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## Acknowledgements

# Mini-RPG game

## I. Introduction:

### 1. I want to build an RPG game :

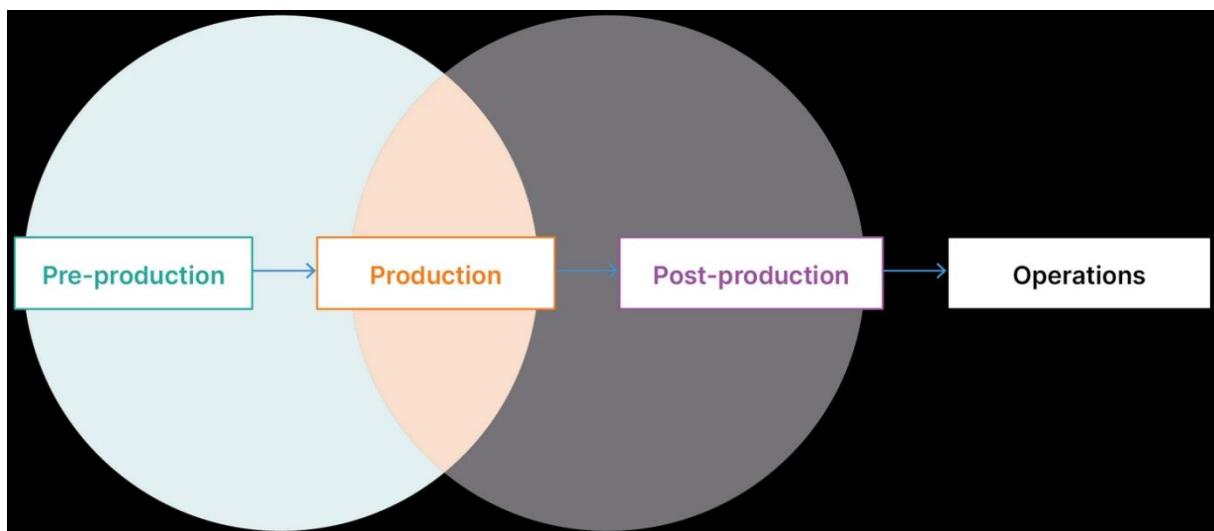
RPG stands for role-playing-game , a game in which players take on the roles of imaginary characters and go for adventures.In my game dev project I will start from 'I want to build an RPG game' a high level statement.a project design document is provided as well(HeroDesignPrim.docs).

### 2. Game Engine:

Unity will be the choice of 3d real-time game engine.

- Loads of documentations and support threads.
- Loads of free assets for commercial use.
- Free\* (with a yearly revenue cap).

### 3. Methodology :



It is consisted mainly of 4 phases of production:

#### • Pre-production:

planning, prototyping and initial designs. Scrum Style: backlog +sprints planning.

- Production:

creation of the product and assets ,user interfaces ,gameplay ,it is the important and largest part. It will be based on Kanban agile method.

- Post-production:

quality assurance (QA), editing, testing, bug fixing, and final polishing.

- Operations:

sales, monetization, updates (going through pre-production again), and continued maintenance.

## 4. Unity Learn:

Unity Essential Pathway: 2 weeks duration: 1→15 Mars 2021

<https://learn.unity.com/pathway/unity-essentials>

The screenshot shows the Unity Learn website interface. At the top, there's a navigation bar with tabs like 'My Learning', 'Pathways', 'Browse', and 'Live'. A search bar is also present. On the right side, there's a user profile for 'aymen ajroud' with an email address 'ajroud.aymen@gmail.com' and options to 'FAQ', 'Settings', and 'Sign out'. Below the navigation, a large banner for 'Unity Essentials' is displayed, featuring a green hexagonal icon with a white 3D model inside. The main content area shows the 'Unity Essentials Pathway' badge, which is a black hexagon with a green border and a white 3D model inside. Below the badge, it says 'Type: Validation' and 'Level: Foundational'. To the right of the badge, there's a section titled 'Skills' with buttons for '2D & 3D Design', '2D Assets', '3D Assets', 'Basic C# Scripting', 'Real-time Creation', and 'Unity Editor'. Further down, there's a 'Earning Criteria' section. The bottom of the screen shows a Windows taskbar with various icons.

[https://www.credly.com/badges/9bc26cc5-600d-4168-84f8-58761fa0a201/public\\_url](https://www.credly.com/badges/9bc26cc5-600d-4168-84f8-58761fa0a201/public_url)

- Unity Junior Programmer: 15→29 Mars 2021:

<https://learn.unity.com/pathway/junior-programmer>

The screenshot shows the Unity Learn website with the 'Junior Programmer' pathway selected. The page features a large purple hexagonal badge icon at the top. Below it, the title 'Junior Programmer' is displayed in bold white text. Underneath the title, it says 'Pathway • Beginner • +3000 XP • 12 Weeks • 1864' and 'Unity Technologies'. A descriptive paragraph explains the pathway is designed for beginners interested in learning to code or obtaining an entry-level Unity role, assuming basic knowledge of Unity and no math prerequisites. It prepares users for Unity Certification. The bottom of the screenshot shows a Windows taskbar with various icons.

[https://www.credly.com/badges/64eda053-97f5-456b-be5a-743354f3d263/public\\_url](https://www.credly.com/badges/64eda053-97f5-456b-be5a-743354f3d263/public_url)

The screenshot shows the Credly badge details page for the 'Unity Junior Programmer' badge. It features a large purple hexagonal badge icon. To the left of the badge, there is a circular profile picture placeholder. Below the badge, the text 'This badge was issued to [aymen ajroud](#) on 29 March 2021.' is displayed. On the right side, there are two buttons: 'Share' and '...' (more options). Below the badge, the title 'Unity Junior Programmer' is shown in bold, followed by 'Issued by [Unity Technologies](#)'. A descriptive paragraph states that the pathway validates skills and competencies for a proficient junior programmer writing scripts in C# to create interactive experiences with the Unity Editor. A 'Skills' section lists several categories: Application Debugging, Application Prototyping, Code Development & Testing, Code Optimization, C# Programming, Database Programming, Game Engines, Unity Programming, and User Interface Programming. At the bottom, there is a link 'Additional Details'.

## 5. Why Unity game engine:

- Full of license-free assets : <https://assetstore.unity.com/account/assets>.
- Rich documentation :a huge online manual,  
<https://docs.unity3d.com/Manual/index.html>
- a huge communities with tons of threads and debugging: forum.unity.com ,
- blogs.unity3d.com, reddit.com.
- C# base coding language.
- Real-Time testing :I can run the game whenever I want using the editor built in
- real-time emulator along with a “Profiler” that calculate frames, resources consumption, all technical info , all for the cause of optimization.
- An impressive link with microsoft visual studio for advanced scripting and easy documentation.

## 6. Workstation and tools:

- Motherboard: H310M PRO-VD PLUS
- CPU: intel i5 9400F 2.9 GHz
- GPU: Nvidia GeForce GTX 1650
- Screen: 32" Vega Led
- Microsoft office suite validated with the institute office 365 email  
[aymen.ajroud@sousse.r-iset.tn](mailto:aymen.ajroud@sousse.r-iset.tn) .
- Umlet: a powerful diagram designer and freeware.
- SketchBook: a freeware and easy to use image editor.
- Microsoft windows Paint.(who doesn't know Paint)
- Unity editor 2020.3.5f1 LTS
- Blender
- GitHub student pack: GitHub pro.activated by applying with institute email.  
With GitHub pro student pack I have access to more then hundred hosting/storage/databases and many more services on 3<sup>rd</sup> party providers like Microsoft azure student pack, canva.com , digital ocean,...  
<https://education.github.com/pack>

- Firebase.google.com , free basic plans for start ups, cloud storage, Realtime database NoSQL , statistics , web hosting, user authentication .Easy and documented implementation with unity projects.
- Hundreds of free assets in unity assets store for commercial use.

## II. Pre-production:

### 1. BrainStorming:

I've spent 3 days writing down any idea I think of, at any time, and anywhere.

- Level system with experience points.
- With/without level cap.
- Stamina (hp), scalable with items/level
- Multiplayer
- Offline solo
- Openworld
- Stages , each stage have small map, stage=scene.
- Classes like warrior rogue mage priest
- Resources like mana rage energy
- Casting skills/spells
- Talent points tree
- Achievements system
- Google play implementation
- Guest login/ linking account
- Skills and spells upgradable
- Money system (gold , coins, gems,)
- Storyboard (implementing a manga/anime...)
- Characters to start with(female/male) race humain/other imaginairies.
- Quest/reward system.
- Npc (NonPlayerCharacters) quests, trading (sell buy).
- Inventory system
- Character equip system
- Character stats interface
- Enemies to kill (drop items/money/experience/quests requirements).
- Moving touch pad, spells/skills button list
- Free look button
- Swipe to fast cast spells/skills

- duel with other players with pvp reward system
- daily + weekly quests
- 2 or more factions to join
- Guild system
- Messaging system/mail box
- Compare achievements with others in a scoreboard
- Items with levels and rarity
- Fixed view
- Customized view
- Options interface (menu quit volume graphic quality)
- Mini map
- Customizing the controls size/visibility/position
- Pets that follow you and help attack
- Compagnions that can equip items and use skills.
- Crafting tab: salvage items and create higher lvl ones.
- Tap enemies to attack
- Payment ui.
- Googleplay plugin
- Global/guild/party chat system
- Party with friends and play together

## 2. Scooping a similar game: Eternium

- I really like the gameplay but it feels like I hit the Wall where the Grind begins and nothing else other than running endless Trials is progress. Crafting Items isn't worth it cause i need Set/Named items. And there is nothing else to farm other than CL, everything else will drop or won't. [Reddit.com/](#)
- **Eternium** is an amazingly fun and beautifully crafted Action RPG, reminiscent of the **great** classics. **Eternium** stands out from other mobile Action RPGs by its effortless “tap to move” and innovative “swipe to cast” controls, and its player-friendly “no paywalls, never pay to win” philosophy. [Amazon.in/](#)

### \*\*google playstore reviews\*\*

- Stats decrease when u lvl up , why not increased? lacking joystick support.
- Upgrade skills by gems instead of skill points. Sorta of pay to win.
- No stamina/energy to limit gameplay.
- Old graphics

- The concept to draw lines to use items/cast spell or skill is innovative.
- Low experience gain rate.
- Grinding for items.
- Free play, don't have to daily check in.
- No blood or gore so all ages are welcome.
- Small font and bad resolution compatibility on some phones.
- No too easy where it becomes boring.
- Returning to a level and grinding again and again for experience with same story dialogues showing is boring.
- Bad item drop rate
- Progression for new characters are slow.
- Problem with the crafting tab user interface UI.
- Pvp(player-vs-player) is unbalanced, matching players gear is bad.
- Interactive support in google playstore review section.

### 3. Filtering the brainstorming ideas based on available resources and scooping:

- Level system with experience points.
- With/without level cap.
- Stamina (hp), scalable with items/level
- **Multiplayer**
  - Offline solo
  - OpenWorld
  - Stages , each stage have small map, stage=scene.
- **Classes like warrior rogue mage priest**
  - Resources like mana rage energy
  - Casting skills/spells
  - Talent points tree
  - Achievements system
  - Google play implementation
  - Guest login/ linking account
  - Skills and spells upgradable and unlockable by lvling up
  - Money system (gold , coins, gems,)
  - Storyboard (implementing a manga/anime...)
  - Characters to start with(female/male) race humain/other imaginairies.
  - Quest/reward system.

- Npc (NonPlayerCharacters) quests, trading (sell buy).
- Inventory system
- Character equip system
- Character stats interface
- NPC Enemies to kill (drop items/money/experience/quests requirements).
- Moving touch pad, spells/skills button list
- Free look button
- Swipe to fast cast spells/skills
- ~~duel with other players with pvp reward system~~
- daily + weekly quests
- ~~2 or more factions to join~~
- ~~Guild system~~
- Messaging system/mail box
- Compare achievements with others in a scoreboard
- Items with levels and rarity
- Fixed view
- ~~Customized view~~
- Options interface (menu quit volume graphic quality)
- Mini map
- Customizing the controls size/visibility/position
- ~~Pets that follow you and help attack~~
- ~~Compagnions that can equip items and use skills.~~
- ~~Crafting tab: salvage items and create higher lvl ones.~~
- ~~Tap enemies to attack~~
- Payment ui.
- Google play plugin
- Global/guild/party chat system
- ~~Party with friends and play together~~

#### 4. Story+plot:

A hero came to save the village from skeletons, take quests, gather, kill , find, and return for exp and glory.

