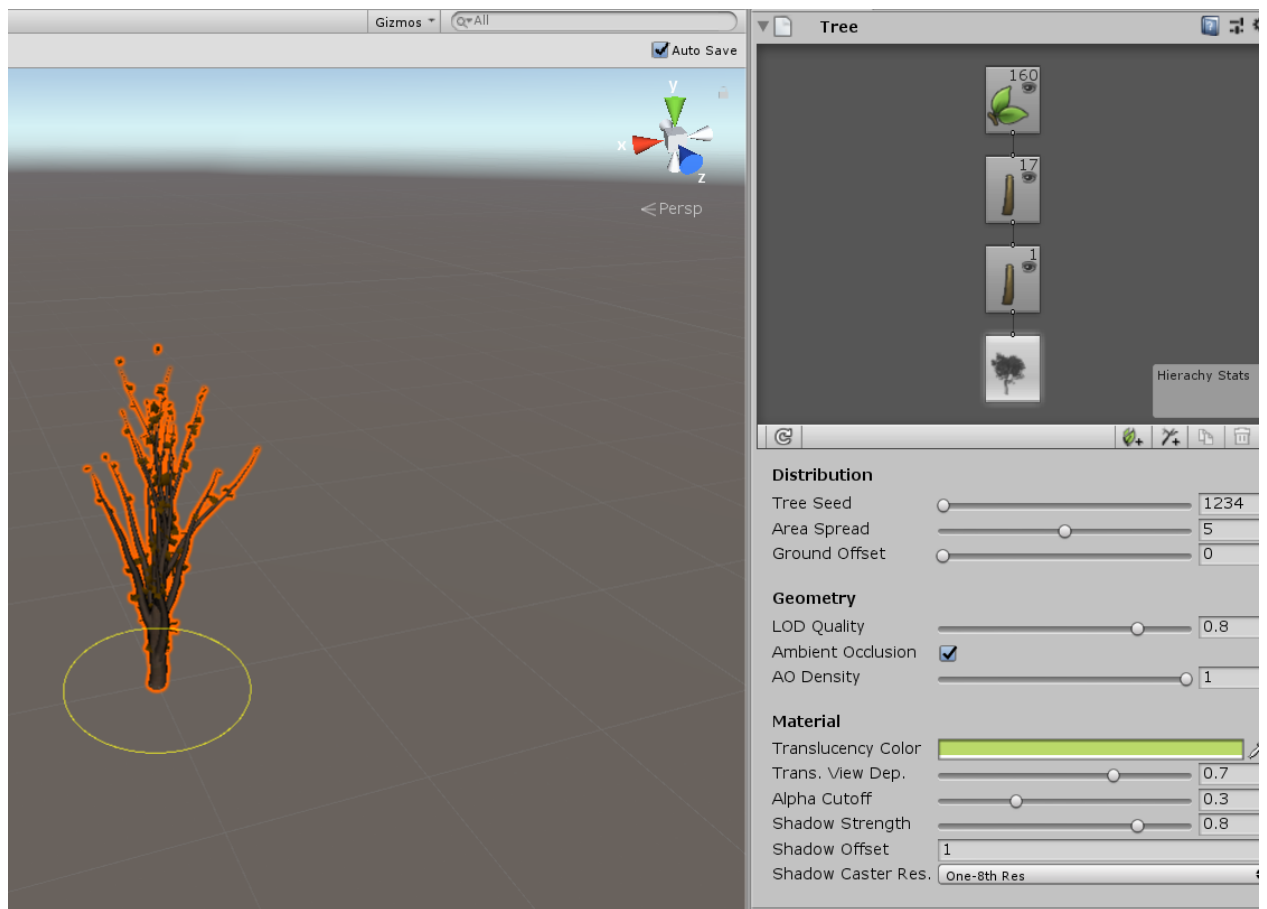
Figure 6 Tree #4
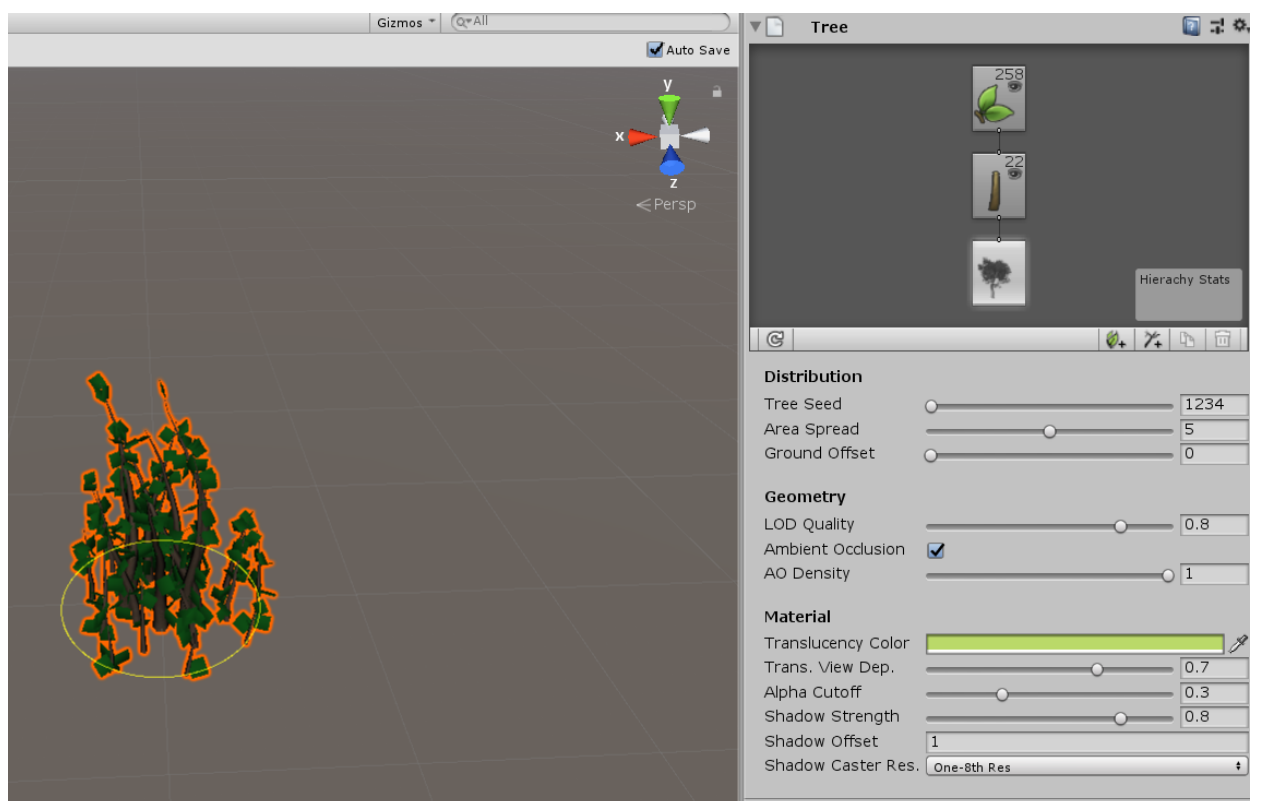
Figure 7 Tree #5

Task #3. Import a unique model and assign it to a third person character controller

Model taken from [here](#).
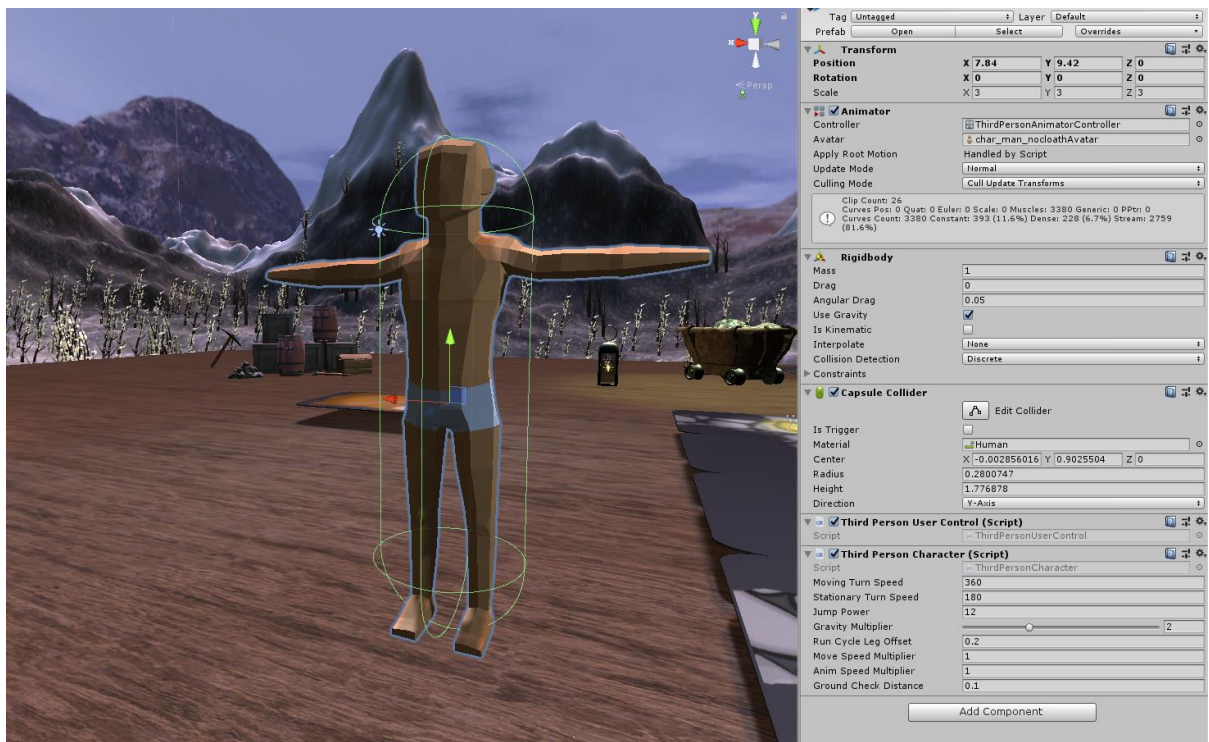
Figure 8 Model with third person character controller

Task #4. Add and animate 5 objects to your game map
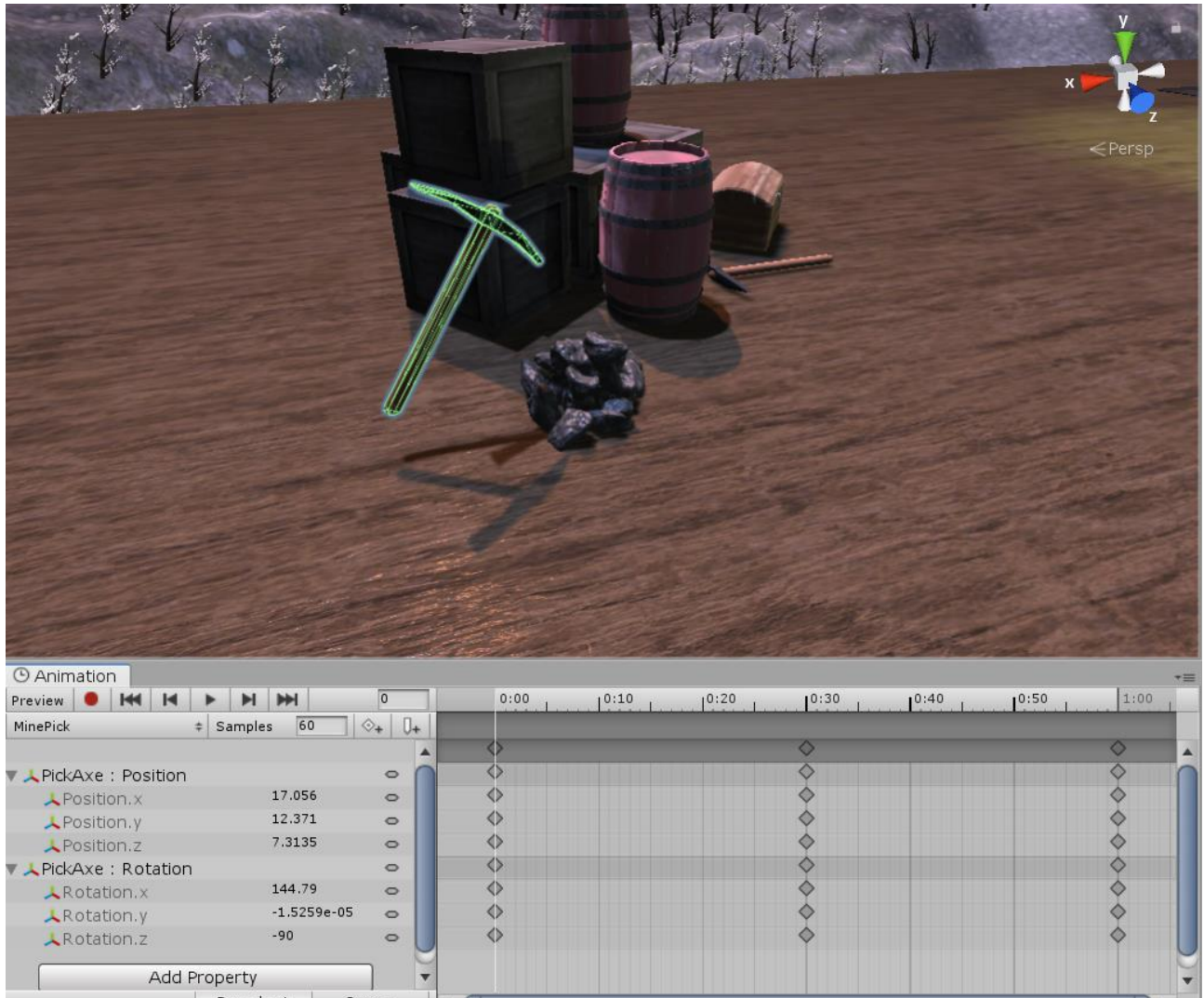
Figure 9 Animated pickaxe