#### 5. Core mechanics:

- player can move freely.

- Talk to npcs in the village for questing.
- Attack goblins.
- Find stolen items.
- Gather herbs.

## 6. Game Play:

1<sup>st</sup> u choose between a male/female character,then u spawn beside a village. You can move freely in the open world. Kill threatening skeletons ,find rare items, collect herbs for quests to earn exp and lvl up.

## 7. Music/sound:

A calm music running in background.

## 8. Art style:

Medieval style of sword and magic.free assets from unity strore.

## 9. Project Concept

<b>Player Control</b>	1	You control a	in this	
		<i>A male/female character</i>	<i>Top down view</i>	<i>gam e</i>
<b>Basic</b>	where	makes the player		
	<i>The touch pad+buttons</i>	<i>move run attack</i>		
<b>Basic</b>	2	During the game,	from	
		<i>Enemies/friendly npcs</i>	<i>appear</i>	<i>Moving around the open world</i>

## Gameplay

stage

and the goal of the game is to

*Complete missions, earn money, upgrade skills and leveling up*

3

There will be sound effects

and particle effects

### Sound & Effects

*when moving, attacking, dying, enemy dying, friendly npcs talk*

*when Dying, moving, finishing quests, leveling up*

[optional] There will also be

*All characters have basic animation effect.*

4

As the game progresses,

making it

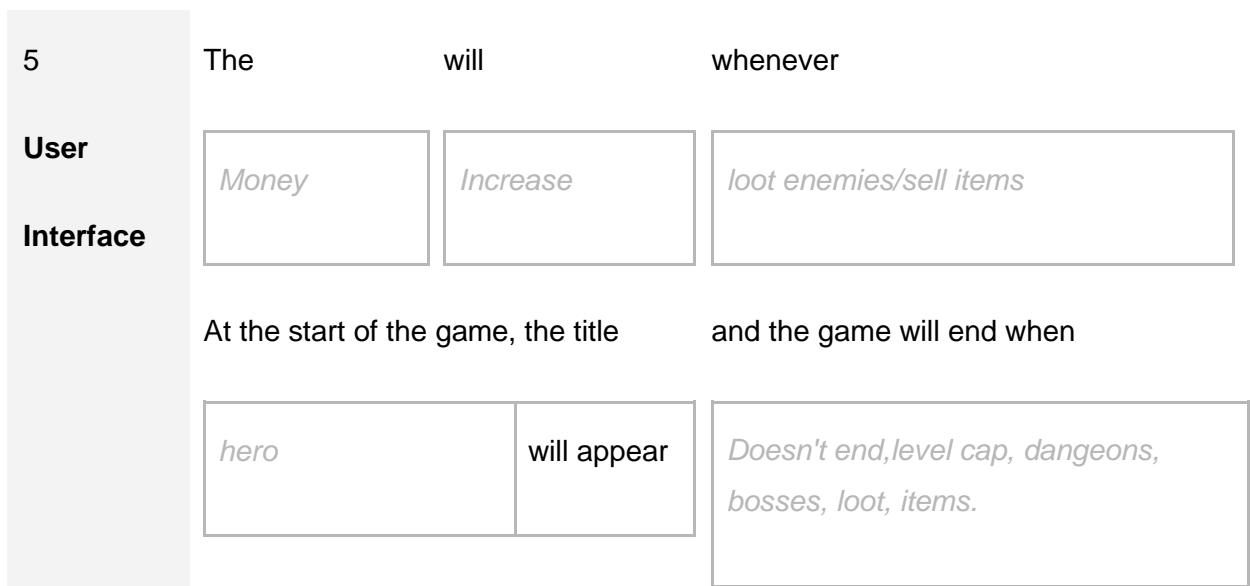
### Gameplay Mechanics

*Enemy level increases, quests rewards increases, experience needed to lvl up increases, talent points*

*Scalable*

[optional] There will also be

*when you die, you need to watch an ad video or wait ? minutes to respawn*



## 10. Project Timeline

Milestone	Description	Due
#1	<ul style="list-style-type: none"> <li>- Menu/start/quit ui + 1st stage+controls+characters+npc+ennemis+deploy to googleplay store</li> </ul>	29/04
#2	<ul style="list-style-type: none"> <li>- log in functionality+google play integration+back end server+databases</li> </ul>	29/05
#3	<ul style="list-style-type: none"> <li>- optimization+adding more features +ads+billing system</li> </ul>	

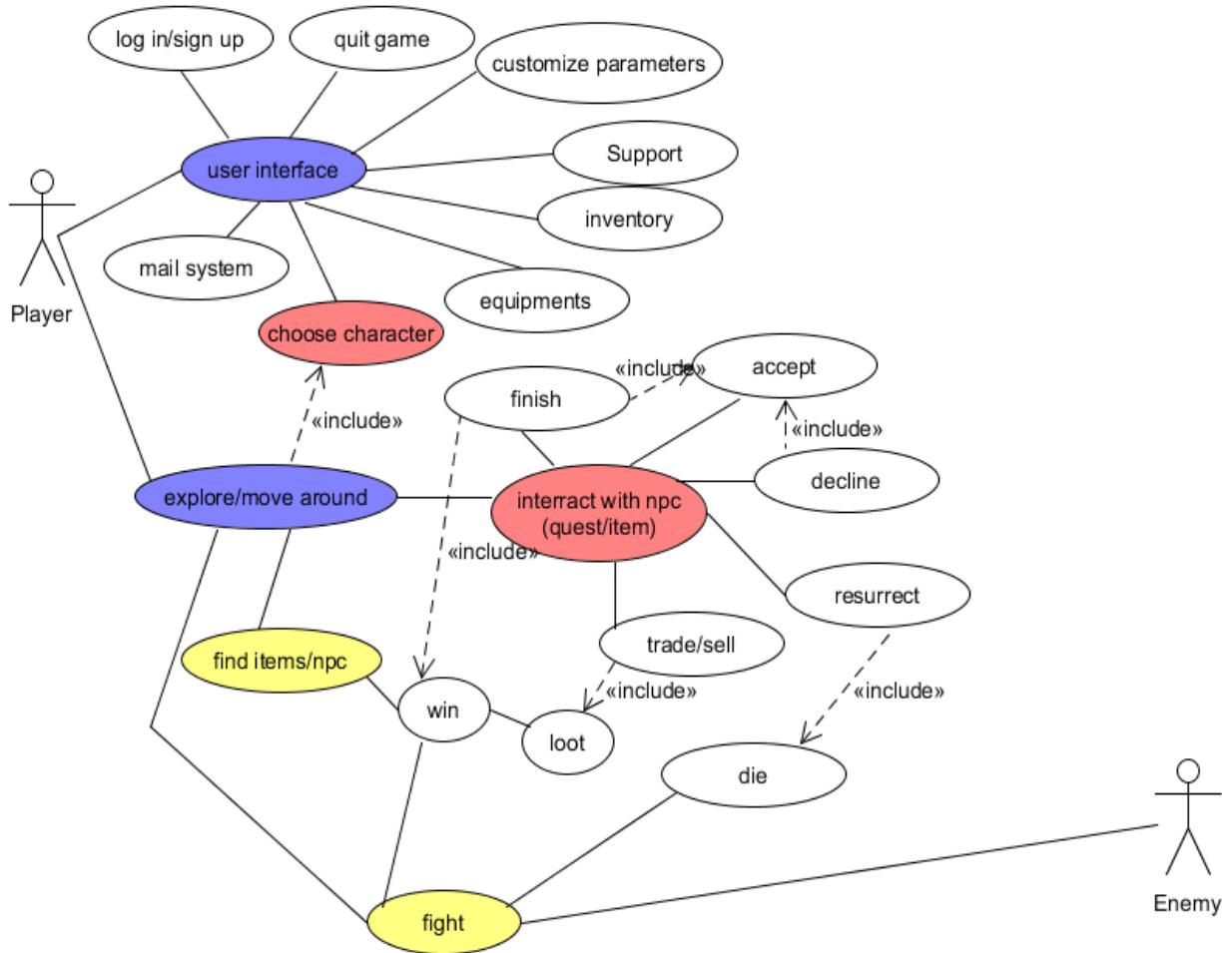
15/06

**#4**

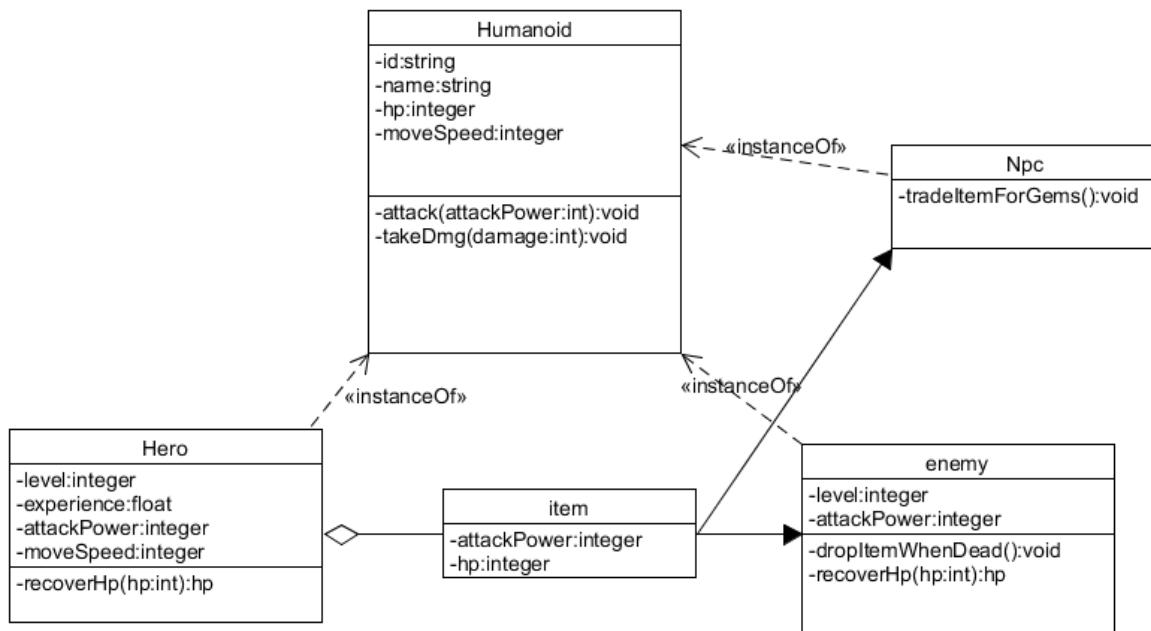
- *more code optimization+release of more stages.+facebook page+advertising*

30/06

## 11. Use Case diagram:

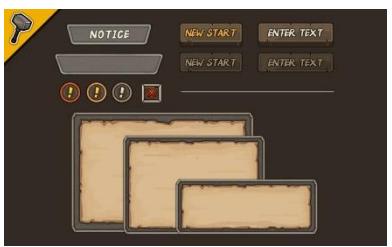
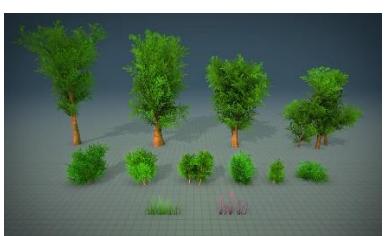


## 12. Class Diagram:

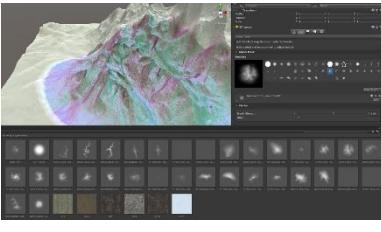
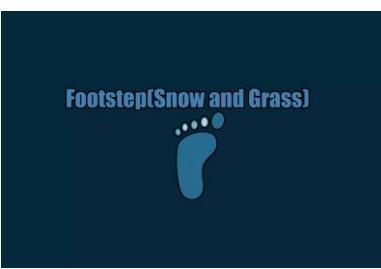


## 13. Chosen assets:

	<a href="https://assetstore.unity.com/packages/3d/characters/humanoids/girl-with-clothes-worker-set-162925">https://assetstore.unity.com/packages/3d/characters/humanoids/girl-with-clothes-worker-set-162925</a>	A female villager with idle animation only
	<a href="https://assetstore.unity.com/packages/3d/characters/humanoids/fantasy/oriental-fantasy-character-berserker-grade-0-171147">https://assetstore.unity.com/packages/3d/characters/humanoids/fantasy/oriental-fantasy-character-berserker-grade-0-171147</a>	Female hero with animations

	<a href="https://assetstore.unity.com/packages/3d/characters/humans/humans/fantasy-chess-rpg-character-arthur-160647">https://assetstore.unity.com/packages/3d/characters/humans/humans/fantasy-chess-rpg-character-arthur-160647</a>	Male Hero with animations
	<a href="https://assetstore.unity.com/packages/2d/gui/fantasy-wooden-gui-free-103811">https://assetstore.unity.com/packages/2d/gui/fantasy-wooden-gui-free-103811</a>	Ui materials
	<a href="https://assetstore.unity.com/packages/3d/environments/nature-starter-kit-2-52977">https://assetstore.unity.com/packages/3d/environments/nature-starter-kit-2-52977</a>	Nature kit 3d
	<a href="https://assetstore.unity.com/packages/3d/characters/humans/fantasy/rpg-skeleton-35463">https://assetstore.unity.com/packages/3d/characters/humans/fantasy/rpg-skeleton-35463</a>	Skeleton 3d with animations
	<a href="https://assetstore.unity.com/packages/2d/gui/icons/basic-rpg-icons-181301">https://assetstore.unity.com/packages/2d/gui/icons/basic-rpg-icons-181301</a>	Basic rpg game icons

	<p><a href="https://assetstore.unity.com/packages/3d/environments/fantasy/fantasy-forest-environment-free-demo-35361">https://assetstore.unity.com/packages/3d/environments/fantasy/fantasy-forest-environment-free-demo-35361</a></p>	Trees/bush 3d prefabs
	<p><a href="https://assetstore.unity.com/packages/tools/version-control/github-for-unity-118069">https://assetstore.unity.com/packages/tools/version-control/github-for-unity-118069</a></p>	GitHub unity plugin
	<p><a href="https://assetstore.unity.com/packages/3d/animations/villager-animations-free-157920">https://assetstore.unity.com/packages/3d/animations/villager-animations-free-157920</a></p>	Villager animation pack :mining , fishing .... Works on humanoid unity rig.
	<p><a href="https://assetstore.unity.com/packages/vfx/particles/fire-explosions/fire-spell-effects-36825">https://assetstore.unity.com/packages/vfx/particles/fire-explosions/fire-spell-effects-36825</a></p>	Fire & Spell Effects
	<p><a href="https://assetstore.unity.com/packages/3d/characters/humanoids/character-elf-114445">https://assetstore.unity.com/packages/3d/characters/humanoids/character-elf-114445</a></p>	Character elf

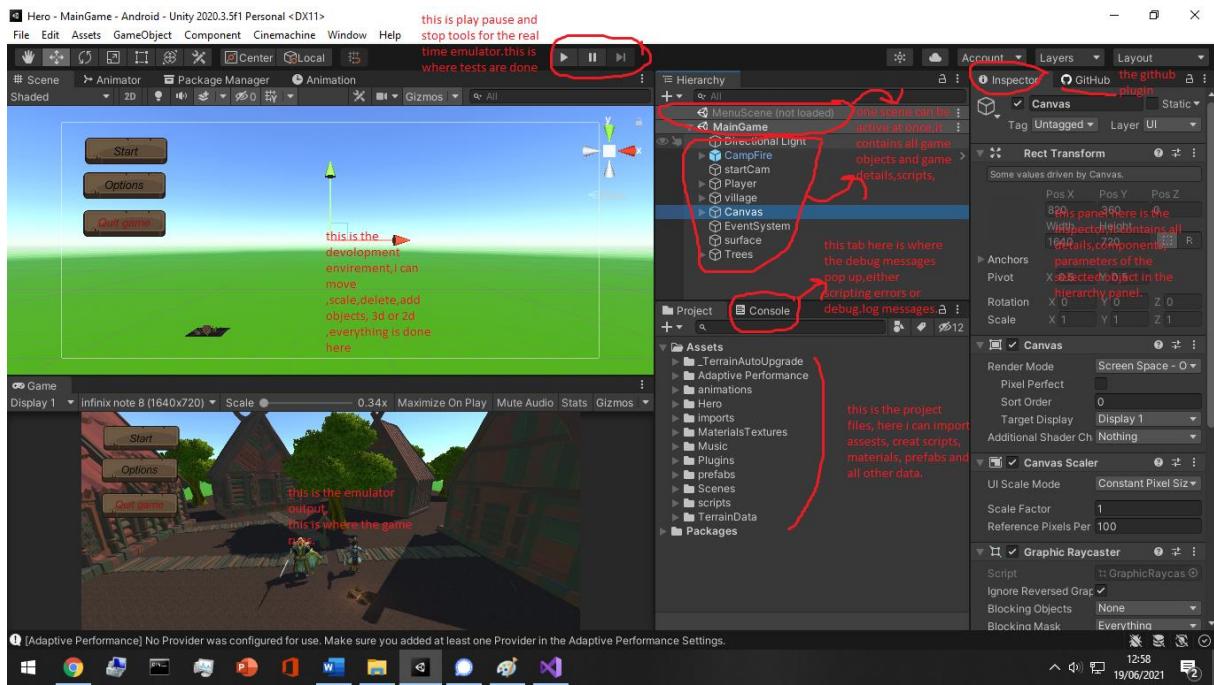
	<p><a href="https://assetstore.unity.com/packages/3d/characters/humans/humans/basic-bandit-89978">https://assetstore.unity.com/packages/3d/characters/humans/humans/basic-bandit-89978</a></p>	<p>Basic bandit character</p>
	<p><a href="https://assetstore.unity.com/packages/3d/animations/rpg-character-mecanim-animation-pack-free-65284">https://assetstore.unity.com/packages/3d/animations/rpg-character-mecanim-animation-pack-free-65284</a></p>	<p>RPG Character Mecanim Animations</p>
	<p><a href="https://assetstore.unity.com/packages/2d/textures-materials/nature/terrain-tools-sample-asset-pack-145808">https://assetstore.unity.com/packages/2d/textures-materials/nature/terrain-tools-sample-asset-pack-145808</a></p>	<p>Terrain Tools Sample Asset Pack</p>
	<p><a href="https://assetstore.unity.com/packages/3d/environments/landscapes/rpg-poly-pack-lite-148410">https://assetstore.unity.com/packages/3d/environments/landscapes/rpg-poly-pack-lite-148410</a></p>	<p>RPG Poly Pack - Lite</p>
	<p><a href="https://assetstore.unity.com/packages/audio/soundfx/footstep-snow-and-grass-90678">https://assetstore.unity.com/packages/audio/soundfx/footstep-snow-and-grass-90678</a></p>	<p>Footstep(Snow and Grass)</p>
	<p><a href="https://soundimage.org/fantasywonder/">https://soundimage.org/fantasywonder/</a></p>	<p>Royalty free music and SFX</p>

## 14. Initial BackLog: Sprints and tasks in priority order:

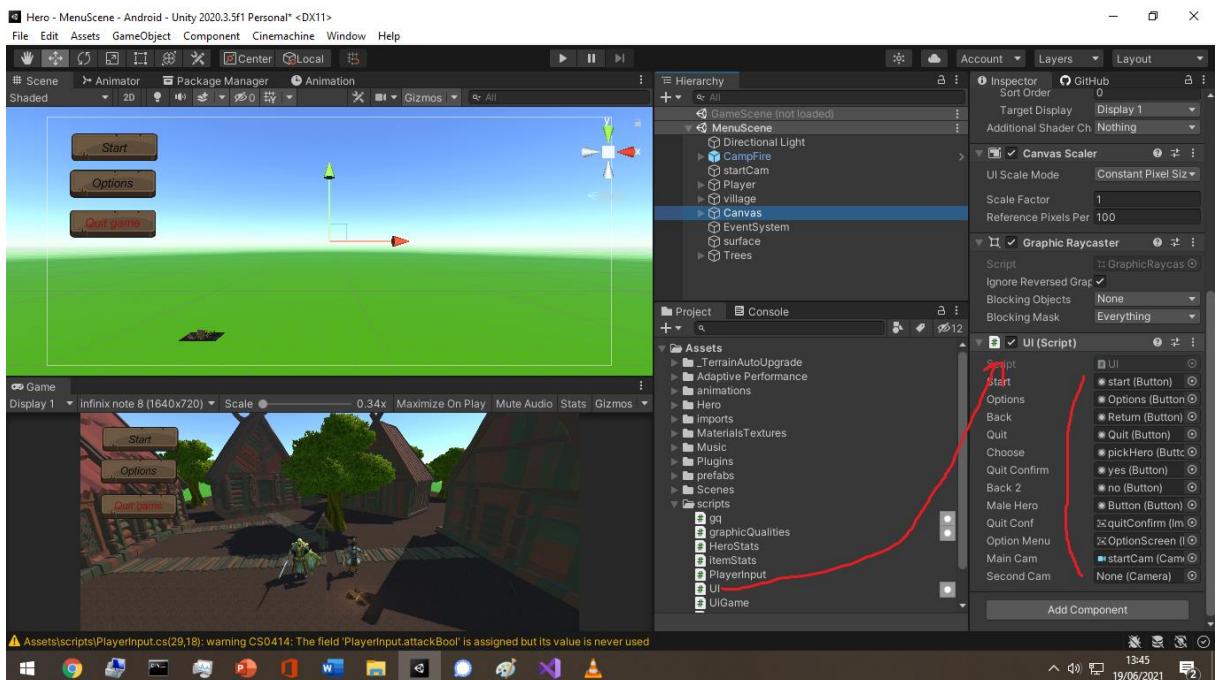
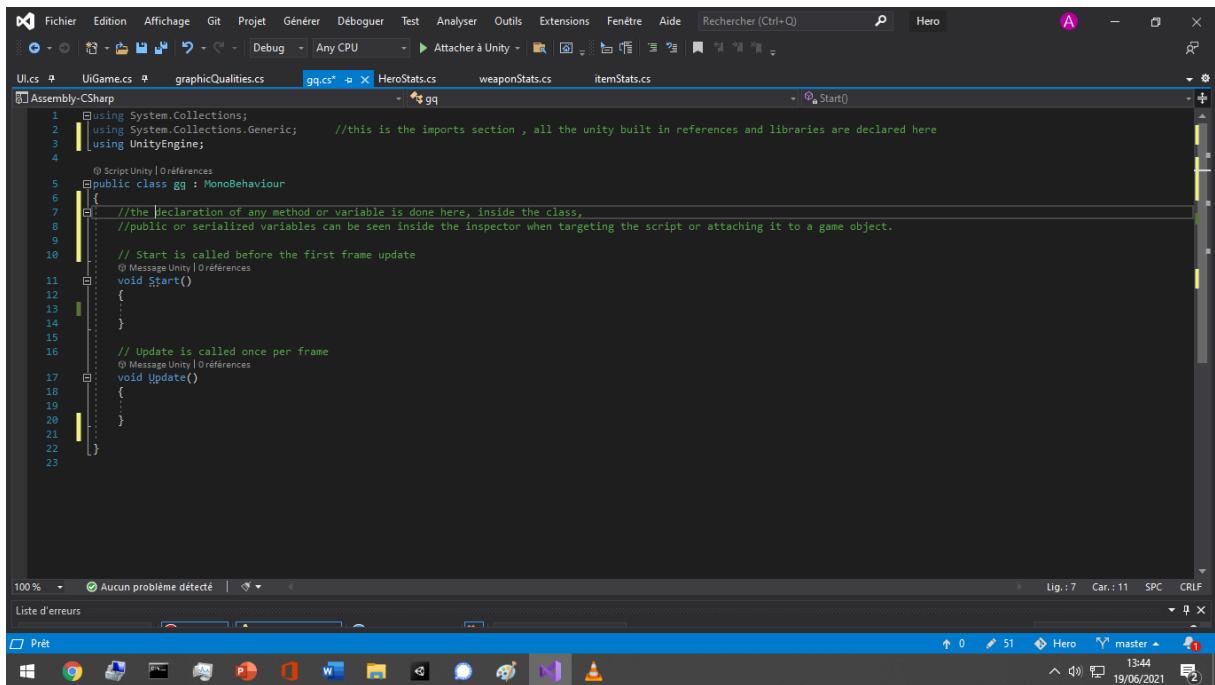
- UI: user interface, login/link interface (dead buttons), support, faq,
- Building initial map
- Graphic settings interface
- Inventory system
- Equip system
- Controls: player input, touch pad.
- Hero stats
- Villager npcs,quest system, and enemy skeletons.
- Environment details, map details.