Task #5. Create 5 unique particle effects

5 different particle systems added to game:
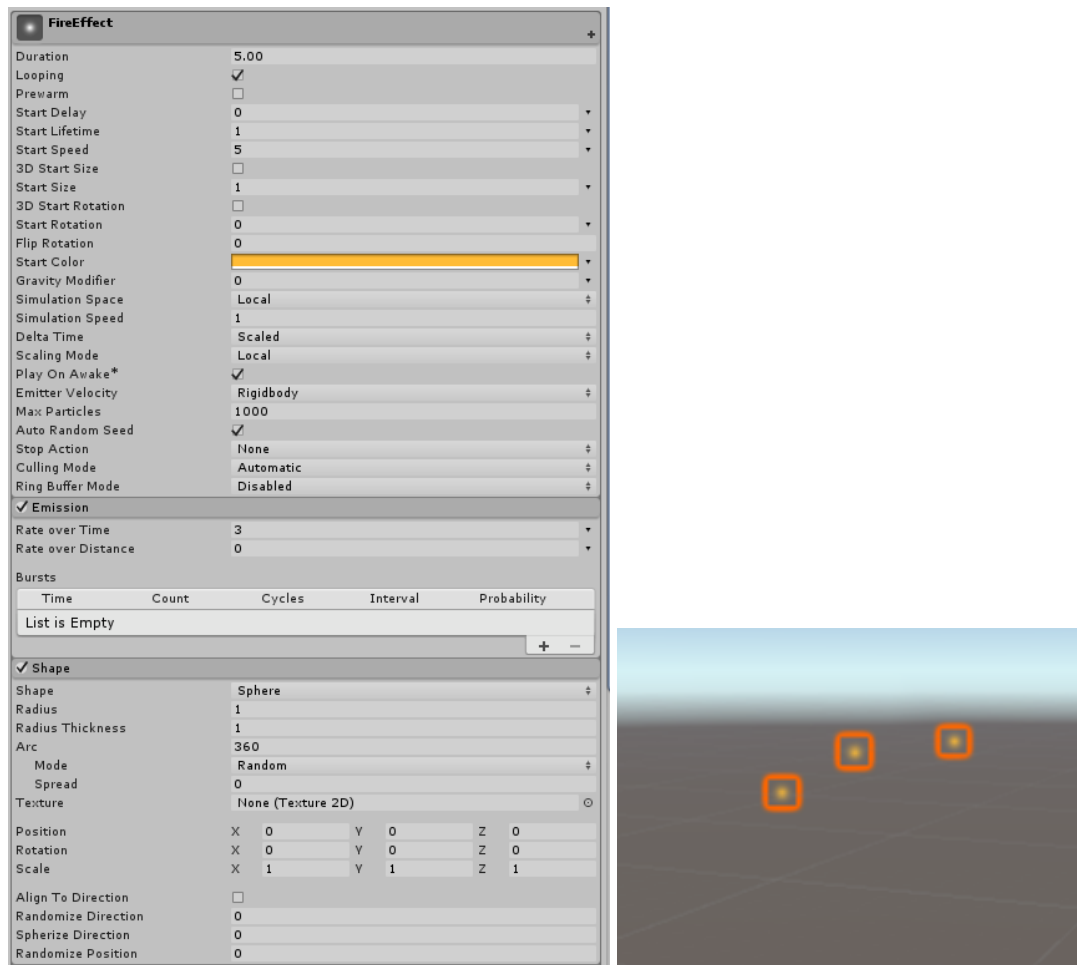
Figure 10 Fire effect particle system

Figure 11 Explosion particle system
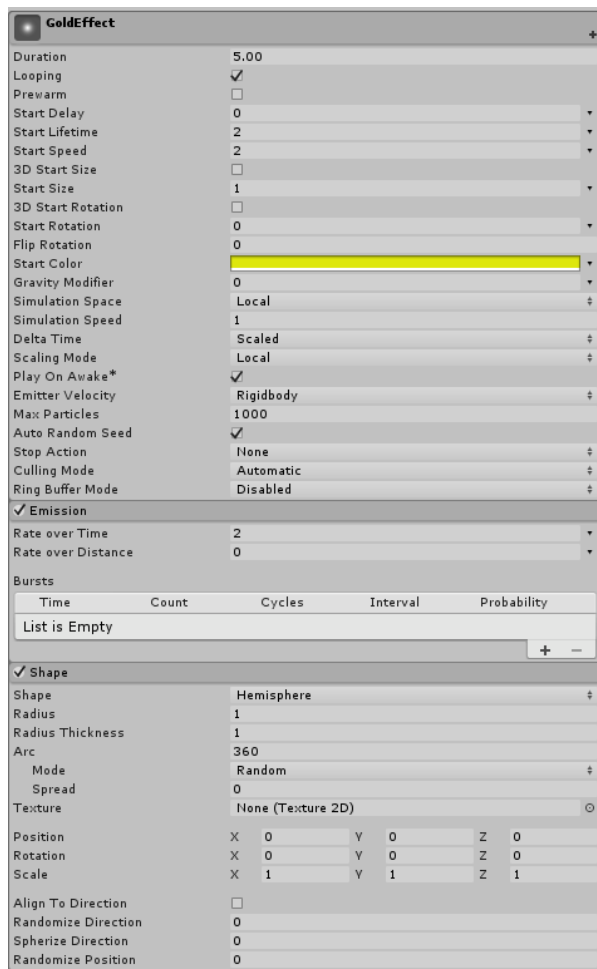
Figure 12 Gold effect particle system