## III. Production:

### 1. Introduction :unity editor



## 2. Introduction: Scripting with visual Studio

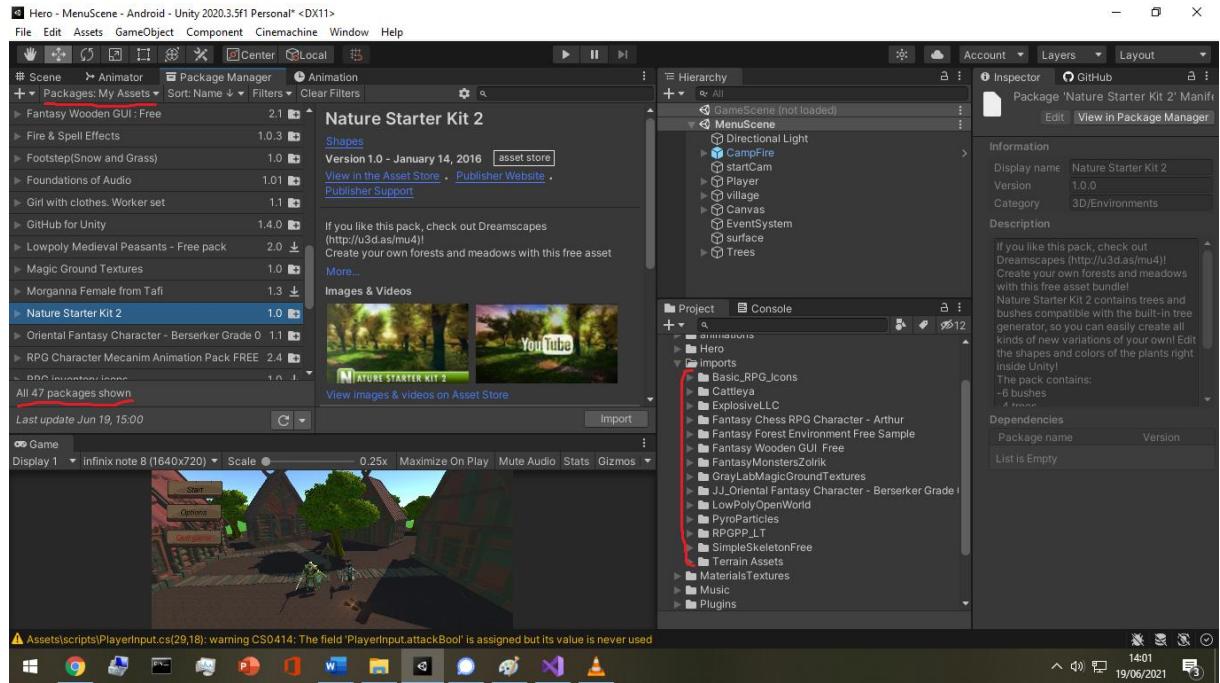


When declaring an object as a public variable inside a script, I need to drag and drop it in the inspector otherwise It gives a null pointer reference if I try to access an empty object.

Example of treatment on a text object : change it value, turn it to inactive state, change its parameters , all through scripting.

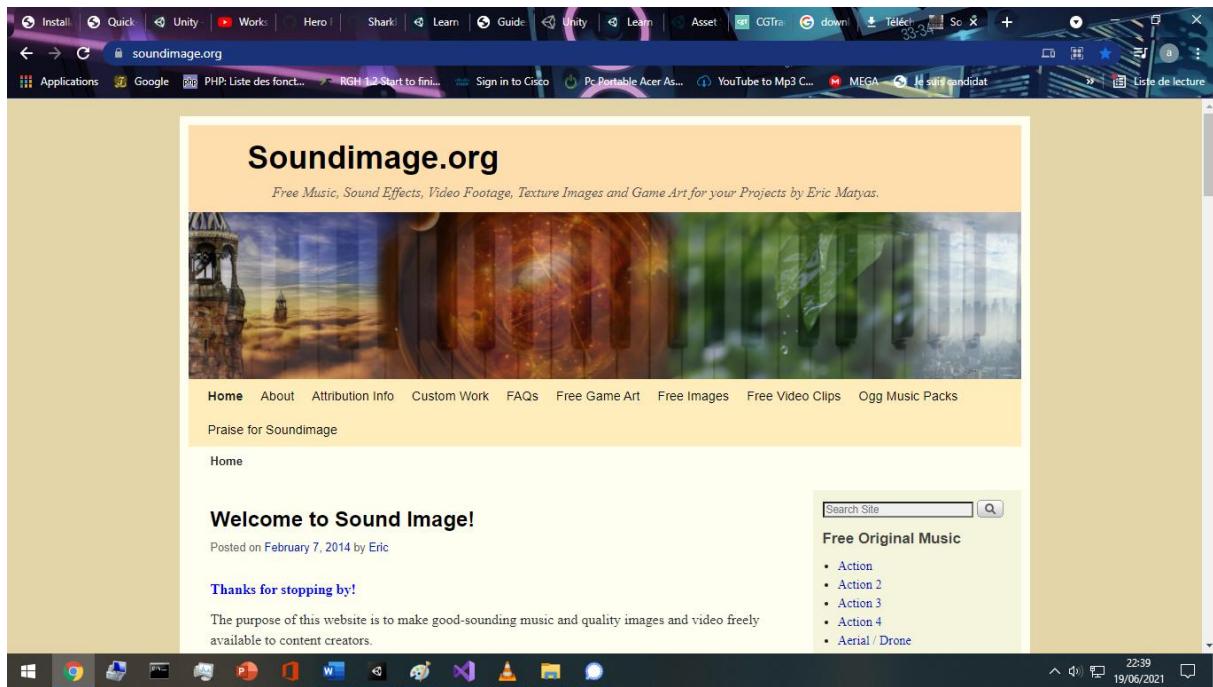
### 3. Assets: Package Manager

The built in unity 2020 packageManager can directly download and import assets from my owned assets related to my unity account.

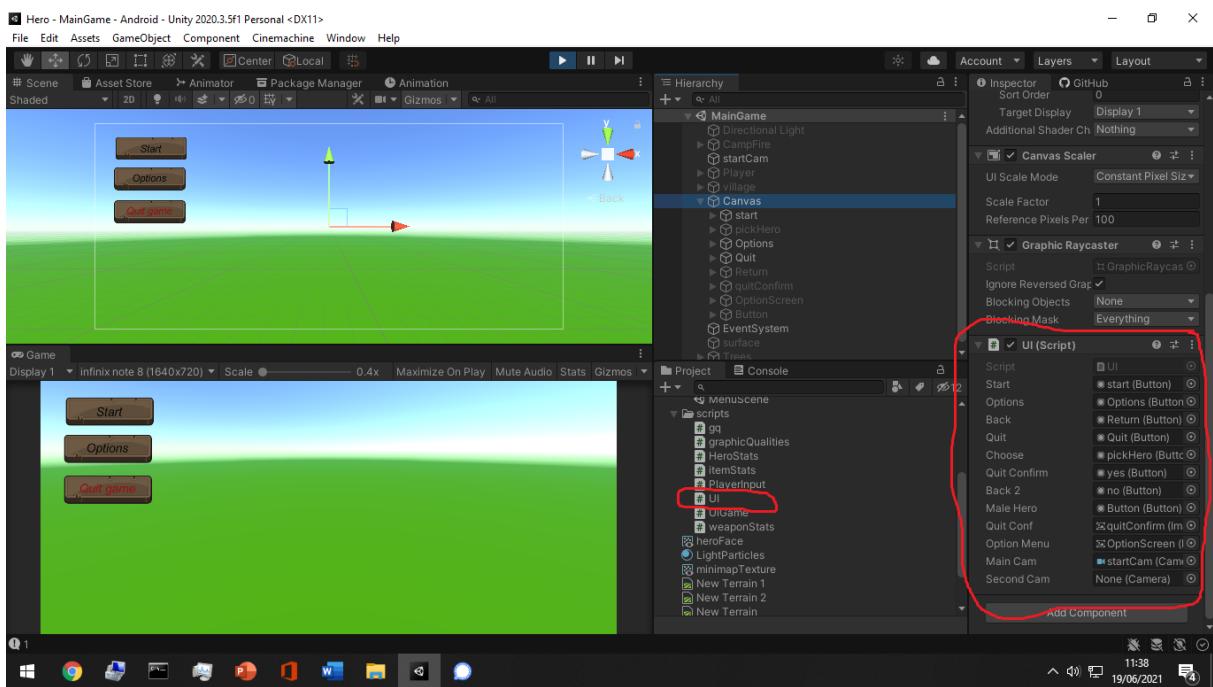


All assets are free to use commercially.

Exterior websites for other assets: <https://www.cgtrader.com/> <https://soundimage.org/>



#### 4. User Interface: The starting scene



all the **canvas** children are attached and declared in **its** script as variables to do what ever is needed along the scripting.

```

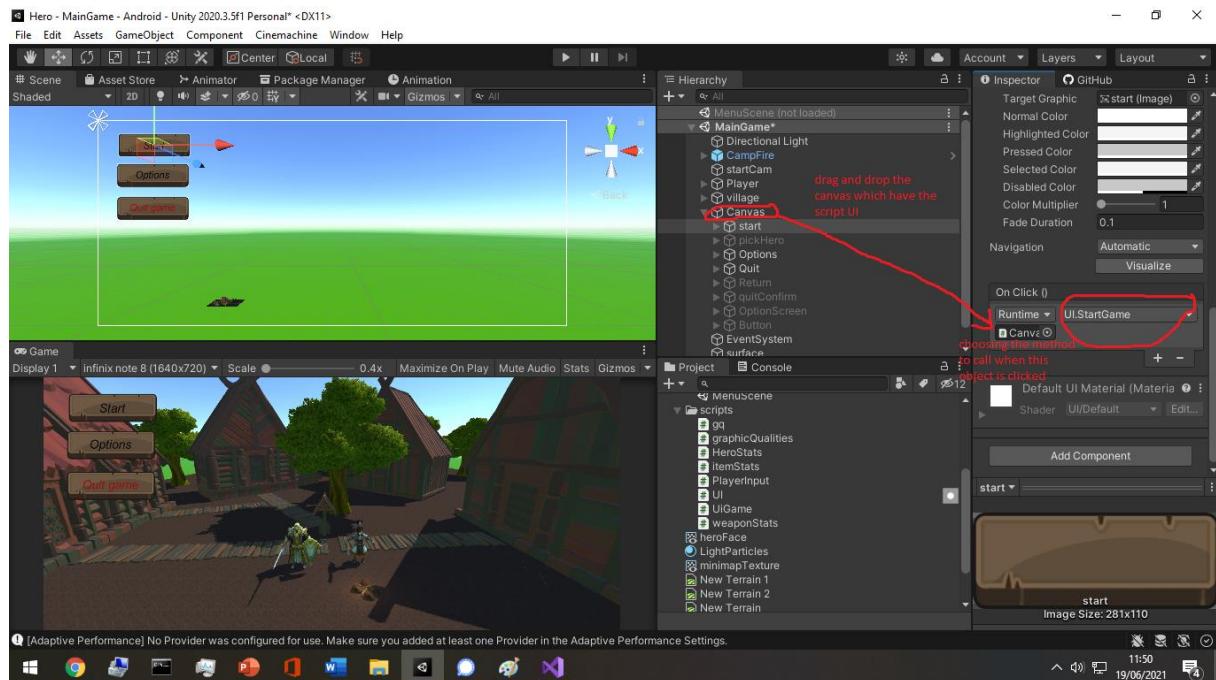
① Script Unity | 0 références
public class UI : MonoBehaviour
{
    3 références
    public static string Hero { get; set; }
    [SerializeField] Button start, options, back, quit, choose, quitConfirm, back2, maleHero;
    [SerializeField] Image quitConf,optionMenu;
    [SerializeField] Camera mainCam,secondCam;

    private bool startGameBo;
    private Transform posCamStart;
    // Start is called before the first frame update

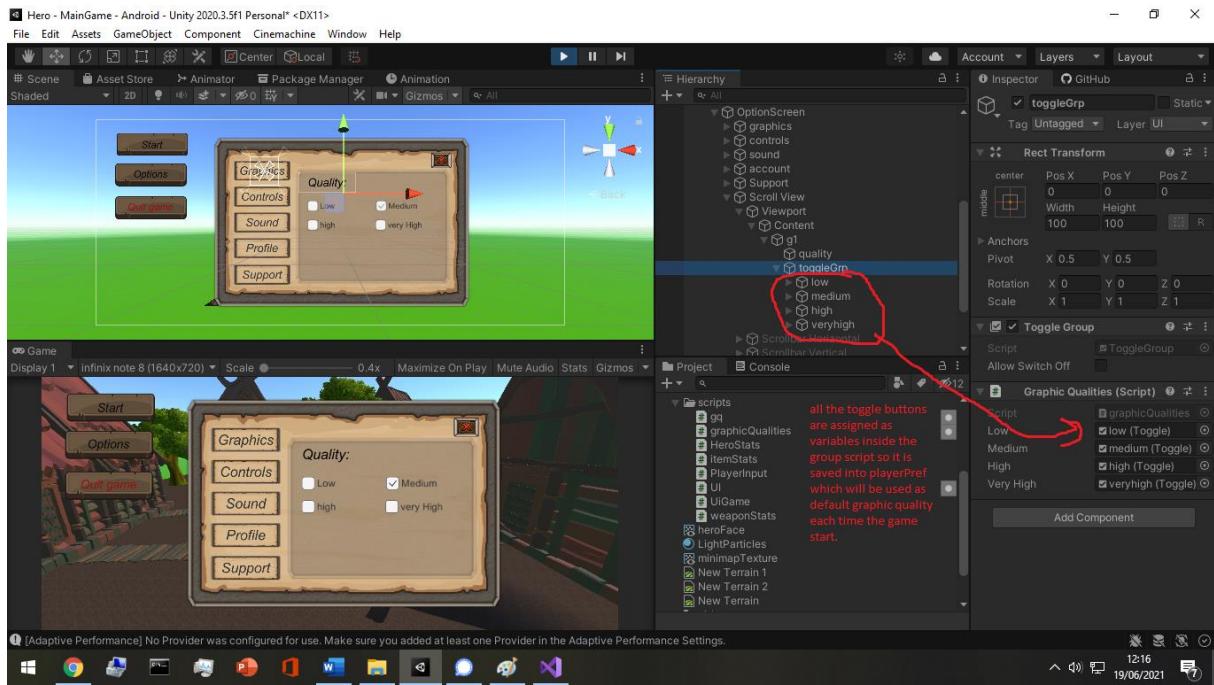
```

In the case of a button/image or any object that should start an event when triggered can extend the onclick events, or I can simply use the built in onclick trigger in the unity inspector.

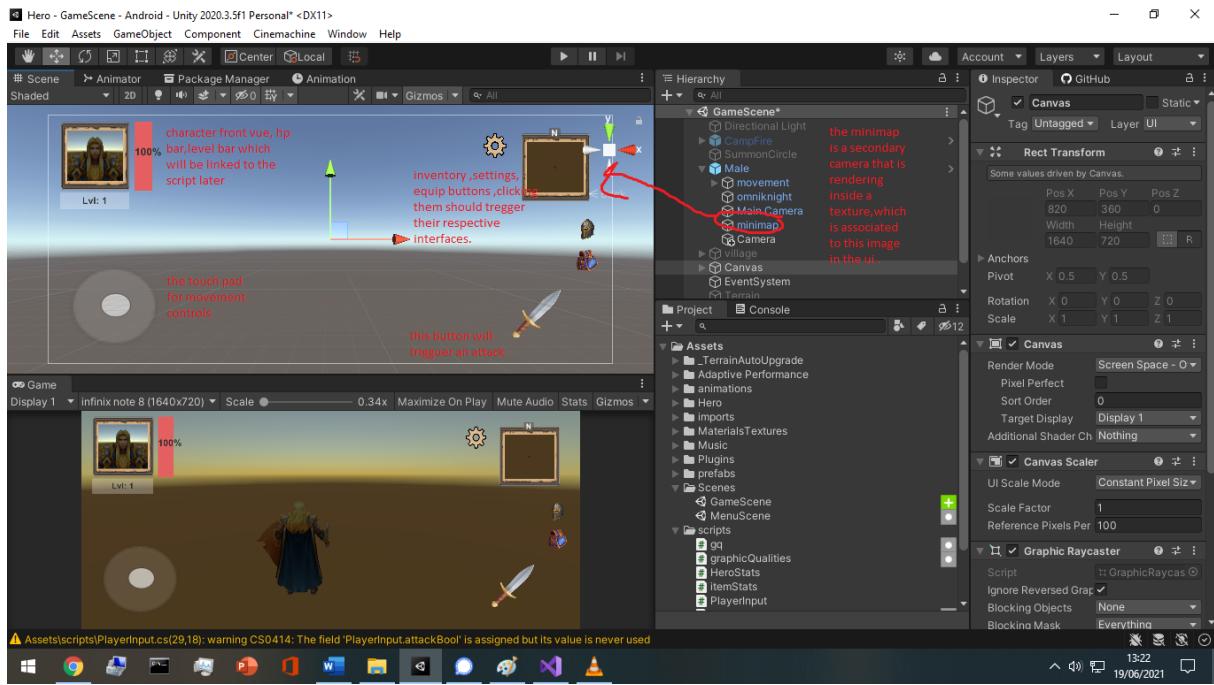
That's almost how ui objects event system works. All the treatments and the events are inside the called method in the onClick Panel.



As for saving the settings stats and players preferred settings, there exists a static class in unity named PlayerPrefs that can save data as a key-value pairs. and this is almost the same concept for every other settings.



## 5. User Interface: The game scene



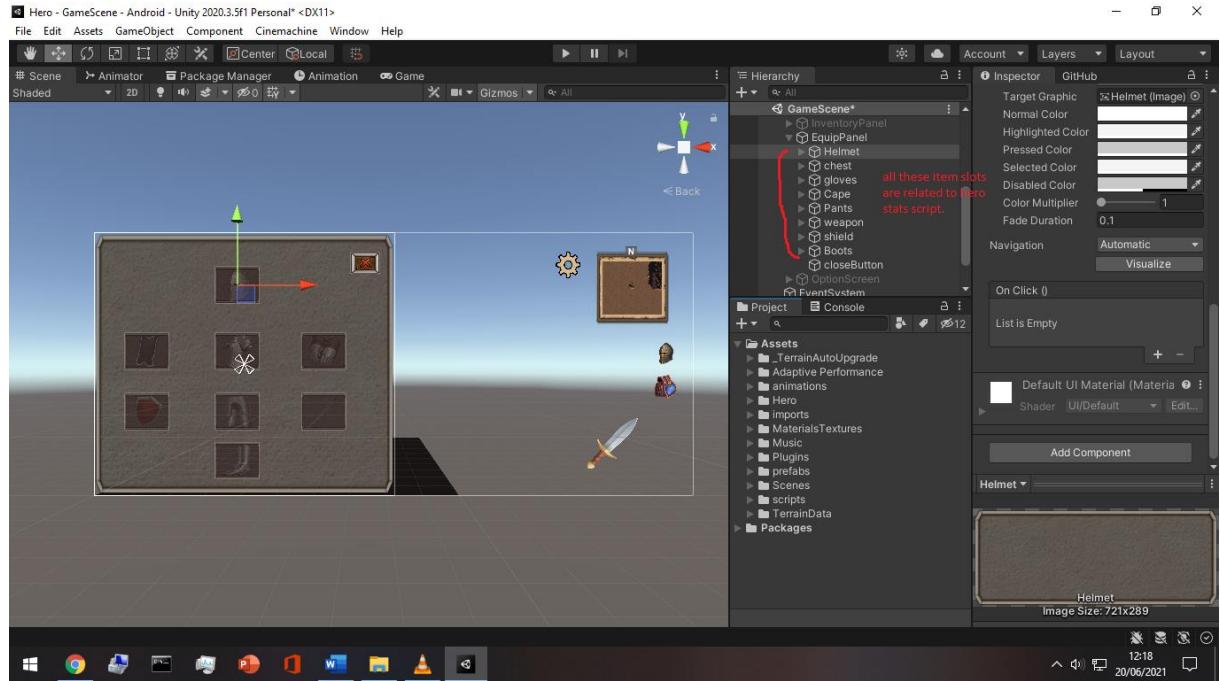
When building ui interface, I found that the order in the hierarchy matters a lot since ui objects in the upper order are rendered on top of the lower level ones.

The input key "escape" is the same as the android return button , so I need to implement this input in order to interact with the interface as well.

The input system should always be in the update() method in a script.

Update() is called every frame, and every device screen have a frame rate and is calculated as fps (frame per second). A frame is simply an image.

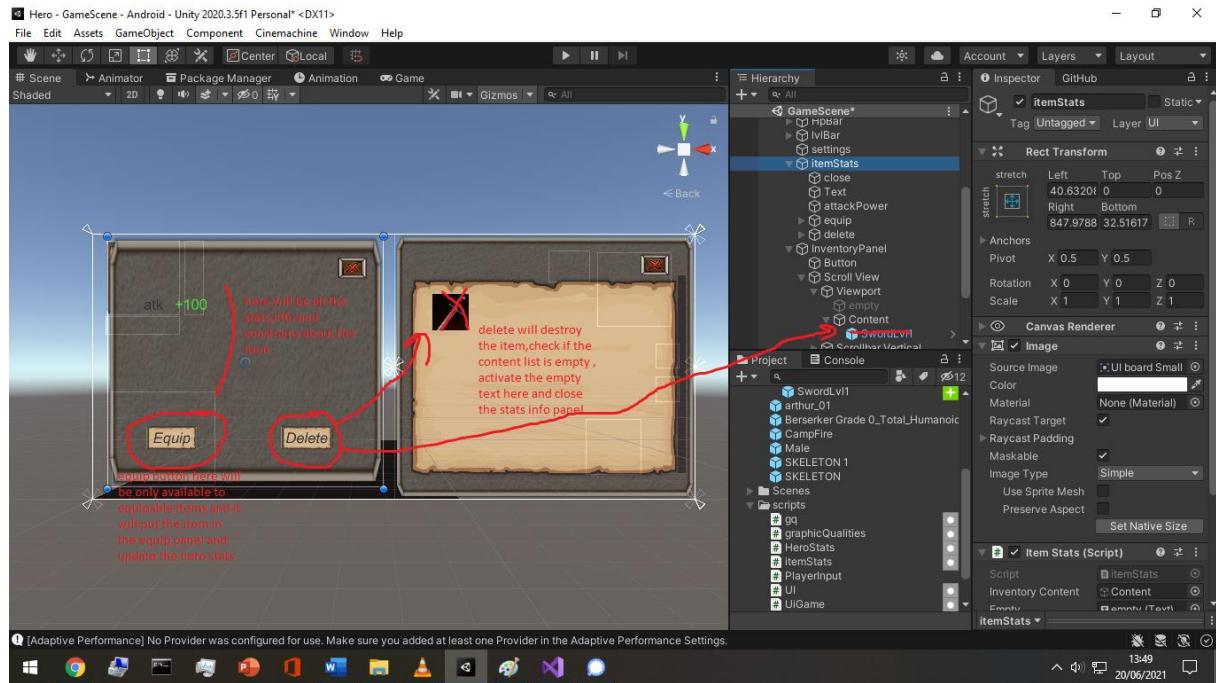
## 6. Inventory/equip system:



An item is built with a ui button interface, it has an icon and on click, it shows its stats in a panel. This is what we call in Unity, a prefab. Here an example of a sword level 1 with 100 attack power and ready for adding more stats and other info and constraints.