Smoke				
Duration	5.00			
Looping	✓			
Prewarm	☐			
Start Delay	0			
Start Lifetime	7			
Start Speed	2			
3D Start Size	☐			
Start Size	2		10	
3D Start Rotation	☐			
Start Rotation	0			
Flip Rotation	0			
Start Color				
Gravity Modifier	0			
Simulation Space	Local			
Simulation Speed	1			
Delta Time	Scaled			
Scaling Mode	Local			
Play On Awake*	✓			
Emitter Velocity	Rigidbody			
Max Particles	1000			
Auto Random Seed	✓			
Stop Action	None			
Culling Mode	Automatic			
Ring Buffer Mode	Disabled			
✓ Emission				
Rate over Time	10			
Rate over Distance	0			
Bursts				

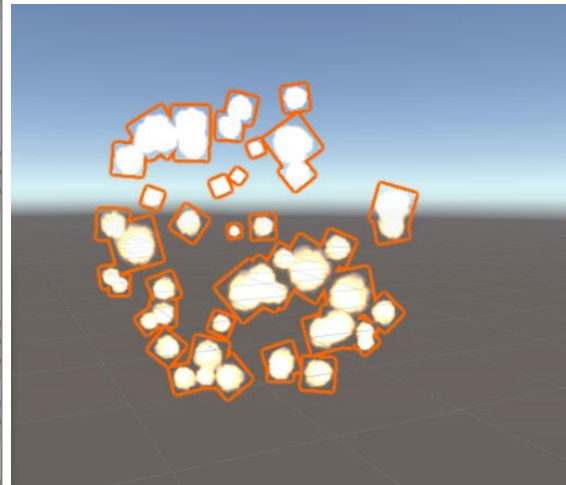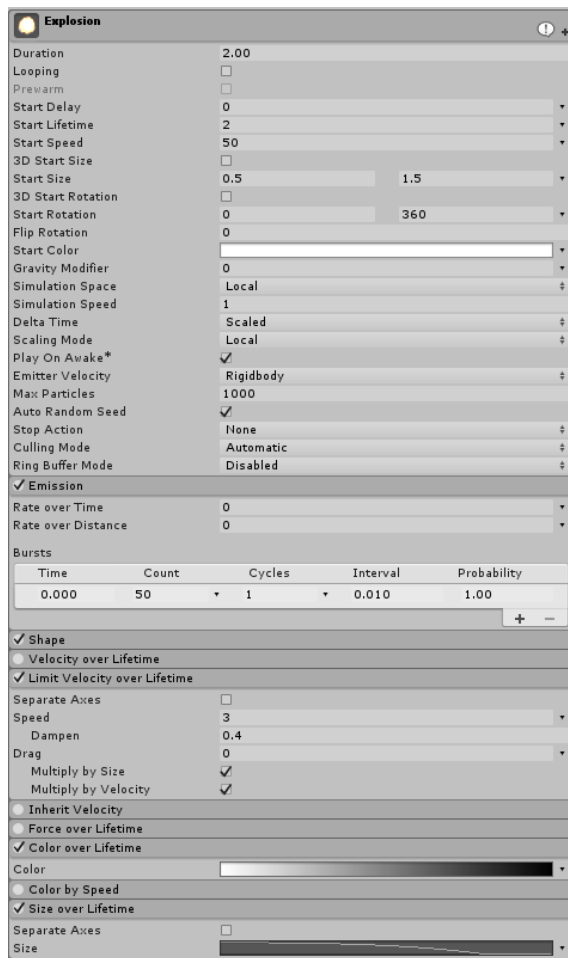| Time	Count	Cycles	Interval	Probability
List is Empty				
				+ −

✓ Shape							
Shape	Cone						
Angle	25						
Radius	1						
Radius Thickness	1						
Arc	360						
Mode	Random						
Spread	0						
Length	5						
Emit from:	Base						
Texture	None (Texture 2D)						
Position	X	0	Y	0	Z	0	
Rotation	X	0	Y	0	Z	0	
Scale	X	1	Y	1	Z	1	
Align To Direction	☐						
Randomize Direction	0						
Spherize Direction	0						
Randomize Position	0						
◯ Velocity over Lifetime							
◯ Limit Velocity over Lifetime							
◯ Inherit Velocity							
◯ Force over Lifetime							
✓ Color over Lifetime							
Color							

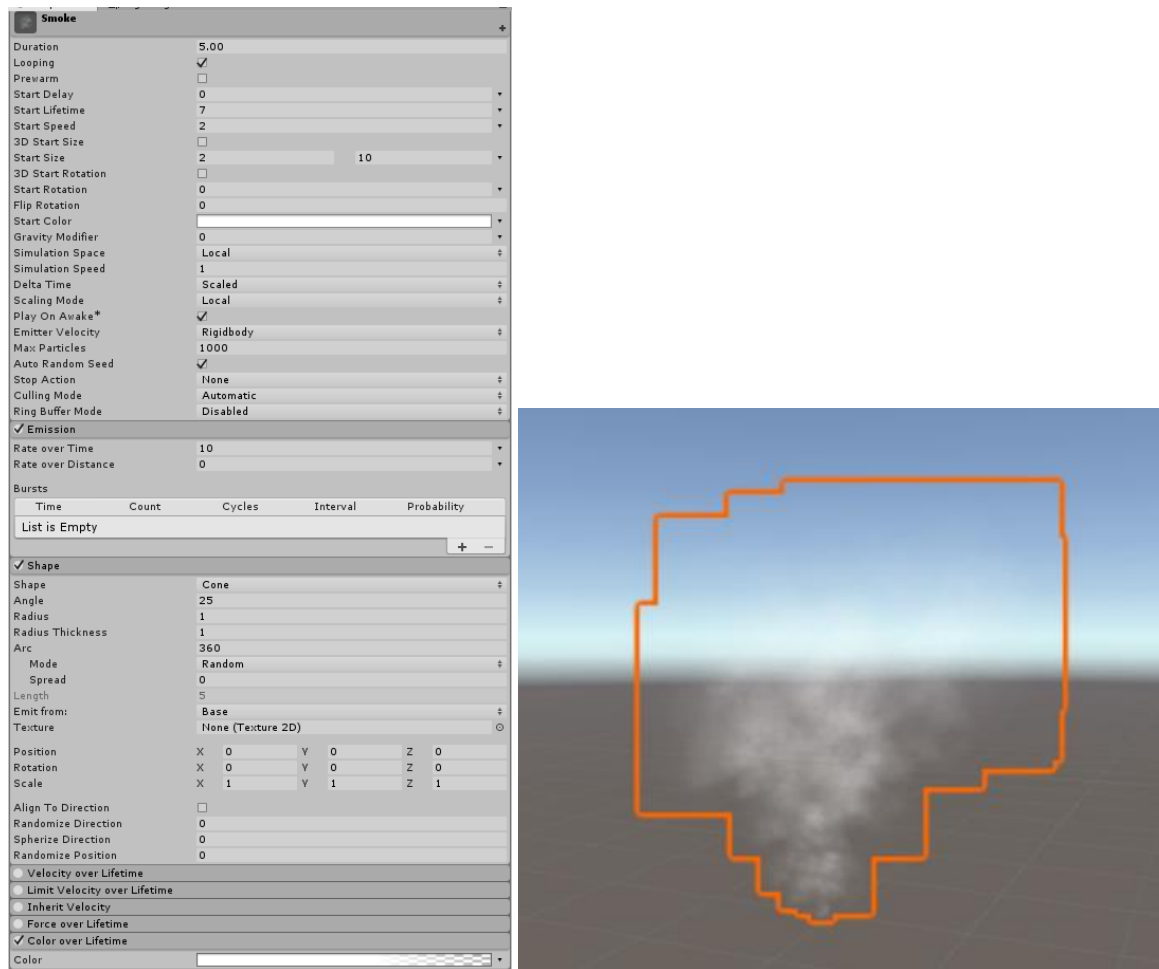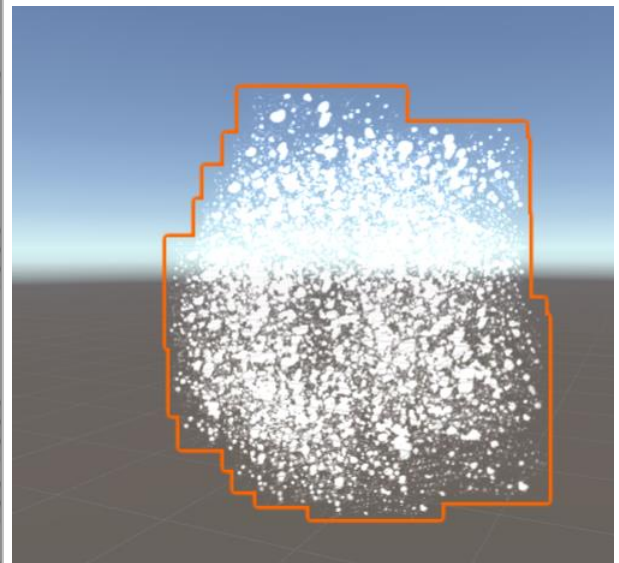**Figure 13 Smoke particle system**