The text for UI elements and text meshes can incorporate multiple font styles and sizes. Rich text is supported both for the UI System and the legacy GUI system. The Text, GUIStyle, GUIText and TextMeshPro classes have a Rich Text setting which instructs Unity to look for

markup tags within the text.



Here is an example pf script.

```

23 public void ItemStats()
24 {
25
26     GameObject.Find("Canvas").GetComponent<UiGame>().ItemStatsOn();
27     GameObject.Find("itemStats").GetComponent<itemStats>().item = this.GetComponent<Button>();
28     atck = GameObject.Find("attackPower").GetComponent<Text>();
29
30     atck.text = "+" + attackPower.ToString();
31 }
32
33

```

This method is called when the item is clicked on and this is where the item stats will be transferred to the item stats panel on the left side.

```

36     Oréférences
37     public void DestroyItem()
38     {
39         Destroy(item.gameObject);
40         if (inventoryContent.transform.childCount == 1) empty.gameObject.SetActive(true);
41         this.gameObject.SetActive(false);
42     }
43

```

void GameObject.SetActive(bool value)  
ActivatesDeactivates the GameObject, depending on the given true or false/ value.

This is called when the destroy item is clicked.

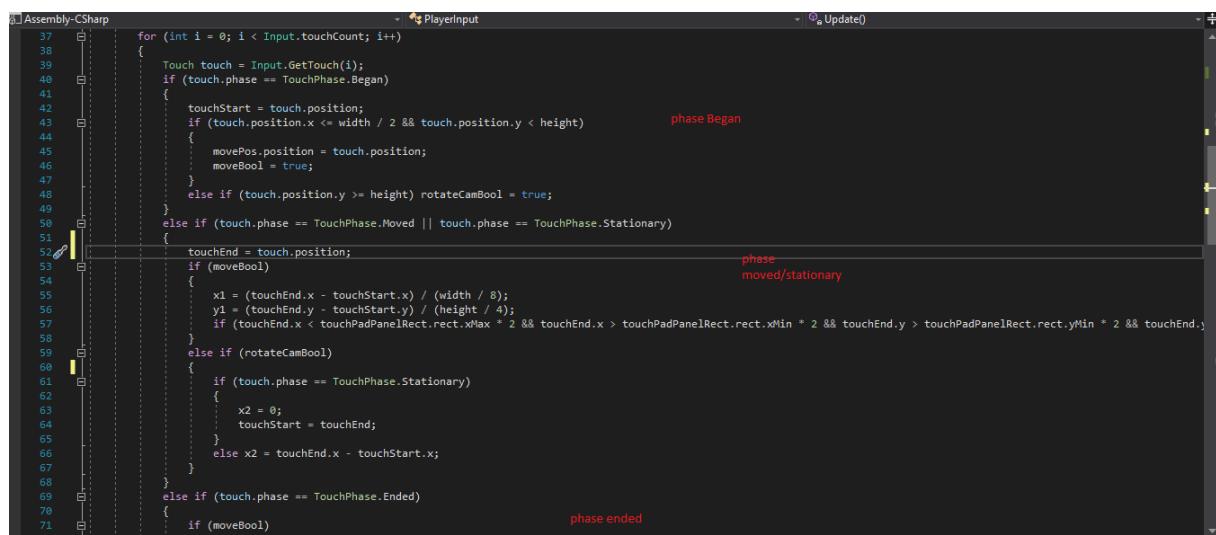
## 7. Touch input for smartphones:

Smartphone devices are capable of tracking up to five fingers touching the screen simultaneously. You can retrieve the status of each finger touching the screen during the last frame by accessing the [Input.touches](#) property array.

The most important property parts are the position, id, and the phase.

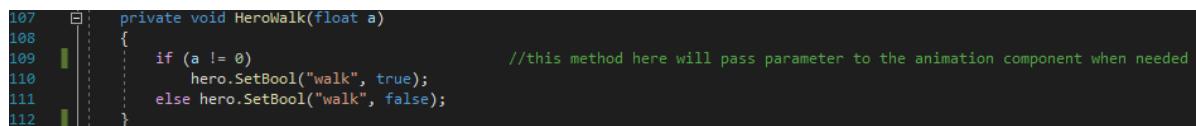
The phase have 5 states: Began, Moved, Stationary, ended and canceled.

## 8. Player Input:

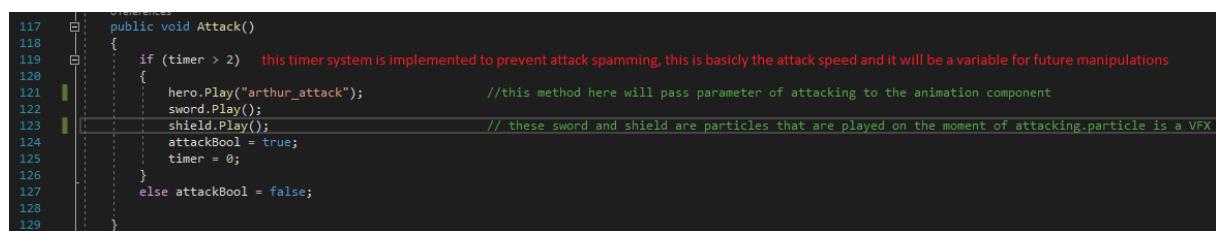


```
Assembly-CSharp
 37   for (int i = 0; i < Input.touchCount; i++)
 38   {
 39     Touch touch = Input.GetTouch(i);
 40     if (touch.phase == TouchPhase.Began)
 41     {
 42       touchStart = touch.position;
 43       if (touch.position.x <= width / 2 && touch.position.y < height)           phase Began
 44       {
 45         movePos.position = touch.position;
 46         moveBool = true;
 47       }
 48       else if (touch.position.y >= height) rotateCamBool = true;
 49     }
 50     else if (touch.phase == TouchPhase.Moved || touch.phase == TouchPhase.Stationary)
 51     {
 52       touchEnd = touch.position;
 53       if (moveBool)
 54       {
 55         x1 = (touchEnd.x - touchStart.x) / (width / 8);
 56         y1 = (touchEnd.y - touchStart.y) / (height / 4);
 57         if (touchEnd.x < touchPadPanelRect.rect.xMax * 2 && touchEnd.x > touchPadPanelRect.rect.xMin * 2 && touchEnd.y > touchPadPanelRect.rect.yMin * 2 && touchEnd.y < touchPadPanelRect.rect.yMax * 2)           phase
 58         {
 59           if (rotateCamBool)
 60           {
 61             if (touch.phase == TouchPhase.Stationary)
 62             {
 63               x2 = 0;
 64               touchStart = touchEnd;
 65             }
 66             else x2 = touchEnd.x - touchStart.x;
 67           }
 68         }
 69       }
 70       else if (touch.phase == TouchPhase.Ended)
 71       {
 72         if (moveBool)           moved/stationary
 73       }
 74     }
 75   }
 76 }
```

When dealing with player moving object, animations and FX either visual or sound.



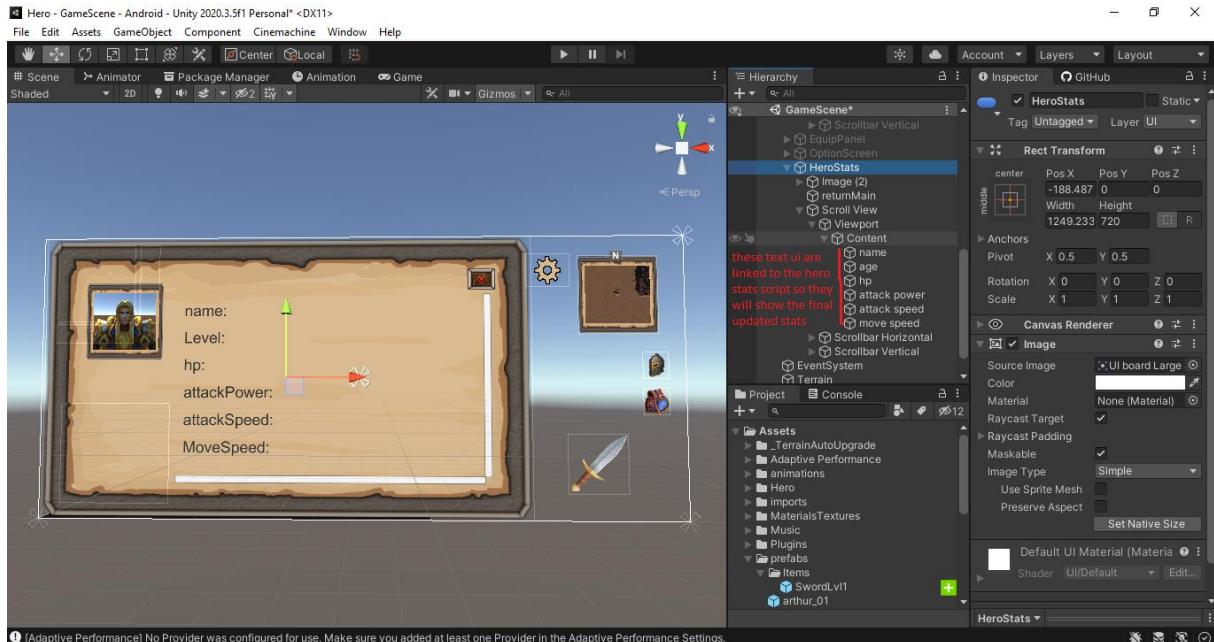
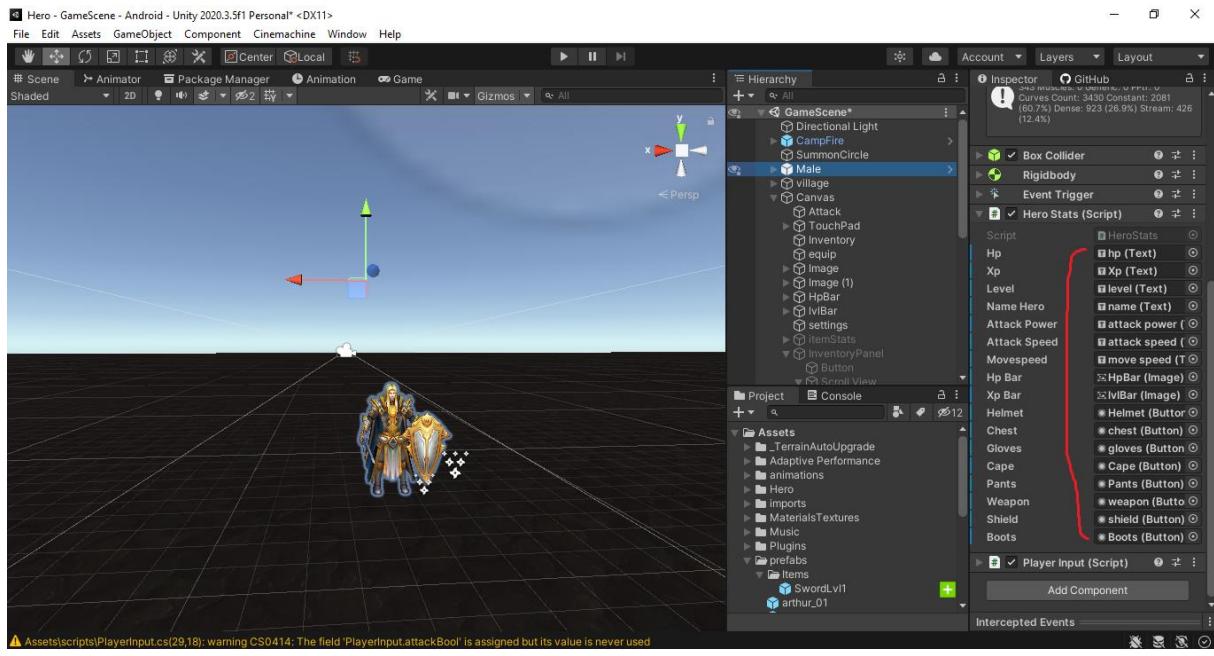
```
107   private void HeroWalk(float a)
108   {
109     if (a != 0)           //this method here will pass parameter to the animation component when needed
110     hero.SetBool("walk", true);
111     else hero.SetBool("walk", false);
112   }
```



```
117   public void Attack()
118   {
119     if (timer > 2)      this timer system is implemented to prevent attack spamming, this is basicly the attack speed and it will be a variable for future manipulations
120     {
121       hero.Play("arthur_attack");           //this method here will pass parameter of attacking to the animation component
122       sword.Play();
123       shield.Play();                     // these sword and shield are particles that are played on the moment of attacking.particle is a VFX
124       attackBool = true;
125       timer = 0;
126     }
127     else attackBool = false;
128   }
129 }
```

## 9. Hero stats:

The hero object will have heroStats script attached to it and from there all ui texts will be referenced here.



## 10. Unity Mechanim:

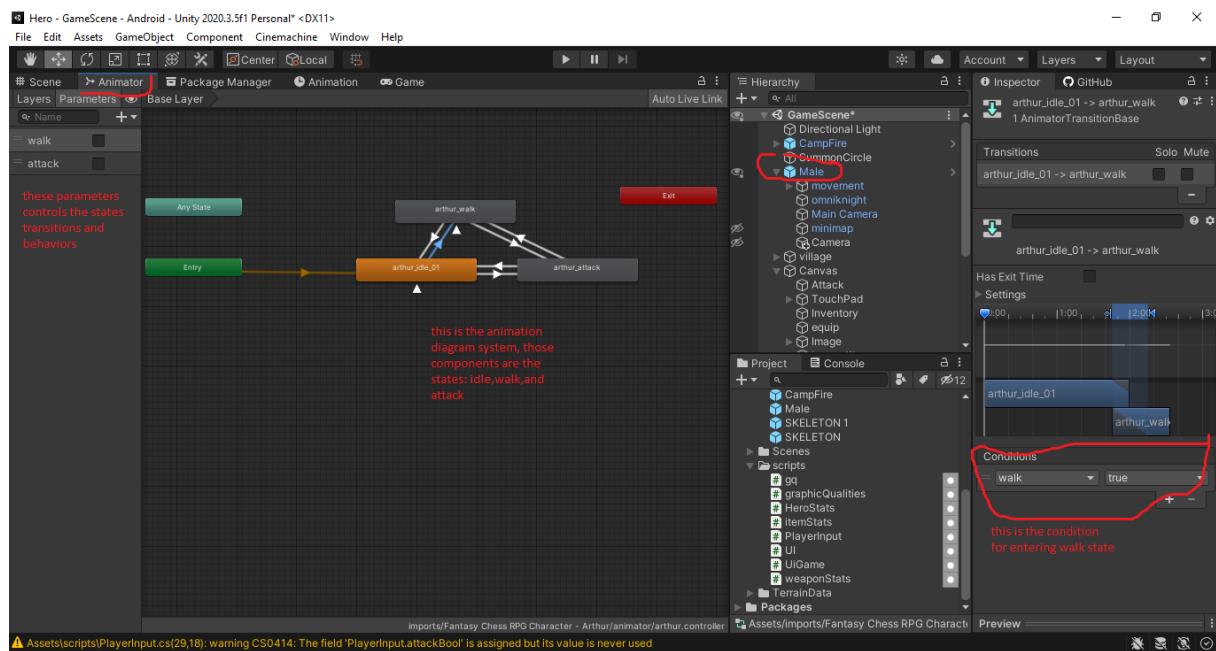
Unity has a rich and sophisticated animation system called Mecanim. Mecanim provides:

- Easy workflow and setup of animations on humanoid characters.
- Animation retargeting - the ability to apply animations from one character model onto another.
- Simplified workflow for aligning animation clips.

- Convenient preview of animation clips, transitions and interactions between them. This allows animators to work more independently of programmers, prototype and preview their animations before gameplay code is hooked in.
- Management of complex interactions between animations with a visual programming tool.
- Animating different body parts with different logic.

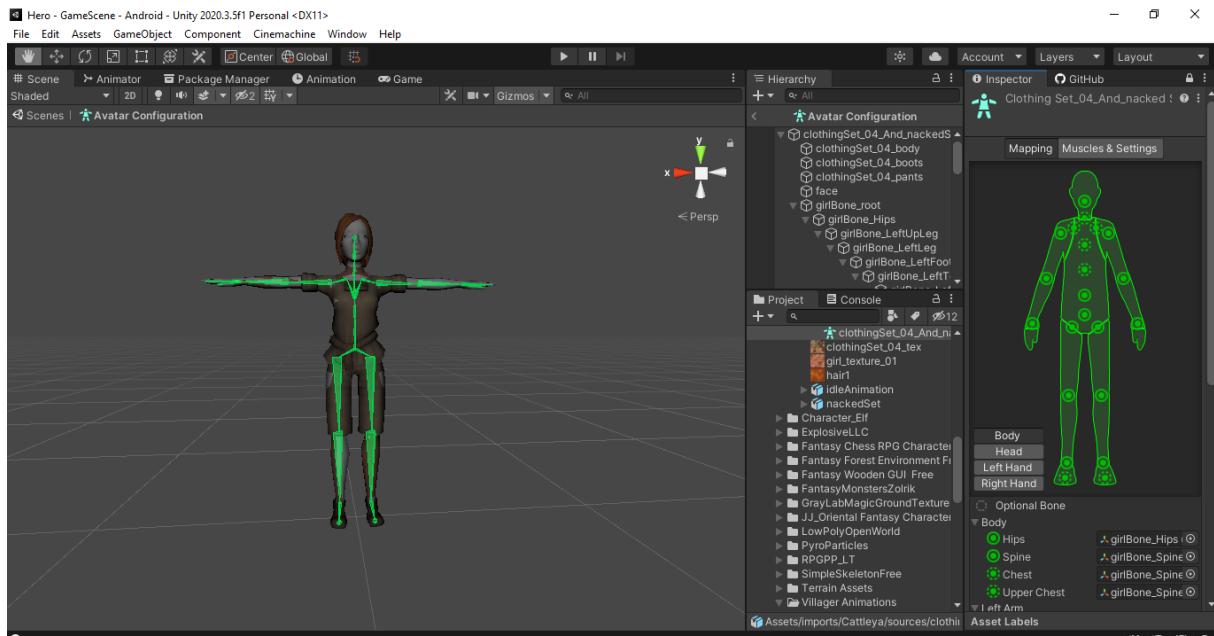
## 11. Unity Rigging:

The Animation **Rigging** package for **Unity** enables users to set up procedural motion on animated skeletons at runtime. This makes it possible to do powerful things during gameplay such as world interactions, skeletal deformation **rigging**, and physics-based secondary motion. Most of the free assets are “rigged” and ready for mechanim.

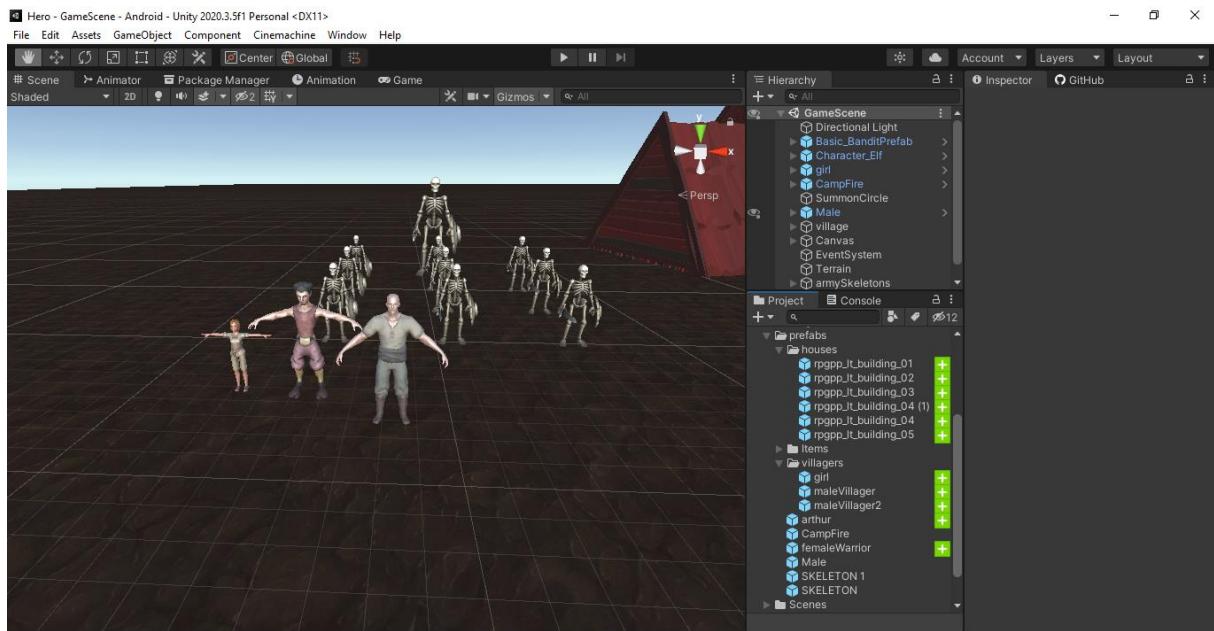


This is unity Mecanim tool for controlling animation flow.

And this one below for rigged humanoid characters.

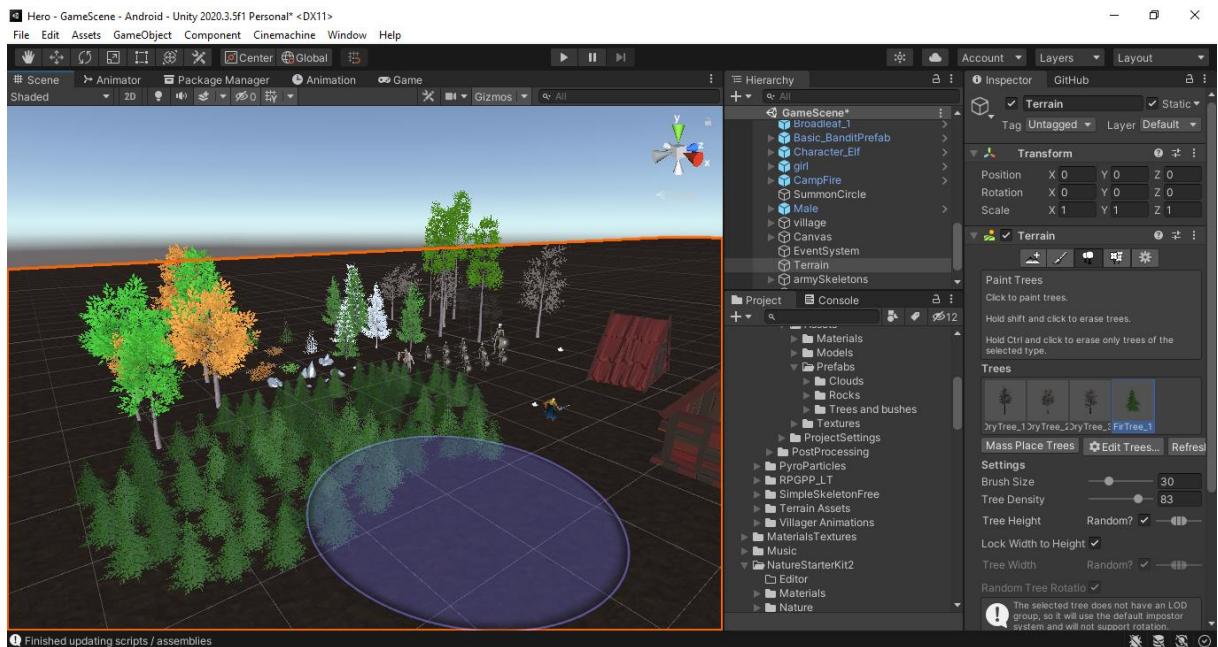
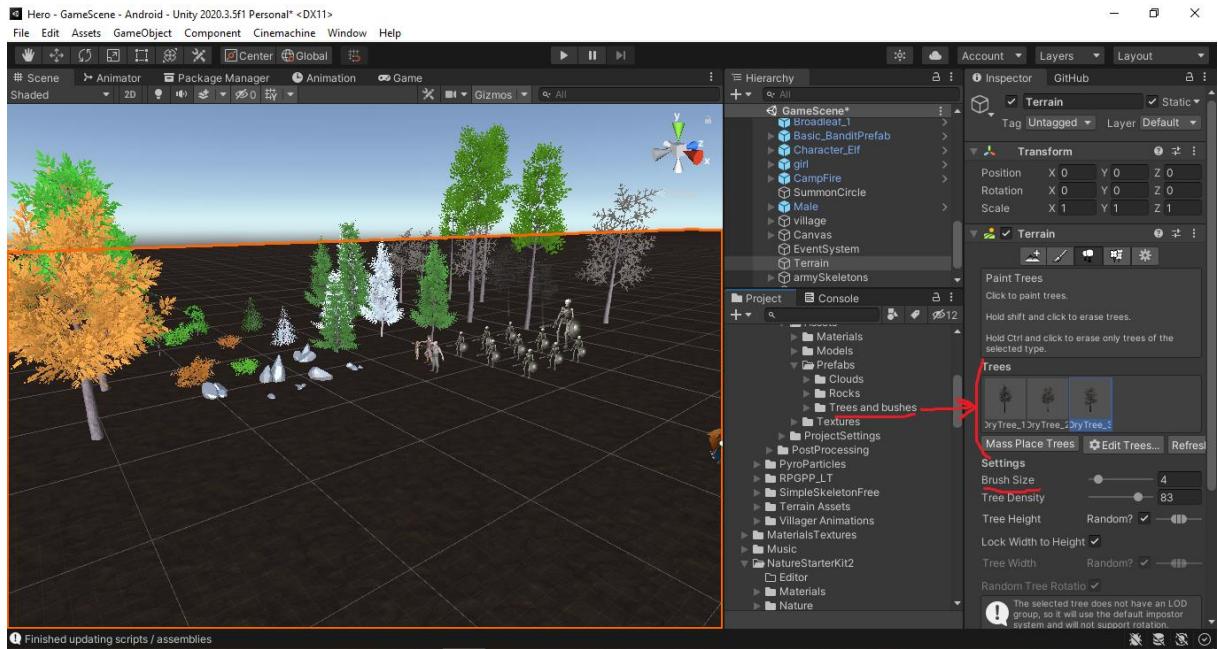