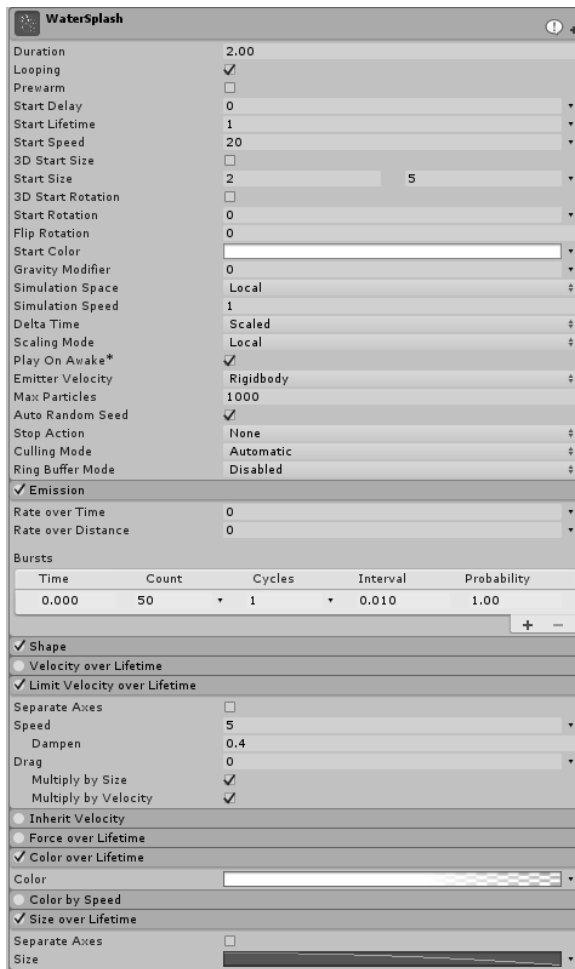**Figure 14 Water splash particle system**

Task #6. Add a custom skybox

Skybox textures taken from here and used in a skybox type material.

Task #7. Create 5 different physics materials

Added 4 different physics materials:

Figure 15 Physics materials

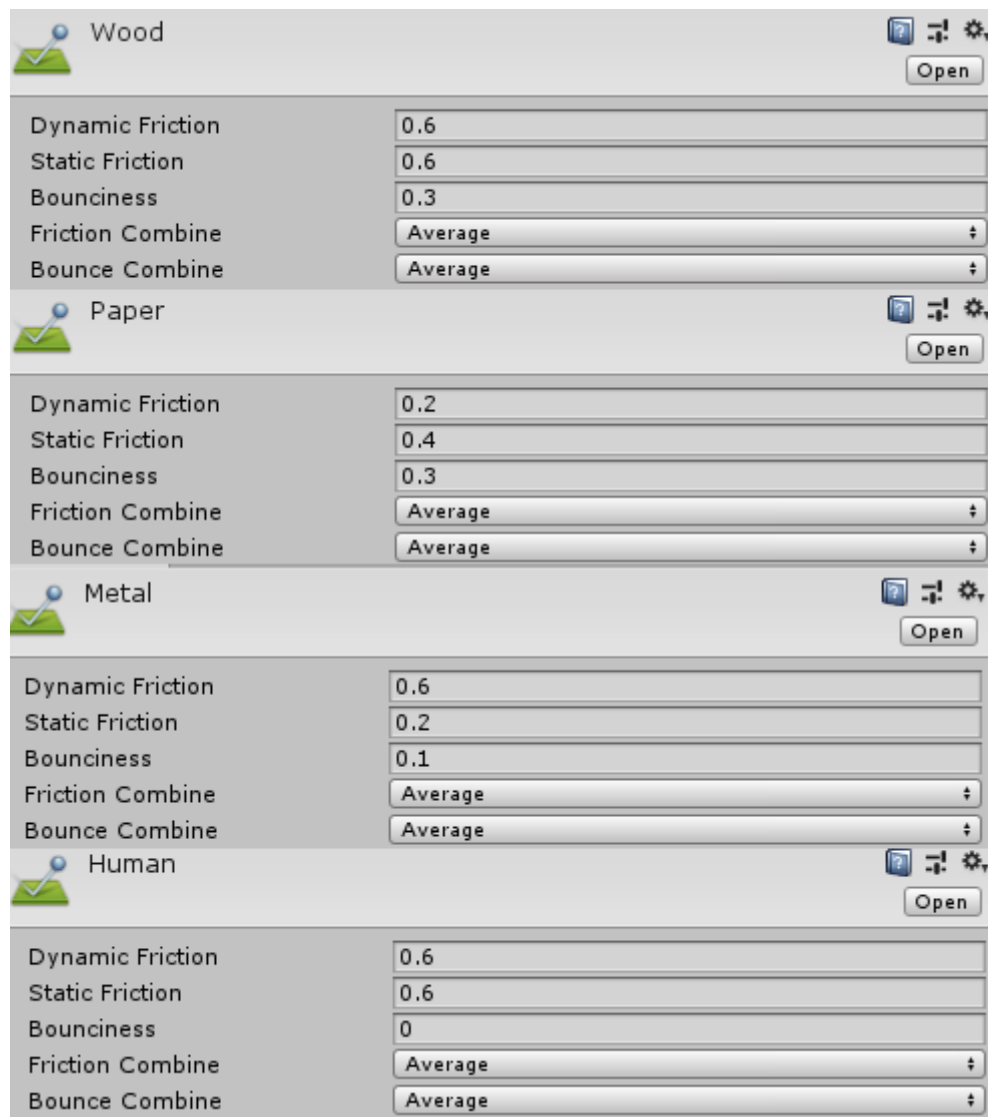## Task #8. Assign colliders for all 3D objects imported in the first laboratory work

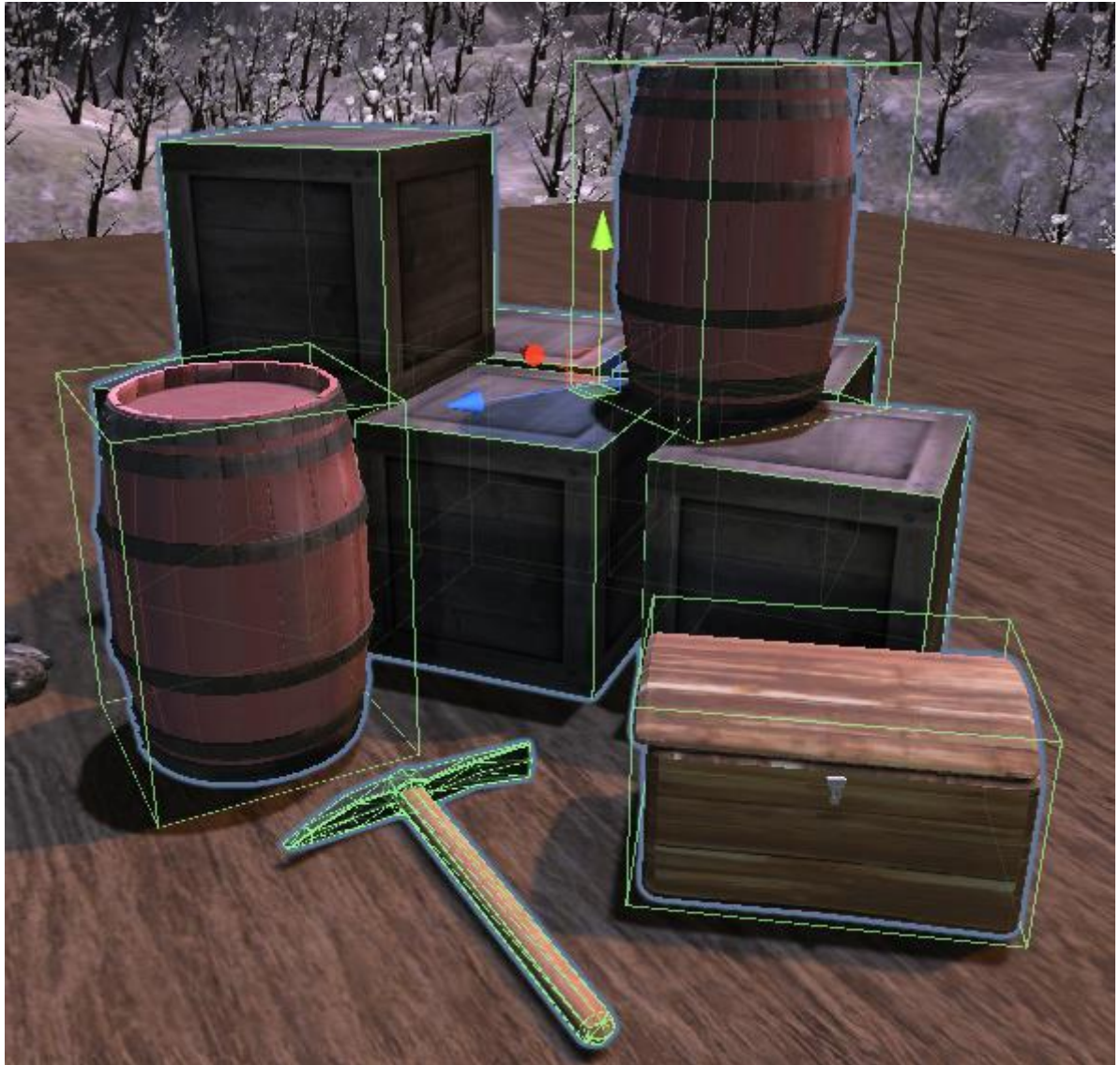Assigned different types of colliders for all props.

Figure 16 Colliders

Task #9. Add and animate 5 objects using physics, force and triggers to your game map

Chest is animated using triggers. On trigger enter chest opens and on trigger exit chest close. Mining pickaxe plays and loops animation when game is started.
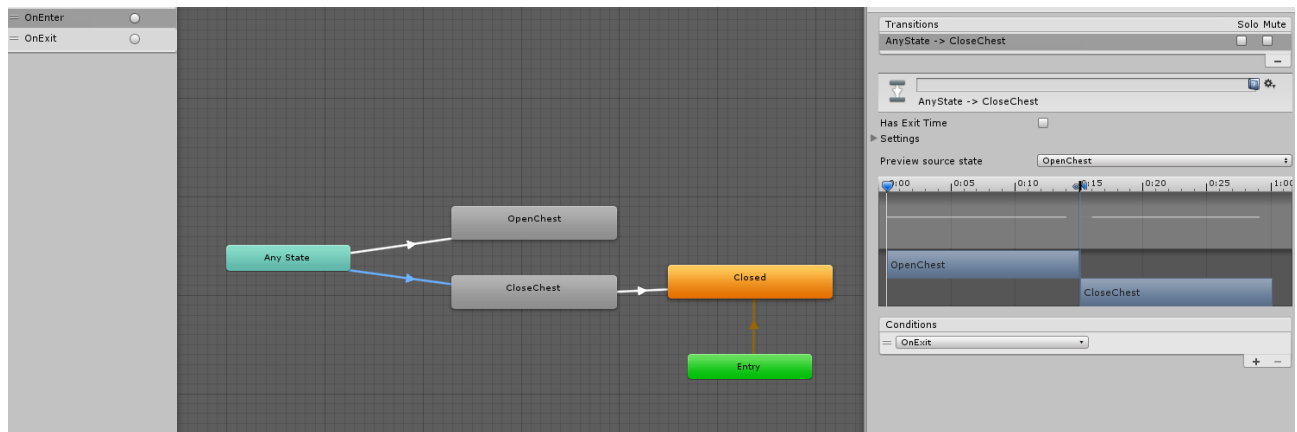
Figure 17 Chest animation controller

Table 1 Trigger script

```
public class Trigger : MonoBehaviour
{
    Animator animator;

    void Start()
    {
        animator = GetComponent<Animator>();
    }

    void OnTriggerEnter(Collider collider)
    {
        animator.SetTrigger("OnEnter");
    }

    void OnTriggerExit(Collider collider)
    {
        animator.SetTrigger("OnExit");
    }
}
```

Task #10. Set static flag to all immobile objects and measure batching performance

Batches with static flags: 1315

Batches without static flags: 1345

Task #11. Try deferred vs forward rendering and measure performance for both
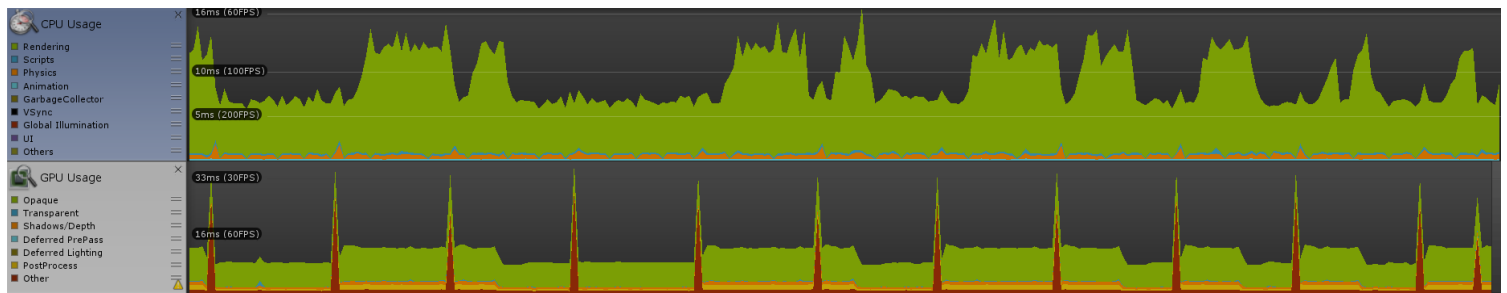

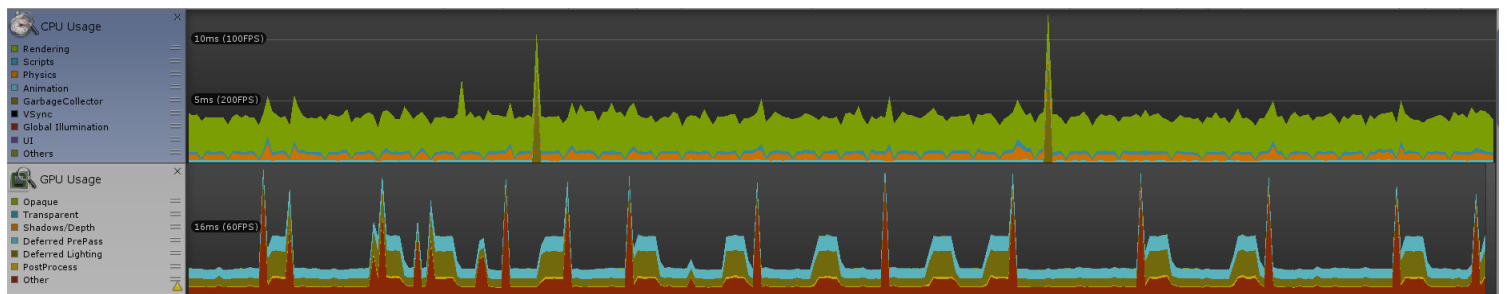**Figure 18 Forward rendering performance**

Figure 19 Deferred rendering performance

Task #12. Bake a lightmap for your scene and measure performance
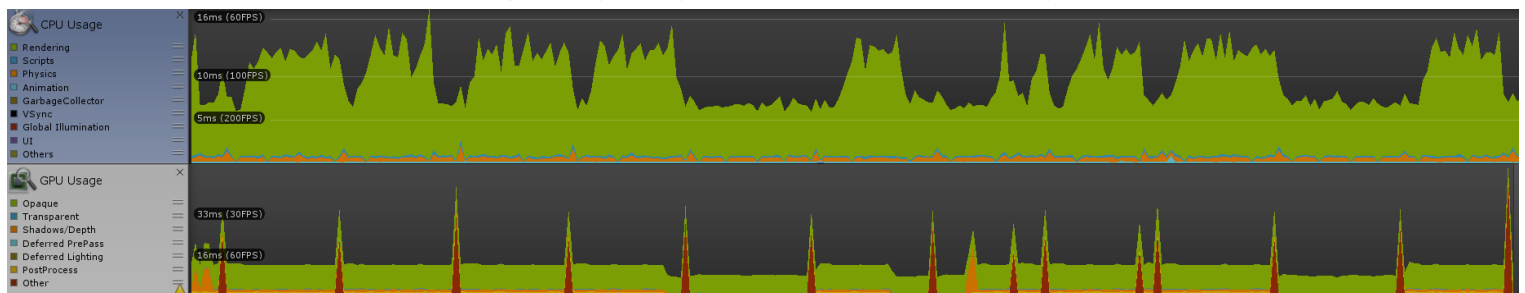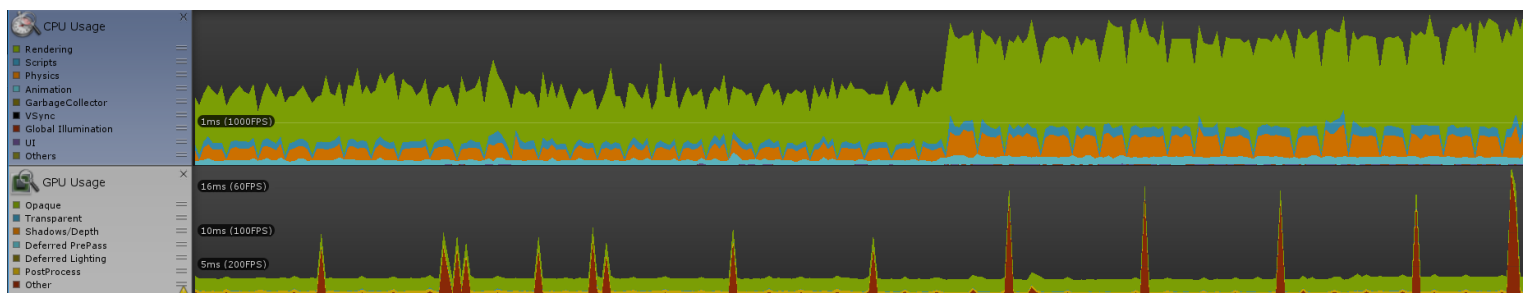

Figure 20 Default performance

Figure 21 Performance with baked lightmap

As seen in the first picture (Figure 20), majority of CPU time is used on rendering. With baked lightmap rendering time decreased.

Task #13. Optimize all textures and measure graphical memory load

Used Total: 0.81 GB   Unity: 0.63 GB   Mono: 10.5 MB   GfxDriver: 61.3 MB   FMOD: 108.8 MB   Video: 0 B   Profiler: 2.6 MB
Reserved Total: 1.11 GB   Unity: 0.92 GB   Mono: 11.1 MB   GfxDriver: 61.3 MB   FMOD: 108.8 MB   Video: 0 B   Profiler: 16.0 MB
Total System Memory Usage: 2.33 GB

Textures: 492 / 152.6 MB
Meshes: 139 / 11.2 MB
Materials: 119 / 249.0 KB
AnimationClips: 27 / 4.3 MB
AudioClips: 7 / 107.5 MB
Assets: 2226
GameObjects in Scene: 325
Total Objects in Scene: 1470
Total Object Count: 3696
GC Allocations per Frame: 310 / 19.0 KB

Figure 22 Default memory stats

Used Total: 0.81 GB   Unity: 0.63 GB   Mono: 9.8 MB   GfxDriver: 60.1 MB   FMOD: 108.8 MB   Video: 0 B   Profiler: 2.6 MB
Reserved Total: 1.11 GB   Unity: 0.92 GB   Mono: 11.1 MB   GfxDriver: 60.1 MB   FMOD: 108.8 MB   Video: 0 B   Profiler: 16.0 MB
Total System Memory Usage: 2.33 GB

Textures: 530 / 127.1 MB
Meshes: 139 / 13.8 MB
Materials: 120 / 249.0 KB
AnimationClips: 27 / 4.3 MB
AudioClips: 7 / 107.5 MB
Assets: 2232
GameObjects in Scene: 325
Total Objects in Scene: 1496
Total Object Count: 3728
GC Allocations per Frame: 315 / 19.0 KB

Figure 23 Memory stats with optimized textures

Comparing these two images we can see that memory load for textures decreased by around 30MB.

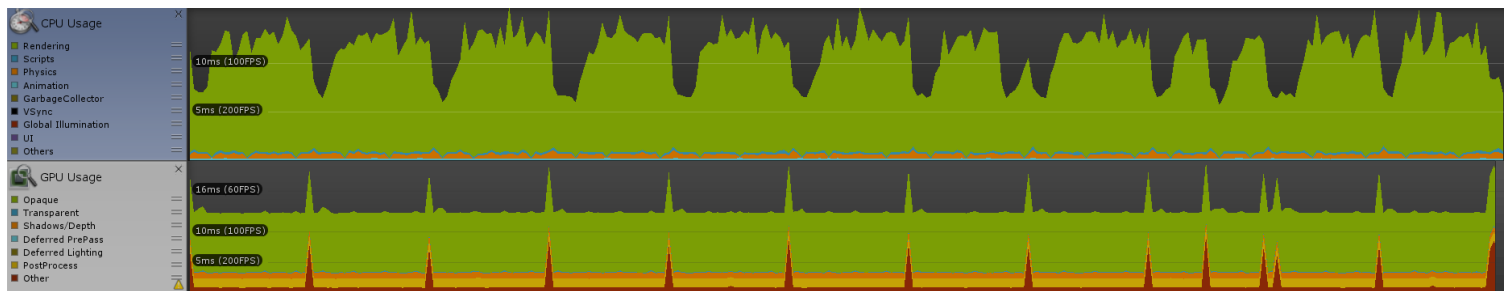## Task #14. Try hard vs soft shadows and measure performance

Figure 24 Performance with hard shadows

Default performance (Figure 20) was measured with soft shadows so we can use that for comparison. From these two images we can see that rendering hard shadows uses a lot more CPU time.

Defense task

Adding a ragdoll:

Figure 25 Ragdoll

Literature list

Resources used from:

- https://www.textures.com/download/pbr0139/133174
- https://www.textures.com/download/3dscans0079/128150
- https://www.freelancer.com/contest/Concept-Art-SKETCH-Gnome-390351-byentry-8768095
- https://www.freepik.com/free-vector/cartoon-stone-texture_976364.htm
- https://www.vectorstock.com/royalty-free-vector/mine-cart-with-coal-vector-1747485
- https://all-free-download.com/free-vector/download/treasure-map-clip-art_23028.html
- https://www.kisspng.com/png-cartoon-ladder-illustration-cartoon-wooden-ladder-497343/
- https://www.turbosquid.com/3d-models/pickaxe-obj-free/912027
- https://sketchfab.com/3d-models/mine-cart-2beeab5f44704421bc10cd310db96860
- https://www.textures.com/download/3dscans0110/130564
- https://www.textures.com/download/pbr0031/133067
- https://sketchfab.com/3d-models/lantern-final-aead6bb3bab344eaab541c5ac52c657c
- https://sketchfab.com/3d-models/40-rocks-a6c5ab5b438f473cb1cafdf4099e1657
- https://free3d.com/3d-model/crate-86737.html
- https://free3d.com/3d-model/barrel-7685.html
- https://free3d.com/3d-model/wooden-chest-44006.html
- sounds from https://www.productioncrate.com and https://www.zapsplat.com
- https://www.textures.com/download/pbr0172/133207
- https://www.textures.com/download/asphaltcloseups0064/12319
- http://www.custommapmakers.org/skyboxes.php
- https://sketchfab.com/3d-models/elysiumvr-male-character-rigged-template-4d0f03c673474921804254658666710d