## 12. NPC prefabs:



Unity's Prefab system allows you to create, configure, and store a GameObject complete with all its components, property values, and child GameObjects as a reusable Asset. The Prefab Asset acts as a template from which you can create new Prefab instances in the **Scene**.

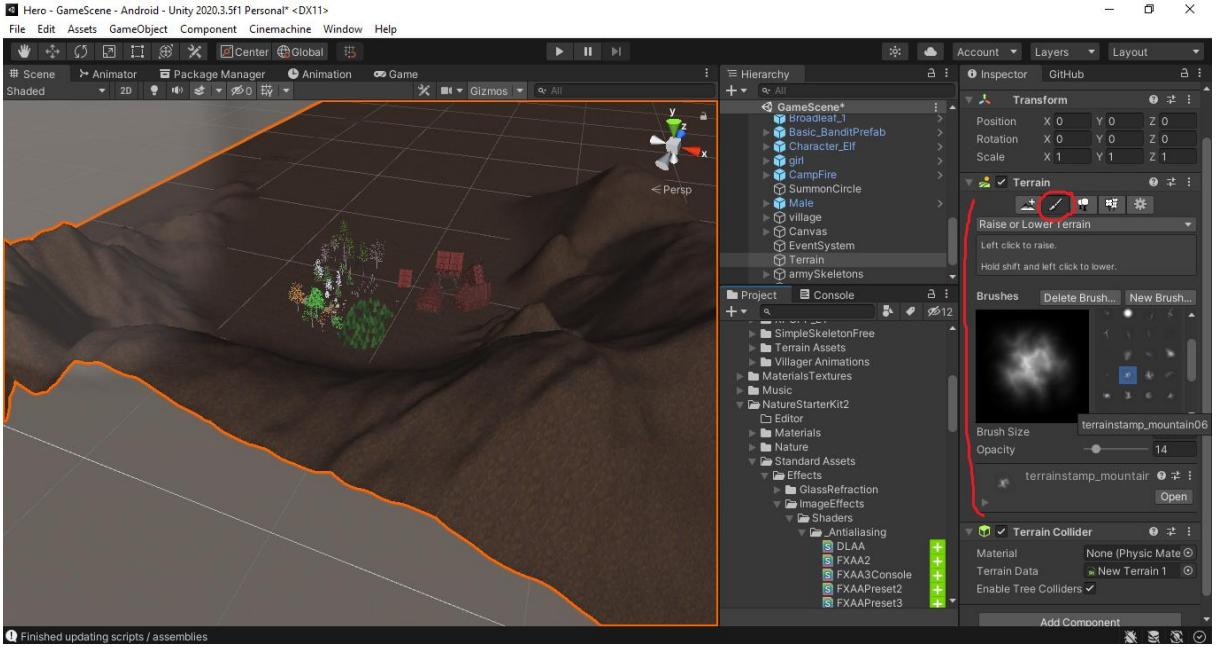
### 13. Terrain building tools:



The terrain tool panel makes building terrain vegetation very quick with the use of a brush that have a dynamic size from 1 tree to hundreds.

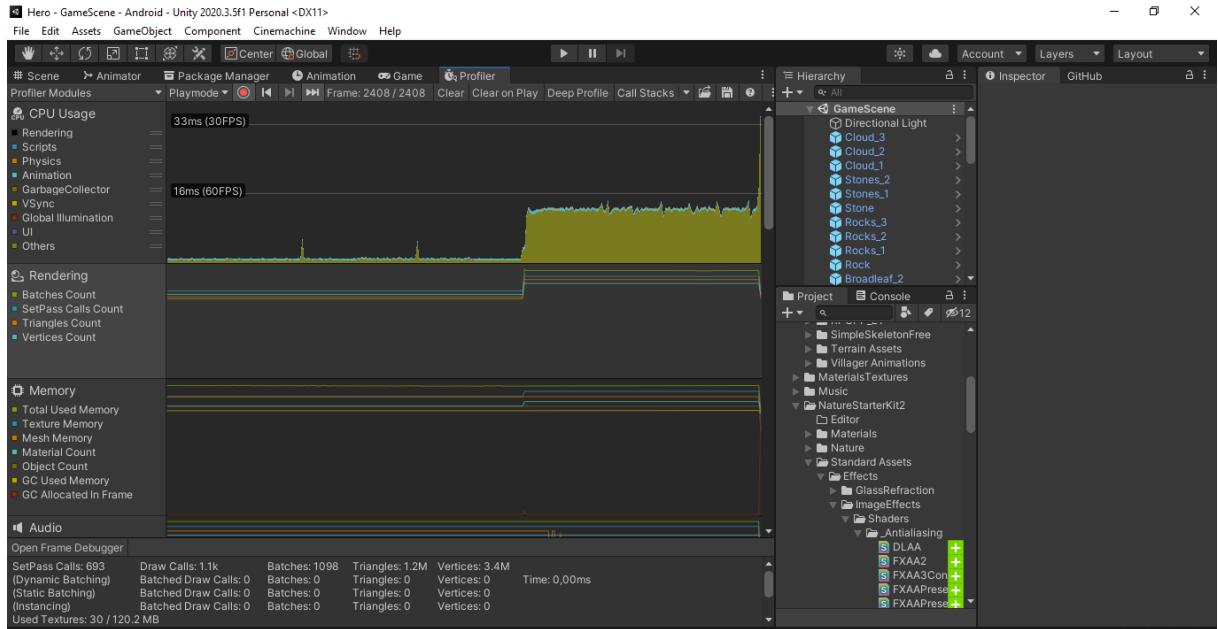
There is also the terrain painting:

- Raise or lower terrain to build rivers, mountains,hills.
- Paint holes(remove part from terrain).
- Paint textures (dirt,snow...).



## IV. Post-production:

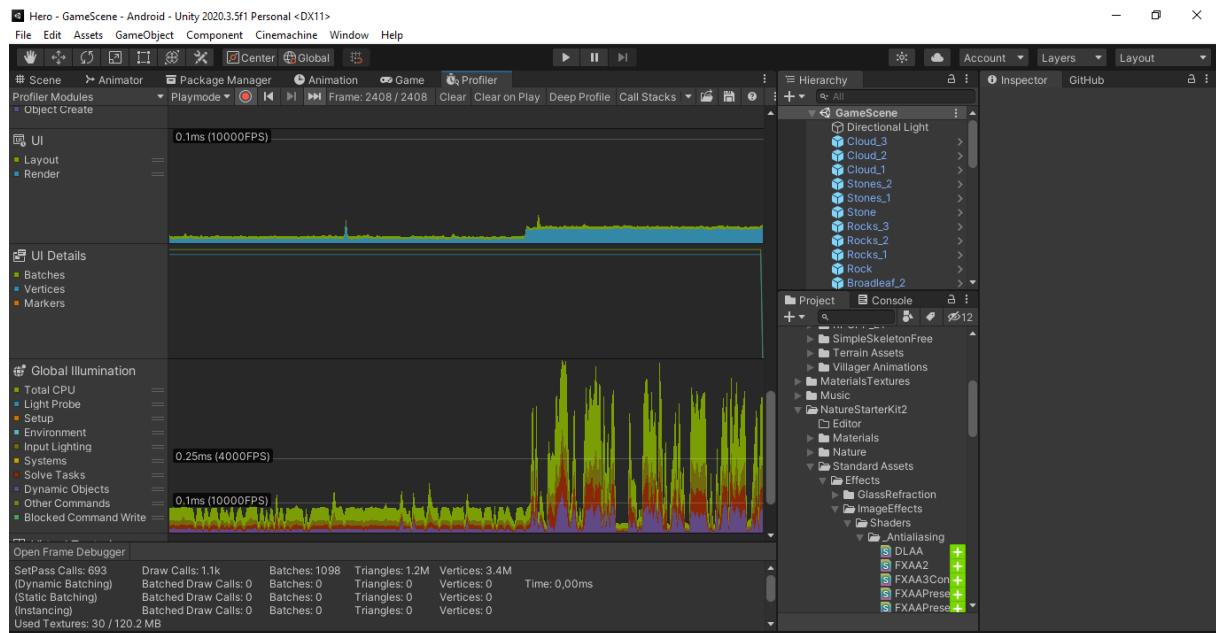
### 1. Unity Profiler:



The Unity Profiler is a tool you can use to get performance information about your application. You can connect it to devices on your network or devices connected to your machine to test how your application runs on your intended release platform.

You can also run it in the Editor to get an overview of resource allocation while you're developing your application.

The Profiler gathers and displays data on the performance of your application in areas such as the CPU, memory, renderer, and audio. It's a useful tool to identify areas for performance improvement in your application, and iterate on those areas. You can pinpoint things like how your code, assets, scene settings, camera rendering, and build settings affect your application's performance. It displays the results in a series of charts, so you can visualize where spikes in your application's performance happen.



## 2. Optimisation and code review:

When developing, optimization should come naturally while coding, here are some tips for RPG kind of games:

- Reduce the music/audios format to keep it light.
- Compress/reuse textures.
- Remove unused assets items.
- Smaller games are faster to download and require less data on initial install, and eventually higher install conversions. Texture compression formats.
- Reduce events number in a scene.
- Reduce/re-use effect plugins (lightning, sounds, particles [or anything that includes "advanced" physics], etc.).
- Support 64-bits architectures.

- Use unity profiler and analyze game performance/requirements.
- Clean code.
- Always add comments.
- Keep it simple.
- Static batching (static objects reduce hugely resource consumption, so whenever an object doesn't move, make it static).
- Dynamic batching (combine meshes ).
- Culling to limit what's rendering (Imagine standing in front of a door and still rendering all objects behind that door. This is where Occlusion Culling comes in).
- Reducing physics computing (It's important to note that having too many Rigidbody objects within your game will affect performance negatively.)
- Object Pooling(Pooling commonly used objects allows you to reuse them over and over again without destroying them).
- Coroutines/update(update will happen every frame, so coroutines sometimes reduce a lot of work).
- Caching Components(for example Don't use GetComponent multiple times in a method when you can cache it once and use that variable throughout the script.).
- Better to manually assign objects in the script component then using the gameObject.find().
- if you're not using something, turn it off.
- in general you should use the minimum amount of lights necessary to achieve your desired style.
- Enable Instancing option within unity.

### 3. Bug fixing and polishing the art state:

## V. Operations:

## VI. Conclusion: