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Glitch Garden Slides

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Welcome To Glitch Garden

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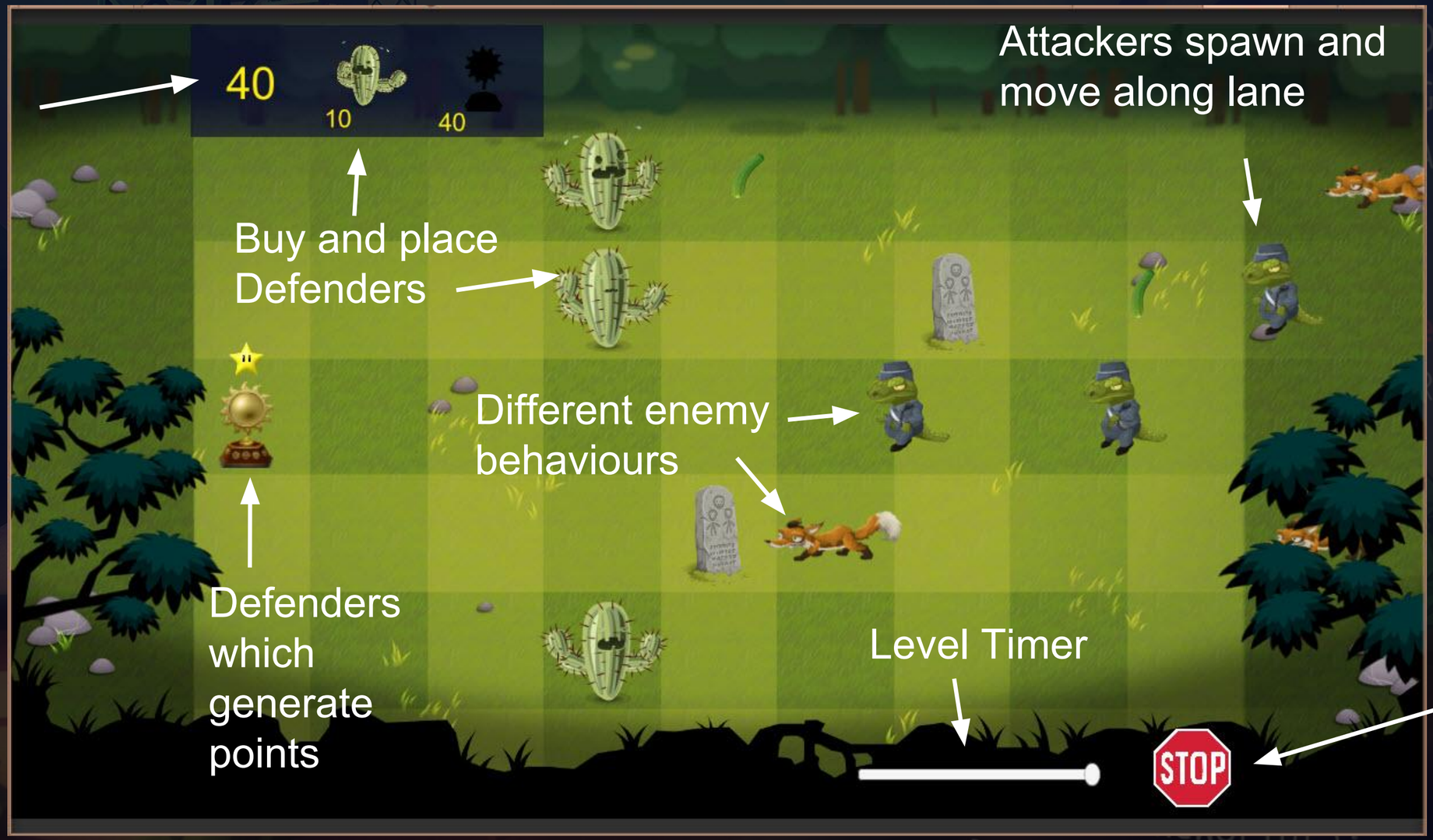
Glitch Garden Game Design

Gameplay Screen

Resource system - earn and spend points



Our Core Game Design

Player Experience:

Strategic thinking

Core Mechanic:

Place defenders to stop attackers

Theme:

Garden

Core game loop:

Kill all the attackers to progress to the next level.

Your Game Theme And Assets

- Use my assets or find your own?
- If your own, find your assets now. You'll need:
  - Background setting for the battle to take place
  - Defenders with sprite sheet animations
    - Idle and attack animations
  - Attackers with sprite sheet animations
    - Idle, attack and jump animations

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Make A Splash Screen

Load Start From Splash

- Create a Level Loader Game Object and script
- From Splash scene, load the Start scene automatically with a 3 second delay
- HINT: Coroutine!

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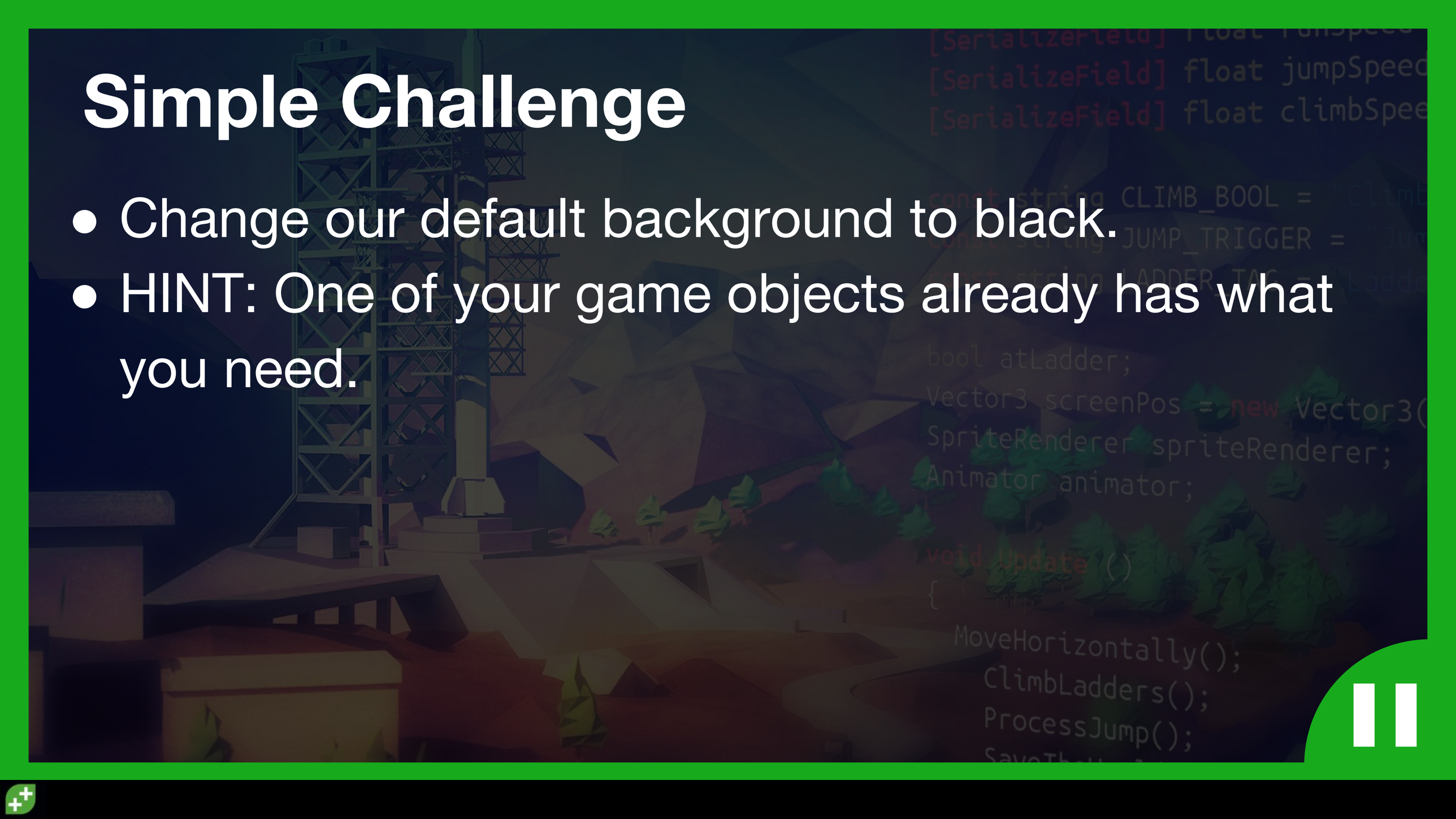
Scaling & Aspect Ratios

Simple Challenge

- Change our default background to black.
- HINT: One of your game objects already has what you need.



Second Challenge

- Anchor your Start Menu text so that it is always close to the right of the screen.

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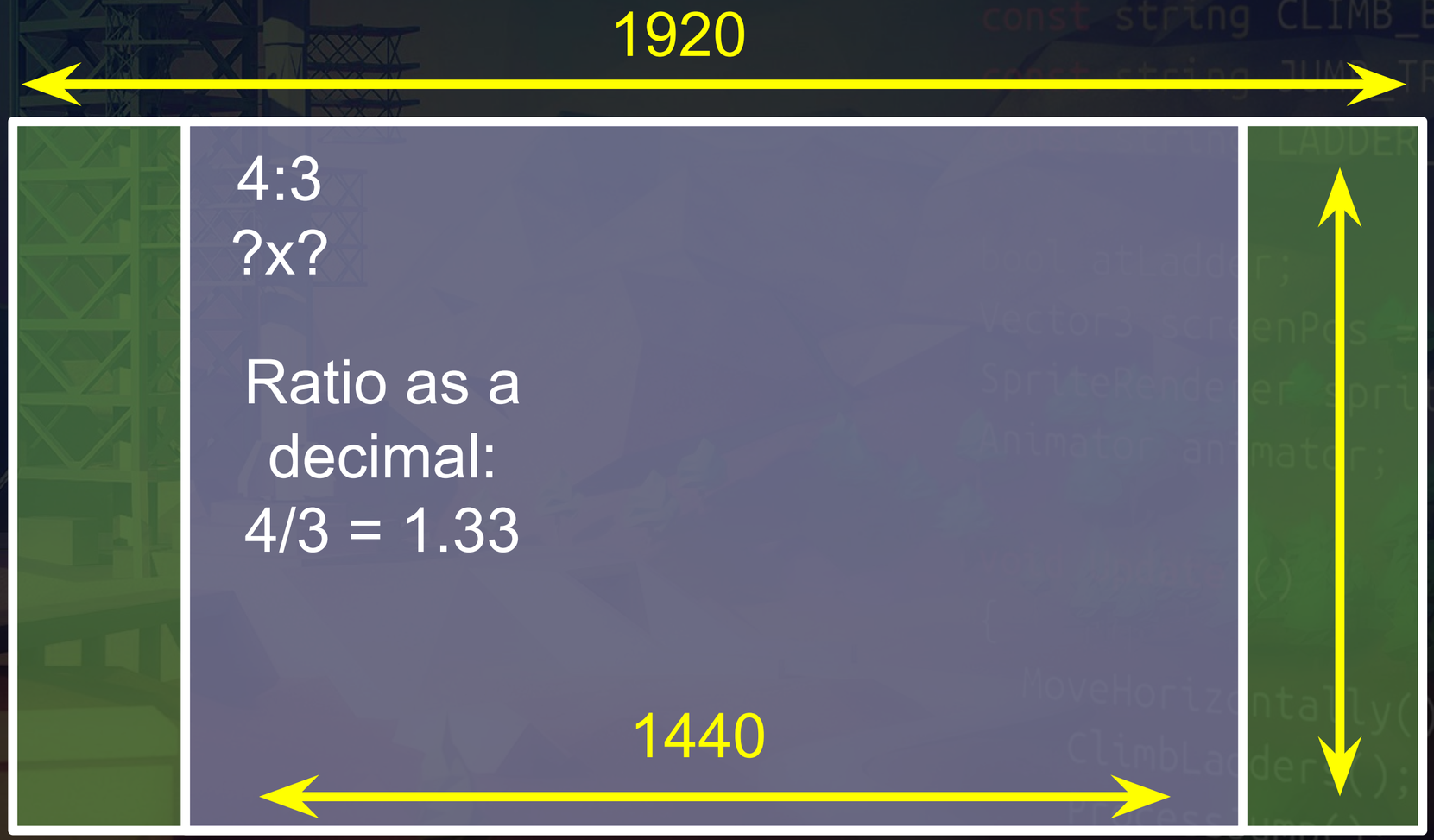
Set Up Background Playspace

Gameplay Screen

Calculating Safe Zone

16:9
1920x1080

Ratio as a decimal:
16/9 = 1.77



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World Space Canvas Mode

World Scale Canvas

- 1 grass square = 1 world unit
- Our canvas width is 1920 pixels
- Our squares are 160 x 160 pixels
- Number of squares = 1920/160 = 12
- So we want 12 world units as our width
- We need to scale (shrink) canvas by
  12 / 1920 = 0.00625

Scale And Move

- Scale your canvas so 1 world unit = 1 square
- Resize and align your camera
- Add trees that are in front of grass background

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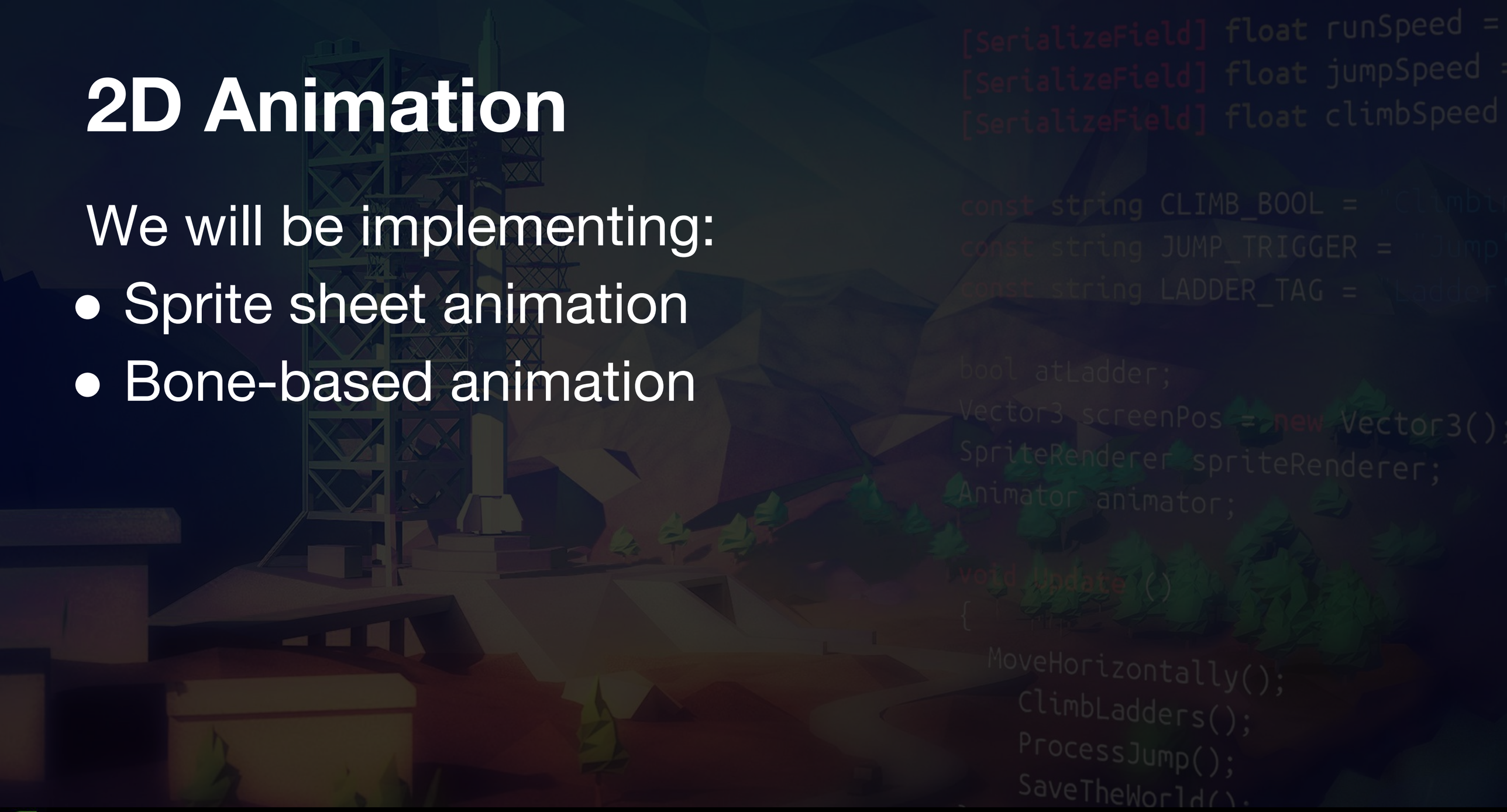
Intro To Animation

2D Animation

We will be implementing:

- Sprite sheet animation
- Bone-based animation



Slice Up A Sprite Sheet

- Import a Sprite sheet.
- Slice up your sprite sheet (just one for now) so that it is ready to be animated.

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Animator Controller & Animation

Terminology

- **Animator Component** - Assigns animations to GameObjects through an Animator Controller
- **Animator Controller** - Arrangement of animations and transitions (state machine).
- **Animation** - Specific pieces of motion
- **Sprite Renderer** - displays the 2D sprite on screen

Create An Animation

- Watch first, then try to do on your own.
- Create Animator Component.
- Create Animator Controller.
- Add Animator Controller to Lizard Game Object.
- Create Animation.
- Tune the speed of the animation.

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Basic Animation Transition

Create A New Animation

- Import a second sprite sheet.
- Slice sprite sheet using Grid By Cell Size. Make the cells equal size...
  - Total width divided by number of columns.
  - Total height divided by number of rows.
- Create new animation and preview it.

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Intro To Keyframe Animation

Animate Base Of Trophy

- Animate the scale or rotation of the base to give it some movement.

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Move Using transform.Translate

Tune Your Walk Speed

- Tune movement speed of attacker across the screen
- Tune the animation speed for attacker walk

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Spawn Attackers Using Coroutine

Spawn Attackers

- Turn Start method into a coroutine
- While our spawn bool is true, keep spawning
- Spawn randomly between 1 second and 5 seconds.

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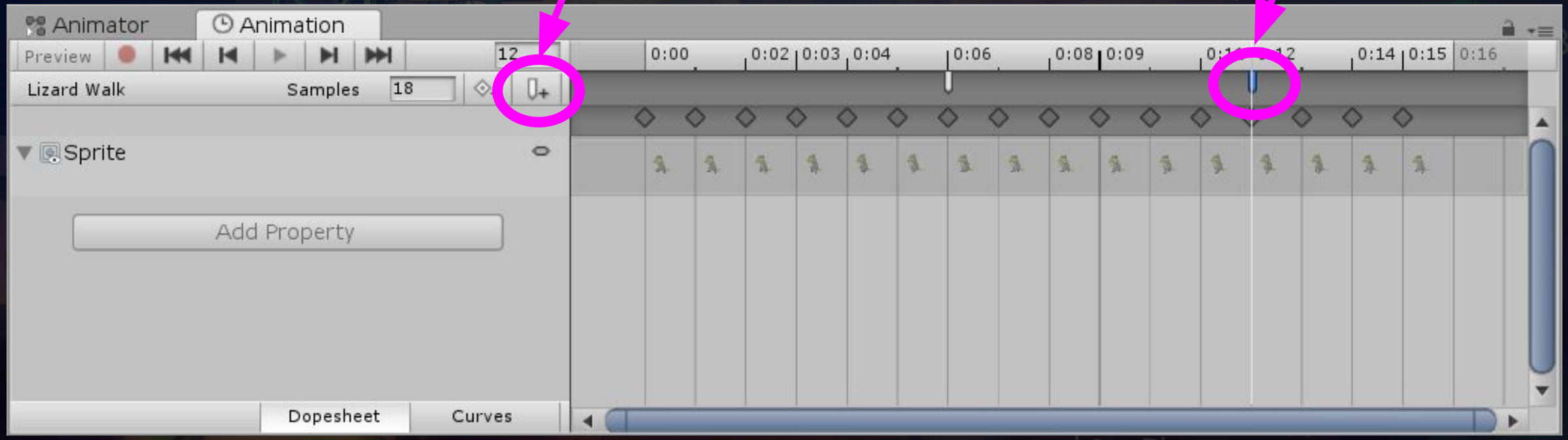
Adding Animation Events

Adding Animation Events

- Add events that can referenced in our code.



Public Method

- Create a public method called `SetMovementSpeed()`
- Require that method to pass in a float called `speed`
- Update the attacker's current speed so that it is now the speed value that was passed in.

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Set Up A Defender Prefab

Create A Defender

- Slice sprite sheet
- Create idle animation
- Create attack animation
- Add animation event when you feel it should shoot projectile
- Create animator controller

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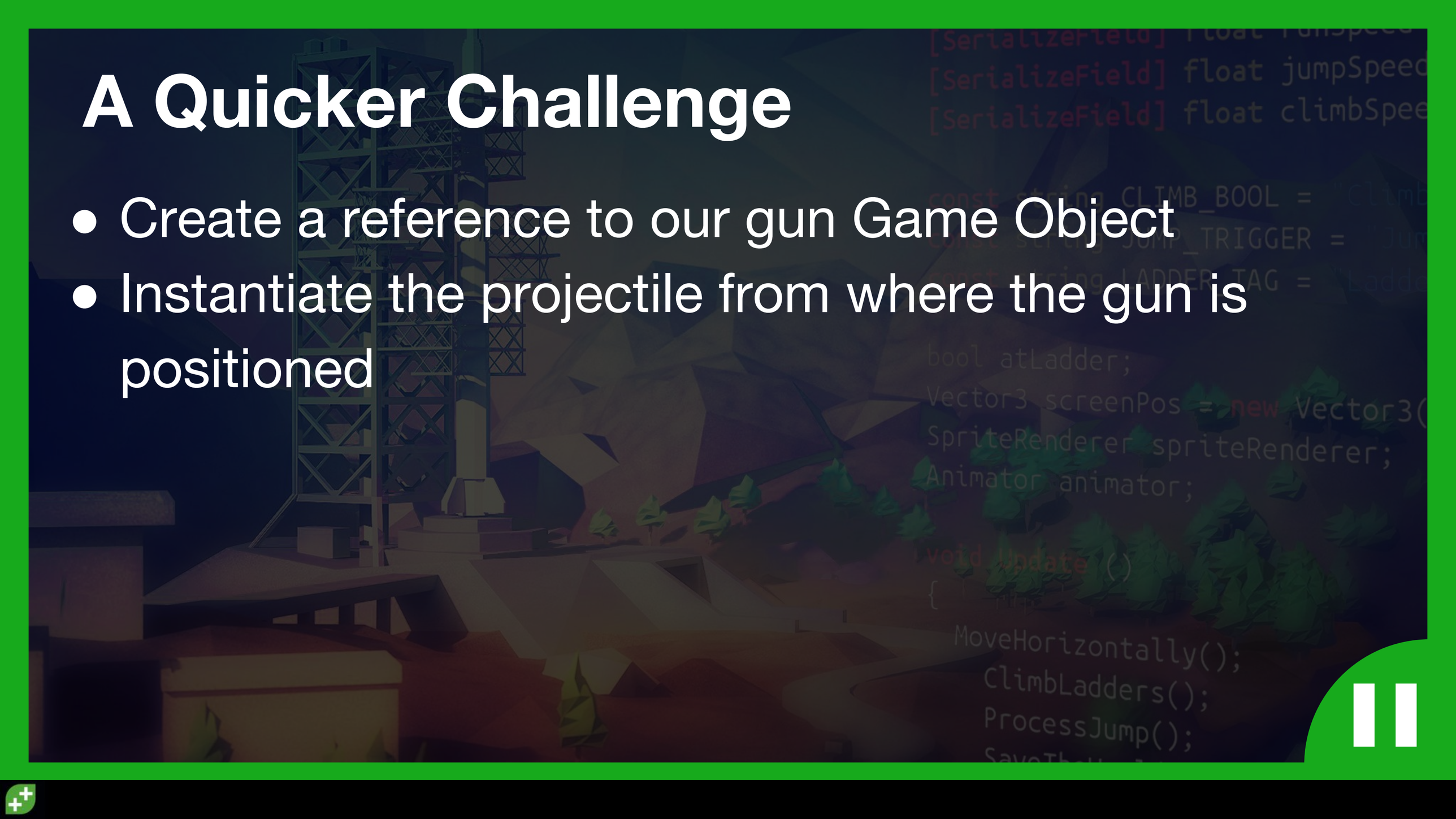
Instantiate From Gun Position

A Quicker Challenge

- Create a reference to our gun Game Object
- Instantiate the projectile from where the gun is positioned



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Make Projectile Move

Move The Projectile Through Code

- Add a component (script) that turns things into projectiles
- Use `transform.Translate()` to move the projectile

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Health & Hurting Attackers

A Different Sort Of Challenge

- Write down all of the things we need to do in order to have our projectile hurt and kill our attackers.
- For example, we need collision on our attackers.

My Quick List Of Things...

- Collision to attackers
- Collision to projectile
- Projectile is a trigger
- Create Health script
- Serialize starting health
- Create DealDamage()
- OnTriggerEnter2D event
- Check collision is with Attacker
- Check Health component is present
- Call DealDamage()
- Decrease current health by damage amount
- If health < 0 then destroy
- Play death VFX

My Quick List Of Things...

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- Projectile is a trigger
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- Decrease current health by damage amount
- If health < 0 then destroy
- Play death VFX

You Can Do It!

- Implement the health and damage system for attackers and projectiles.

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Implementing Health & Damage

	Static Collider	Dynamic Rigidbody Collider	Kinematic Rigidbody Collider	Static Trigger Collider	Dynamic Rigidbody Trigger Collider	Kinematic Rigidbody Trigger Collider
Static Collider		Collision			Trigger	Trigger
Dynamic Rigidbody Collider	Collision	Collision	Collision	Trigger	Trigger	Trigger
Kinematic Rigidbody Collider		Collision		Trigger	Trigger	Trigger
Static Trigger Collider		Trigger	Trigger		Trigger	Trigger
Dynamic Rigidbody Trigger Collider	Trigger	Trigger	Trigger	Trigger	Trigger	Trigger
Kinematic Rigidbody Trigger Collider	Trigger	Trigger	Trigger	Trigger	Trigger	Trigger

My Quick List Of Things...

- Collision to attackers
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- If health < 0 then destroy
- Play death VFX

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Tidy Up & Death FX

Create A Nifty Particle Effect

- Create an effect that triggers when the attacker is killed.

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Click To Spawn Defenders

Test For A Mouse Click

- Create a Core Game Area game object
- Add a collider to your play area where defenders can be placed
- Use `OnMouseDown()` to listen for mouse clicks
- Debug log (“mouse was clicked”)

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Spawn At Mouse Position

Where To Use worldPos?

- Create an argument in `SpawnDefender()` that receives coordinates.
- Use those coordinates when spawning defender.
- Get the coordinates by calling `GetSquareClicked()` “somewhere”

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Snap Defender To Grid

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Create Defender Selection UI

Creating A Foreach Loop

- Allows us to do something to each item in a collection
- Eg. We have a collection of monsters which are of type *Enemy*...

```
foreach (Enemy monster in monsters)
    {
        // do these things
    }
```

Change Button To White

- Add collider to each button
- Create DefenderButton script
- Use `OnMouseDown()` to change colour from black to white
- HINT:
  - `GetComponent<SpriteRenderer>().color = Color.white;`

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Set & Place Selected Defender

When We Click To Place Defender

Defender Spawner

- Store selected defender
- Find cost
- Find if enough stars
- Tell stars to be spent

Star Display

- Current resources
- Have enough stars?
- Spend stars

Defender

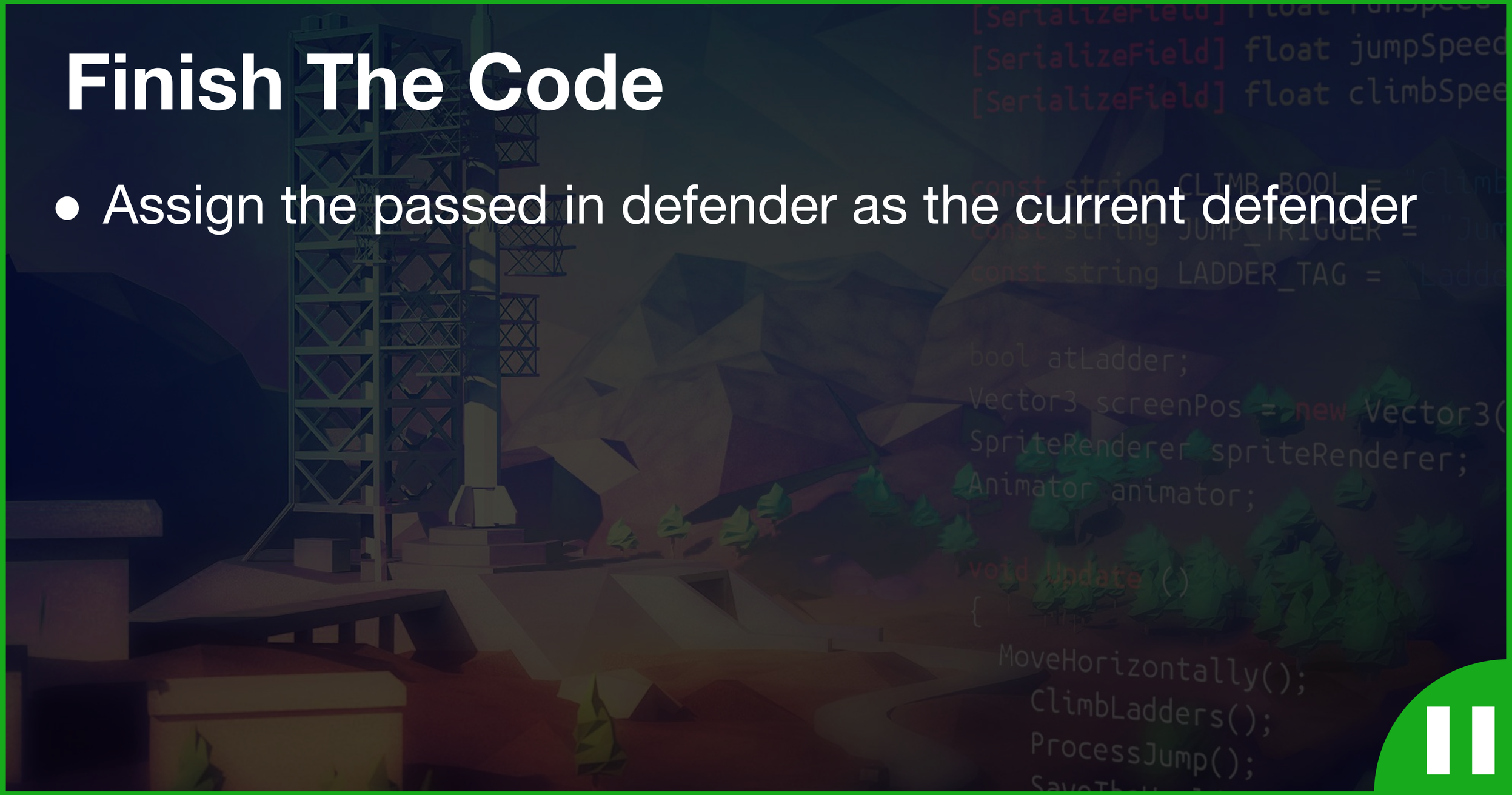
- Provide Cost

Defender Button

- Set defender prefab

Finish The Code

- Assign the passed in defender as the current defender



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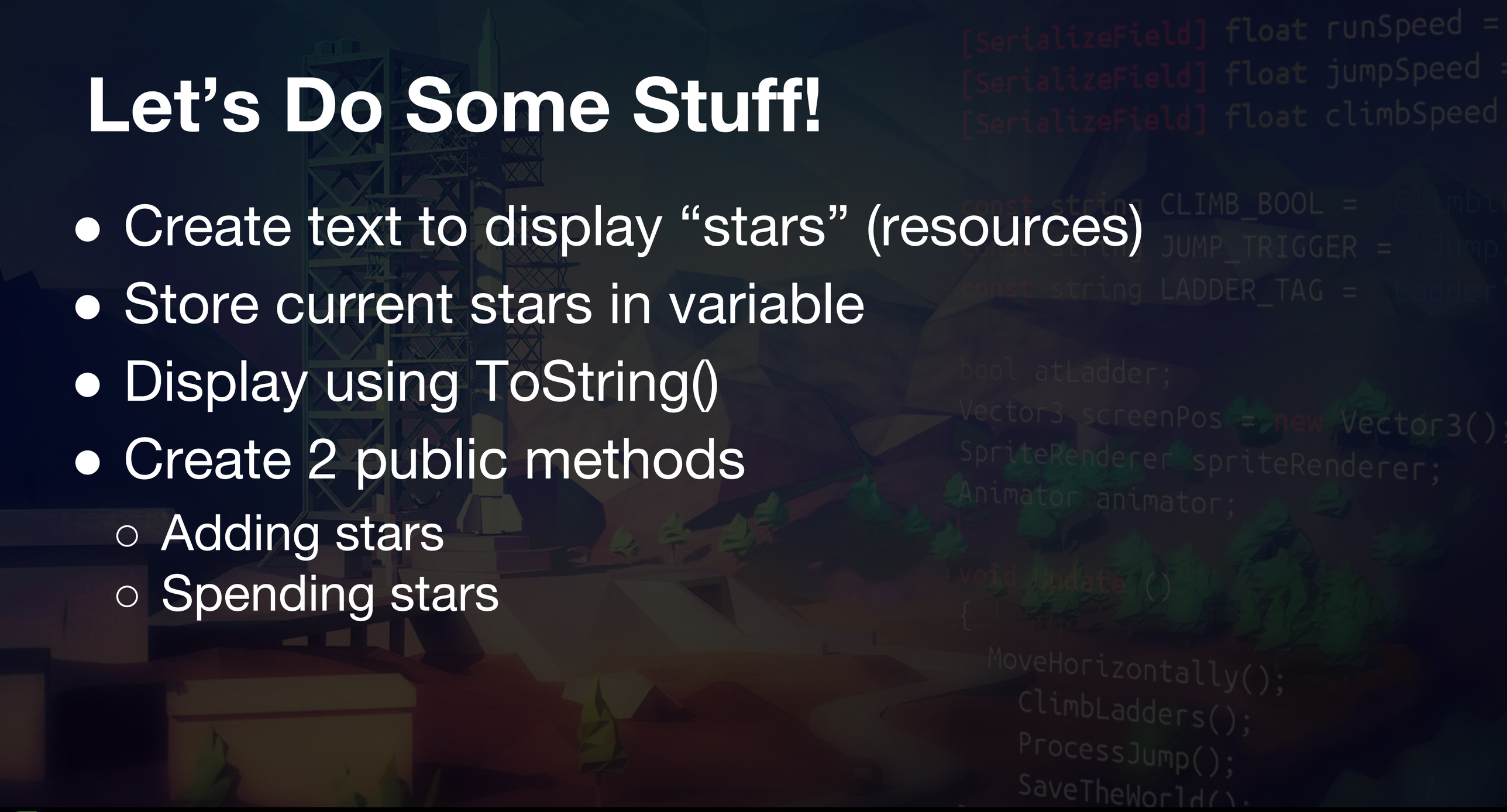
Start Our Resource System

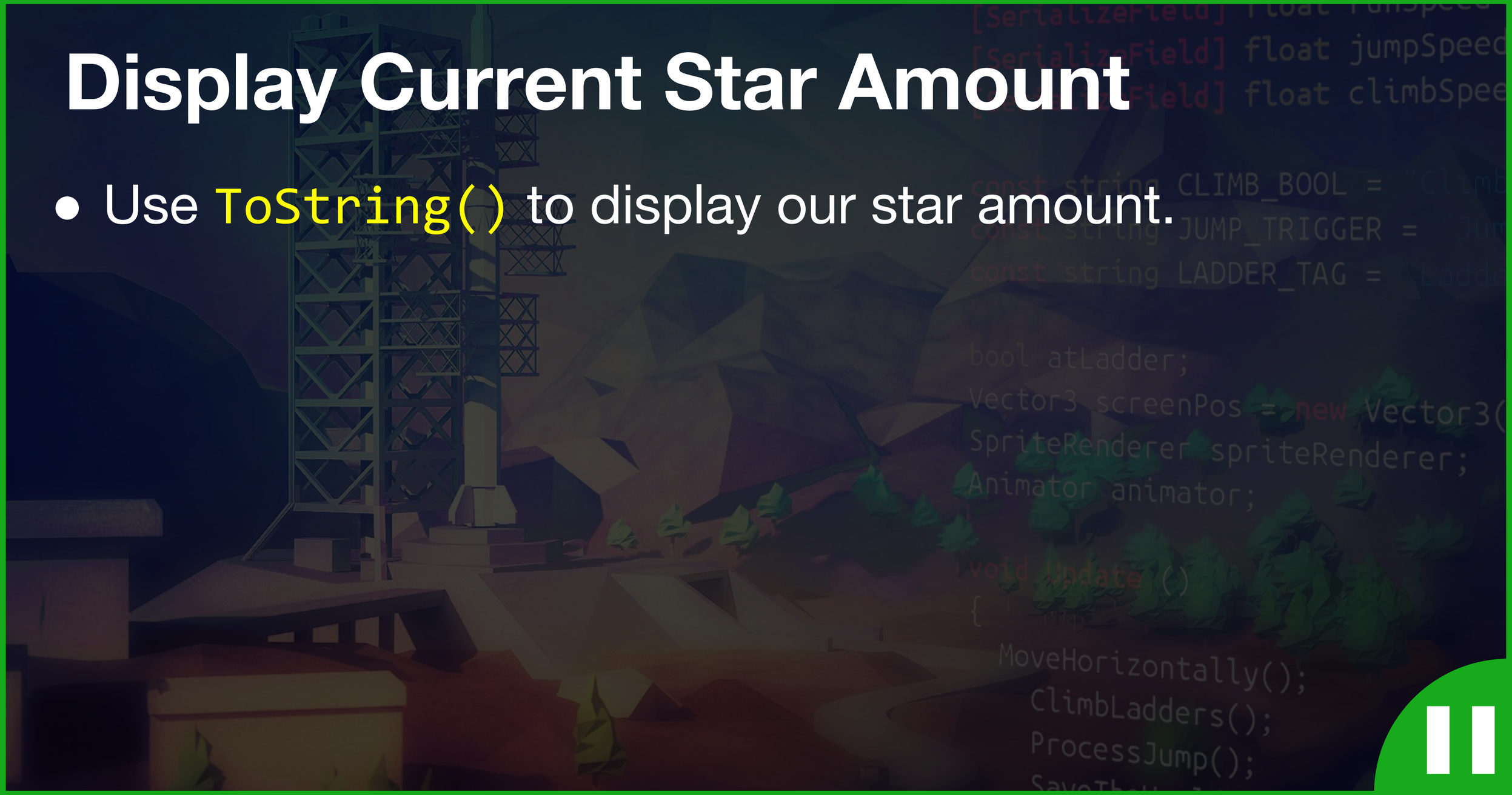
Let’s Do Some Stuff!

- Create text to display “stars” (resources)
- Store current stars in variable
- Display using ToString()
- Create 2 public methods
  - Adding stars
  - Spending stars



Display Current Star Amount

- Use `ToString()` to display our star amount.



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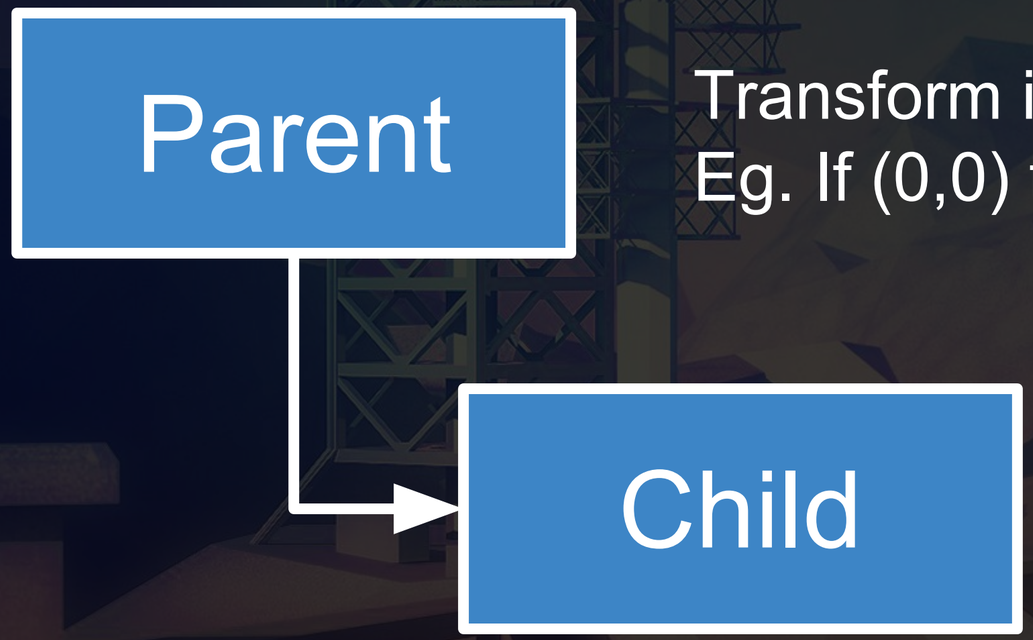
Parent, Child & Animation

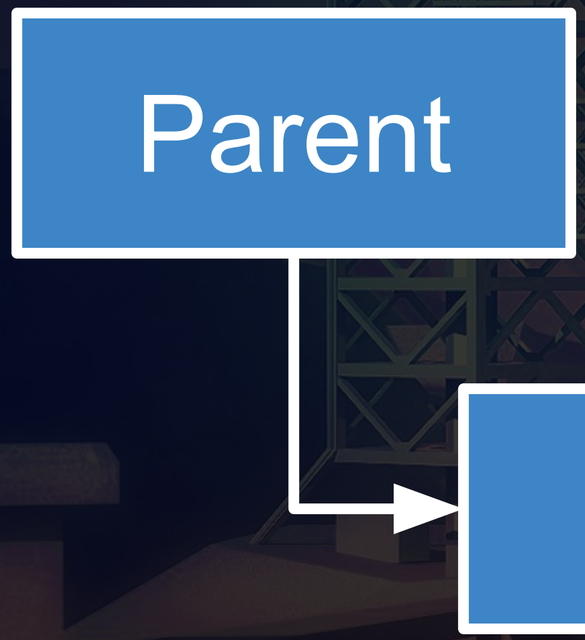
Parent-Child Relationship



Transform is relative to the world
Eg. If (0,0) then is at world origin

Transform is relative to Parent
Eg. If (0,0) then is at centred at parent

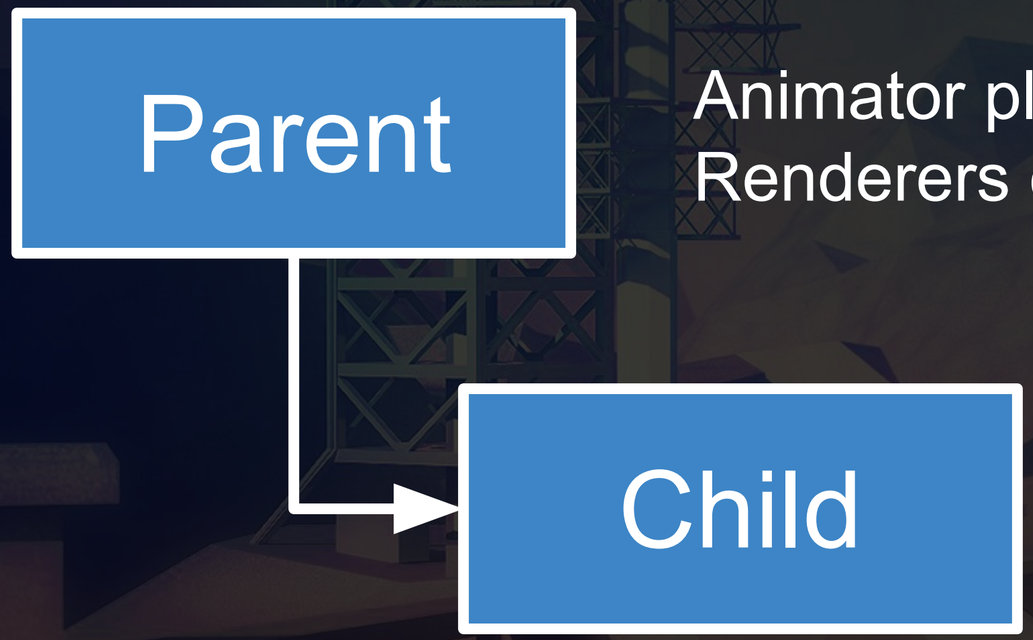
Changes Made To Transform



Changes made to Parent Transform will be applied to Child

Changes made to Child Transform will only impact the Child

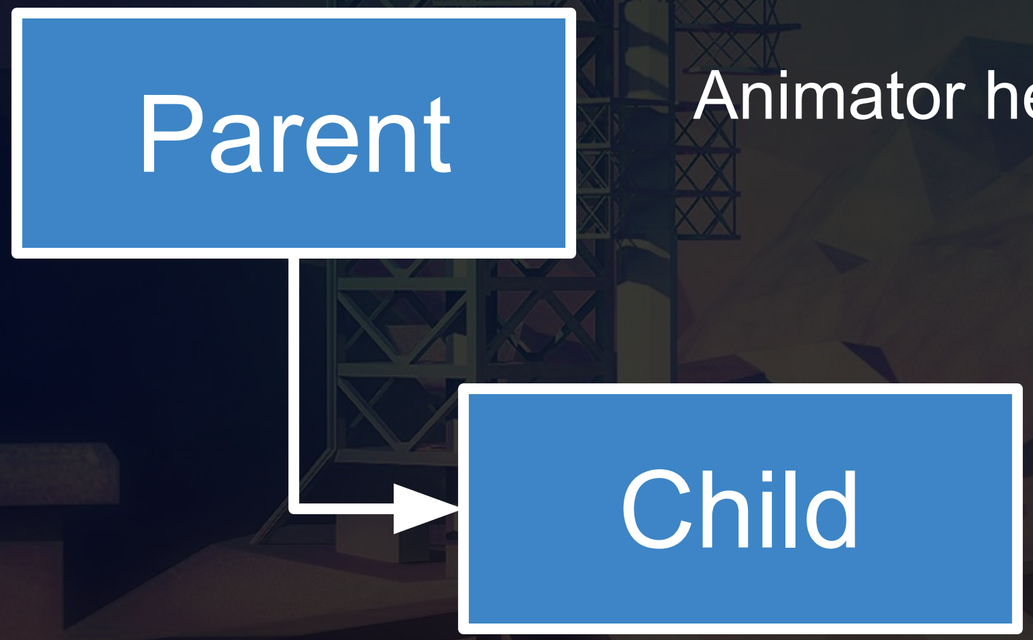
Impacting Animation



Animator placed here can animate the Renderers of Parent and all Children

Animator placed here can only drive animations of Child and its Children

Animation Events



Animator here...

Animator can see Methods at same level.

Cannot use Anim Event to call a Method on a script here

Re-Create Characters

- For the Lizard and Cactus, set them up with a proper Parent-Child relationship
  - Parent has all scripts and animator
  - Child (Body) has renderer
- Animate the characters

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Completing Animation Challenge

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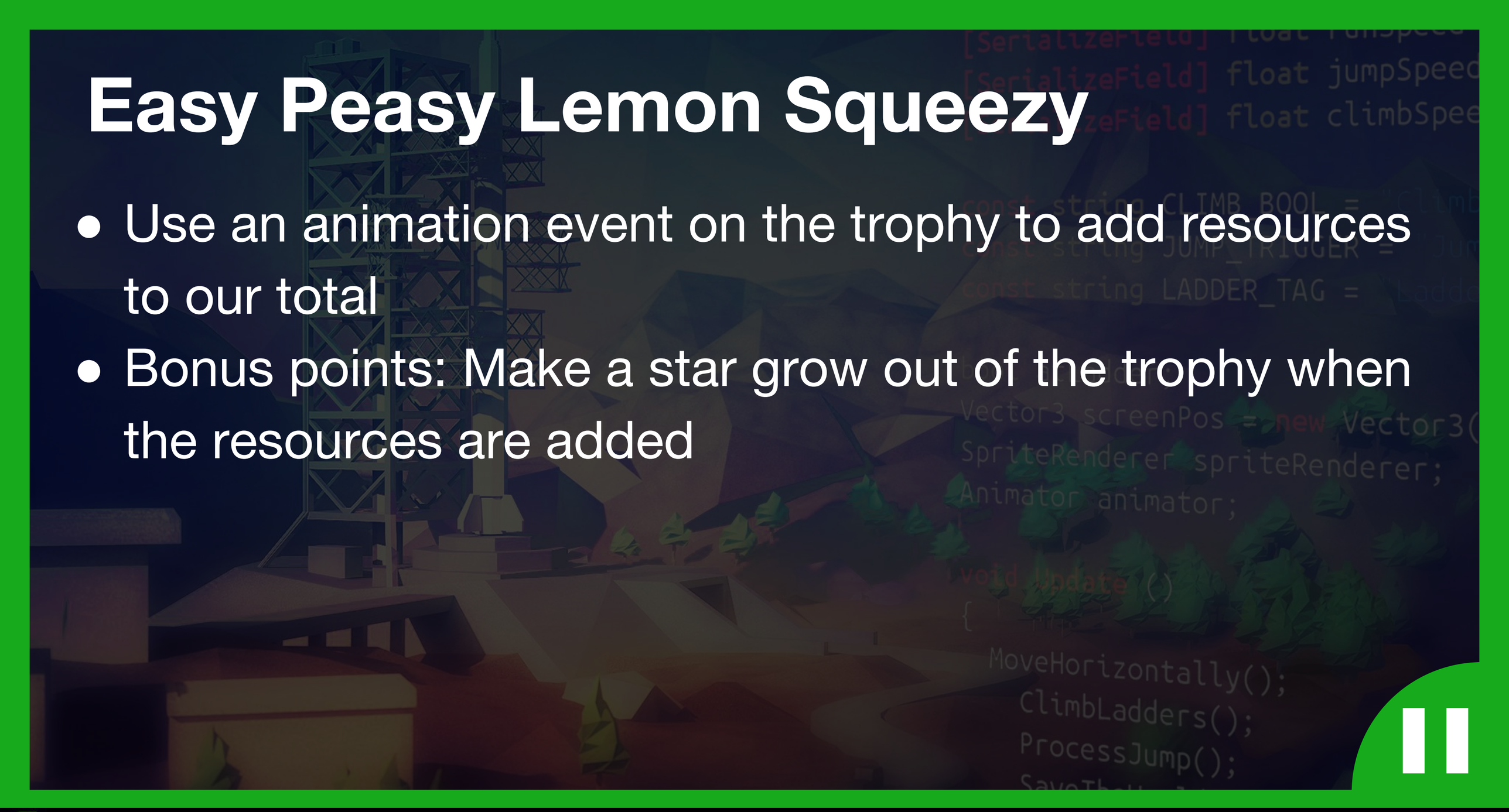
Add Resources As Anim Event

Easy Peasy Lemon Squeezy

- Use an animation event on the trophy to add resources to our total
- Bonus points: Make a star grow out of the trophy when the resources are added



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Defenders Costing Resources

When We Click To Place Defender

Defender Spawner

- Store selected defender
- Find cost
- Find if enough stars
- Tell stars to be spent

Star Display

- Current resources
- Have enough stars?
- Spend stars

Defender

- Provide Cost

Defender Button

- Set defender prefab

Make Cost Publicly Accessible

- In Defender.cs create:
  - Public method called `GetStarCost()` which returns the `starCost`

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Searching For Animation Events

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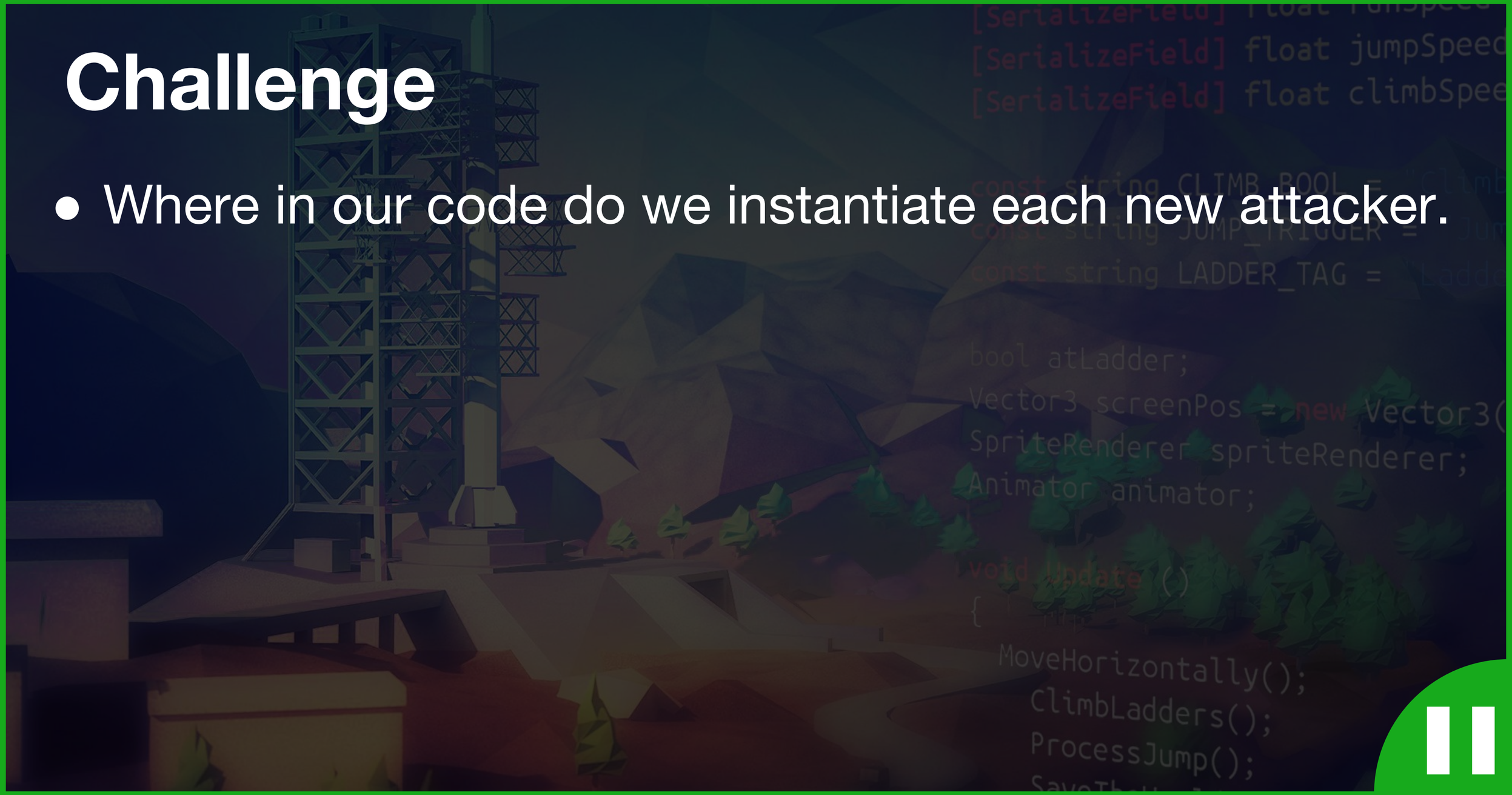
Instantiate As Child

Challenge

- Where in our code do we instantiate each new attacker.



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Attacker In My Lane

Create An Array Of Spawners

- Create an array to store all of the AttackerSpawners.
- Use `FindObjectsOfType`.

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Change Animation State

Get Our Animator Ready

- Create a new animation for the cactus’ idle
- Add idle animation as the first state
- Add back in our attack animation
- Create a transition from idle to attack

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One Defender Per Square

Make Cactus Face Right

- Flip the cactus so that it faces right.
- Check that you don’t break anything by doing this.

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Creating Gnome Defender

Defenders To Create

Cost	Medium	Low	High	Medium
Damage	None	Low	High	None
Health	Low	Low	Low	High

Create Gnome Defender

- Create game object
- Add Animator, collider, scripts
- Create Child object with renderer
- Create Animator Controller
- Create required animations with events (eg. shooting)
- Add animations & transitions to Animator Controller
- Create parameters & conditions for transitions
- Add button to UI with image & script
- Tune health, damage, cost

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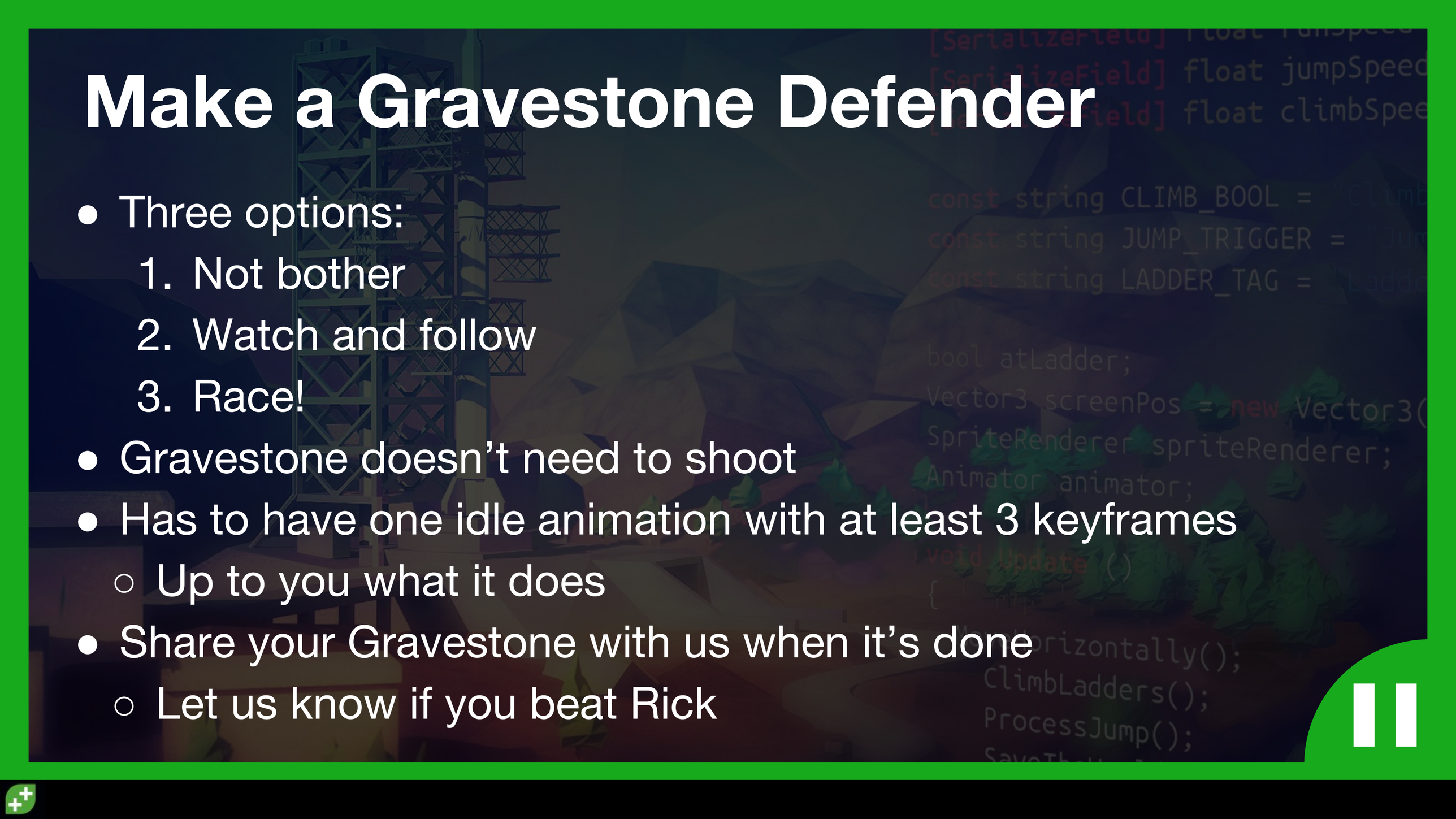
Creating Gravestone Defender Race

Make a Gravestone Defender

- Three options:
  1. Not bother
  2. Watch and follow
  3. Race!
- Gravestone doesn’t need to shoot
- Has to have one idle animation with at least 3 keyframes
  - Up to you what it does
- Share your Gravestone with us when it’s done
  - Let us know if you beat Rick



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Make Our Attackers Attack

Attackers To Create

Speed	Medium	Fast	Medium	Slow
Attack	Medium	Low	None	Huge
Health	Medium	Low	Medium	Huge
Special	None	Jump	Ghosting	?

Attacker Functionality

Attacker

- Move to left
- Set speed
- Update animation state
- Attack specific target

Lizard, Fox, etc

- Listen for collision
- Specific behaviour (jump, etc)

Health

- Track current health
- Decrease health

Finish Our Collision Event

```
// If the other object has a Defender
component
// Call our public attack method
```

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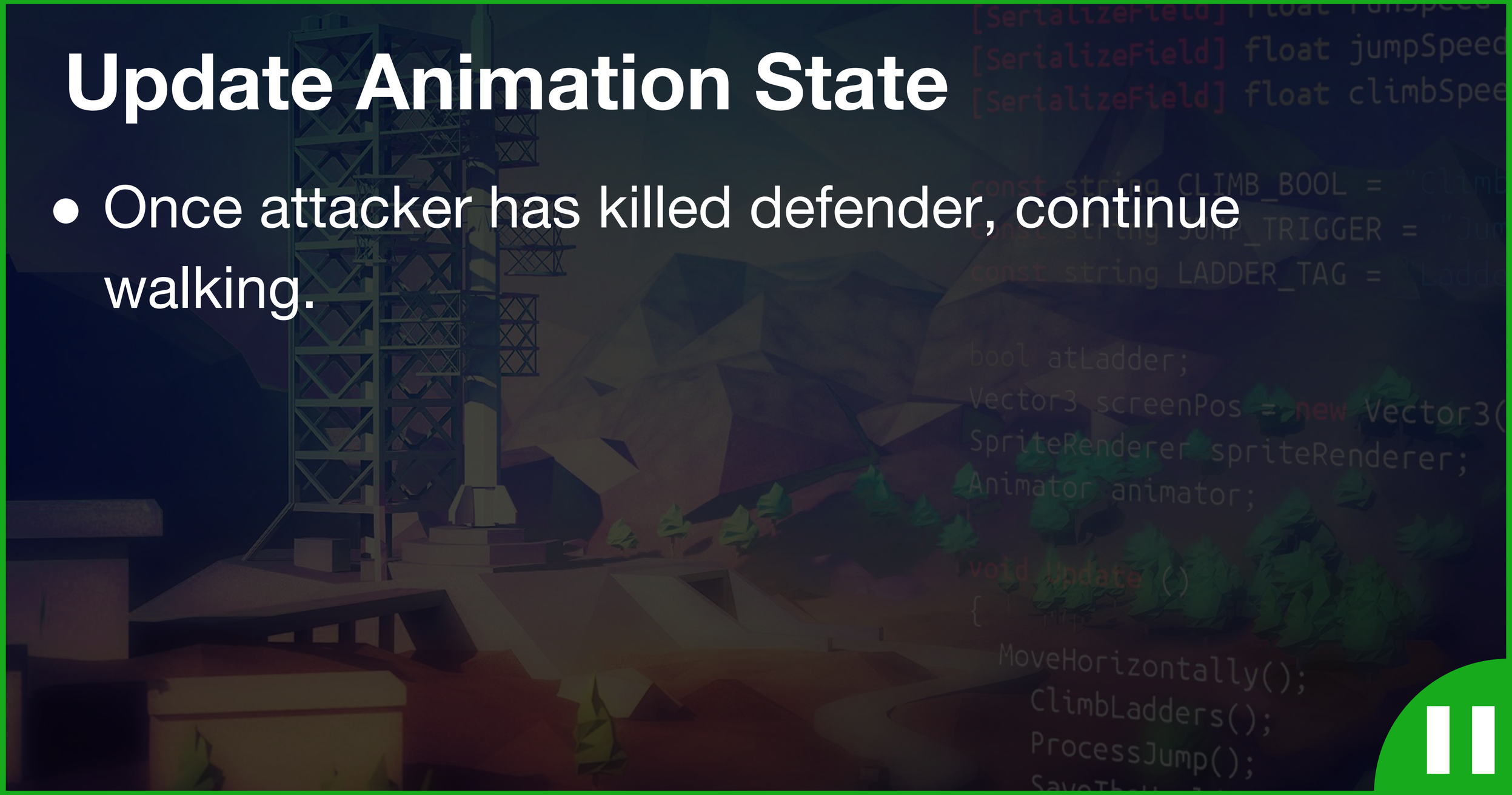
Attackers Striking Target

Update Animation State

- Once attacker has killed defender, continue walking.



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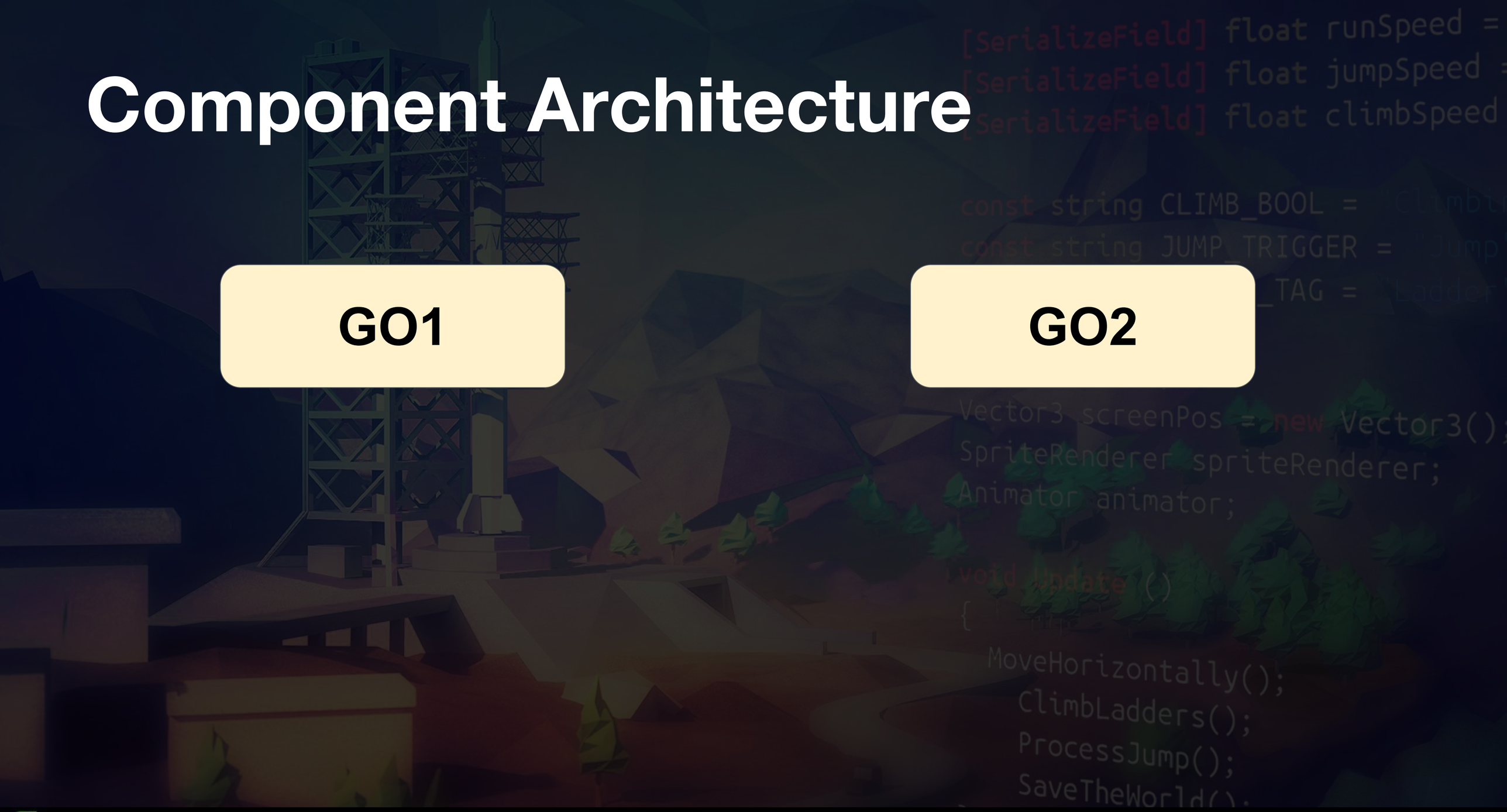
Fantastic Mr Fox

Component Architecture

+ Engine
+ Wheels
+ Steering
+ Convertable

+ Engine
+ Wheels
+ Steering
+ Plow

Component Architecture



Component Architecture

Attacker1

+ Attacker Component

Attacker2

+ Attacker Component

Component Architecture

Lizard

+ Attacker Component
+ Lizard Component

Fox

+ Attacker Component
+ Fox Component

Create Fox Component

- Create Fox.cs
- Behaviour we want:
  - If we encounter a Gravestone, Jump
  - If we encounter anything else, Attack

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Array For Spawning Attackers

Spawn Attackers From Array

- Change our `Attacker` variable to `Attacker[ ]` array and rename appropriately
- Extract where we instantiate an attacker into a new method called `Spawn()`
- Make `SpawnAttacker()` responsible for randomly picking an attacker index from the array and calling `Spawn()` using that index
- Add multiple attackers to spawners and test

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How To Be A Loser

Health And Lose Screen

- Display our health points on screen for the player
- When an attacker reaches our base (enters our “Base Collider”) they inflict damage
- When our health is 0, load You Lose screen.
- HINT:
  - Use our StarDisplay as inspiration

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Create A Level Timer

Animate Your Slider Handle

- WOT?!
- Try to figure out how to add an animated attacker as the progress slider handle (instead of the circle we have there now)
- Share what you come up with!

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Create A Level Controller

Controlling Our Victory Moment

Spawner

- Stop spawning attackers

Attacker

- Announce when attacker is spawned
- Announce when attacker is killed

Level Controller

- Listen for timer finishing
- Track current live attackers
- Tell spawners to stop spawning
- Enable “Win” overlay
- Call load next scene

Level Loader

- Load appropriate scene

Advanced Challenge

- If you’re up for a big challenge:
  - Create a system that keeps track of how many attackers are alive
  - Listen for when the timer reaches zero
  - When there are no attackers left and timer is zero, print “End Level Now” to console

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A Nicer Win Experience

Handle Win Condition

- `StartCoroutine(HandleWinCondition())`
  - Play a “finished level” SFX
    - Hint: Add an audio source
  - Set win label to true
  - Yield for tunable length of time
  - Load next scene

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A Nicer Lose Experience

Make A Nicer Lose Experience

- Think of your own design for a nicer lose moment and implement that approach

  OR

- Follow same steps as me
  - Create a “You Lose” canvas with 2 buttons
    - Restart level and Main Menu
  - Toggle it off at start of level & on when player loses
  - Slow game time to 0 and prevent mouse clicks
  - Set game time to normal after action is taken

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Handling Null Reference Exception

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Start Our Options Screen

Options Screen

- Background image
- HEADING
- VOLUME label & slider
- DIFFICULTY label & slider
- BACK button
- DEFAULTS button

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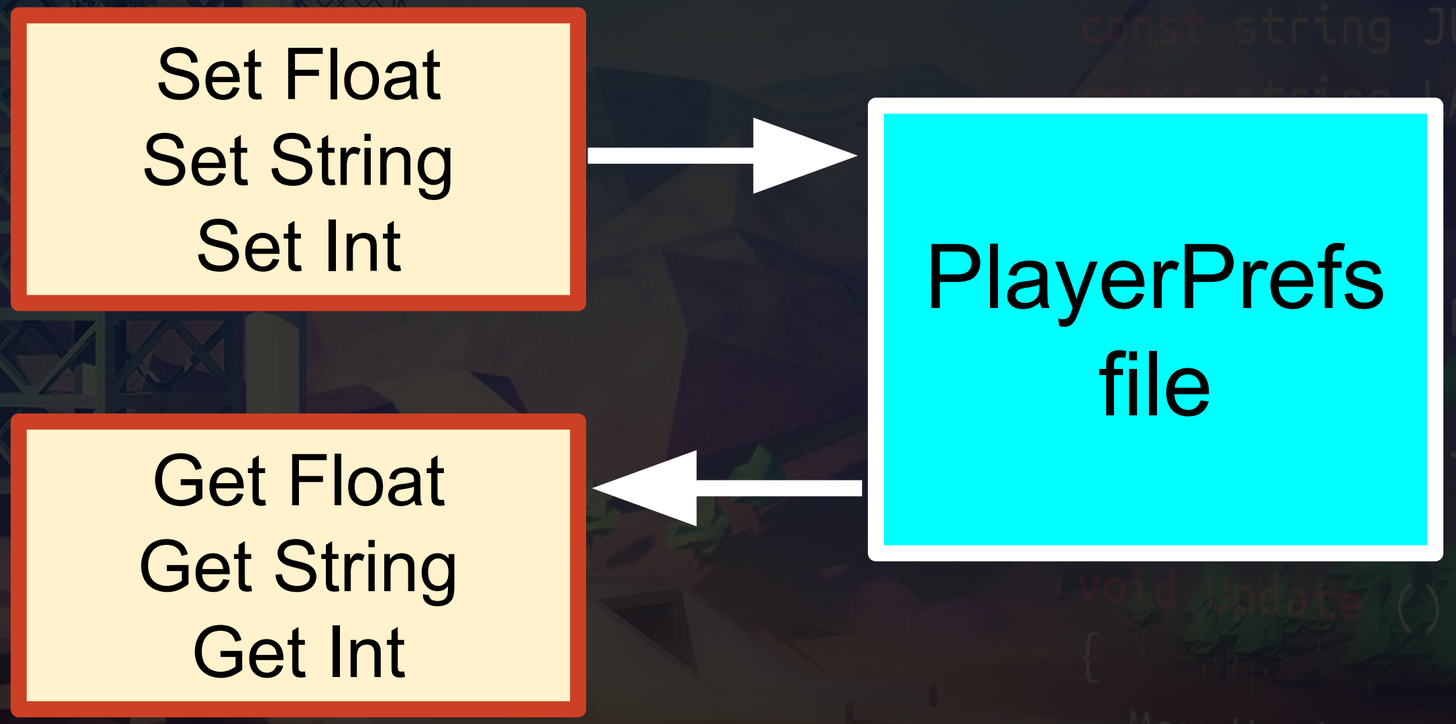
PlayerPrefs To Save Settings

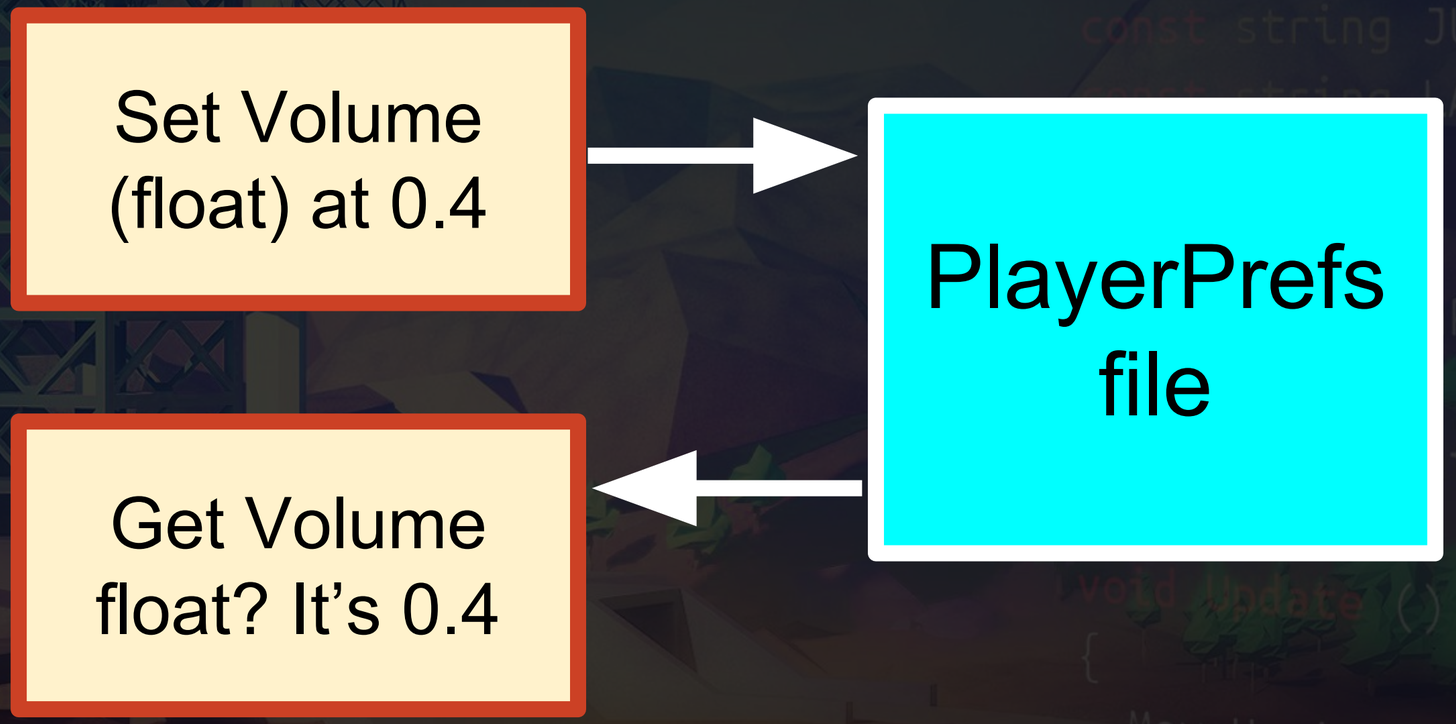
What Are PlayerPrefs?

- A file saved to player's system which stores and accesses player preferences between sessions
- Unity saves to relevant location depending upon platform used (PC, Mac, PS, XBox, iOS, Android, etc)
- Easily hacked, so not used for important data!

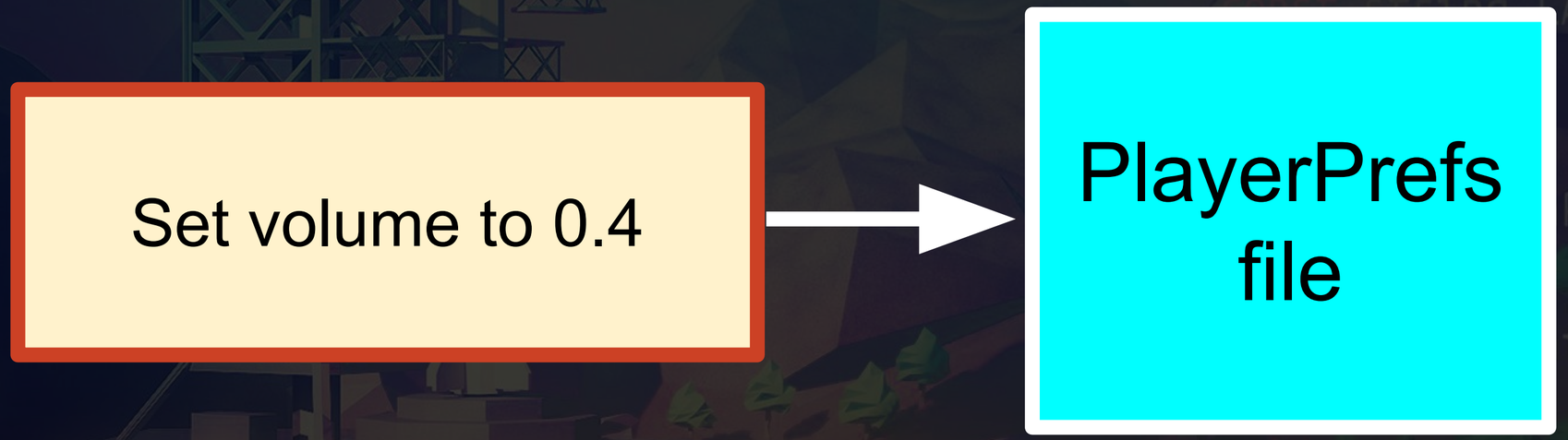
Using PlayerPrefs



For Example

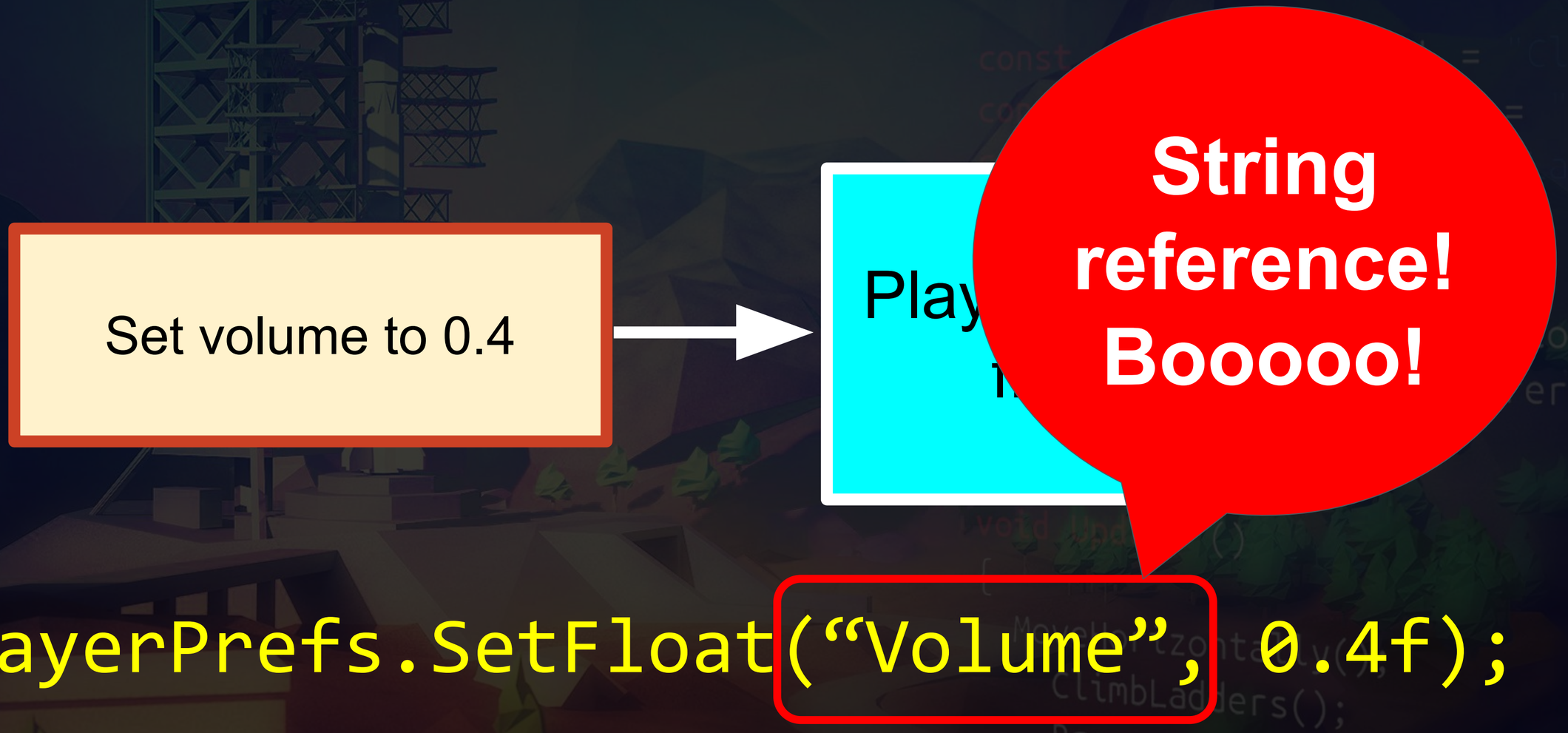

Set Volume
(float) at 0.4
PlayerPrefs
file
Get Volume
float? It's 0.4

It Can Get Messy




```
PlayerPrefs.SetFloat(“Volume”, 0.4f);
```

It Can Get Messy



Simple Wrapper

- Not an easy way to see all our stored keys PlayerPrefs keys
- Create a PlayPrefs class to keep all keys in one place
- Use public setter methods so we can access from any other class

Get Master Volume

- Write a public getter method that returns our master volume from PlayerPrefs
- Create a Test Game Object and script to set master volume, then to get it and print the value to console with a witty message

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Set & Save Music Volume

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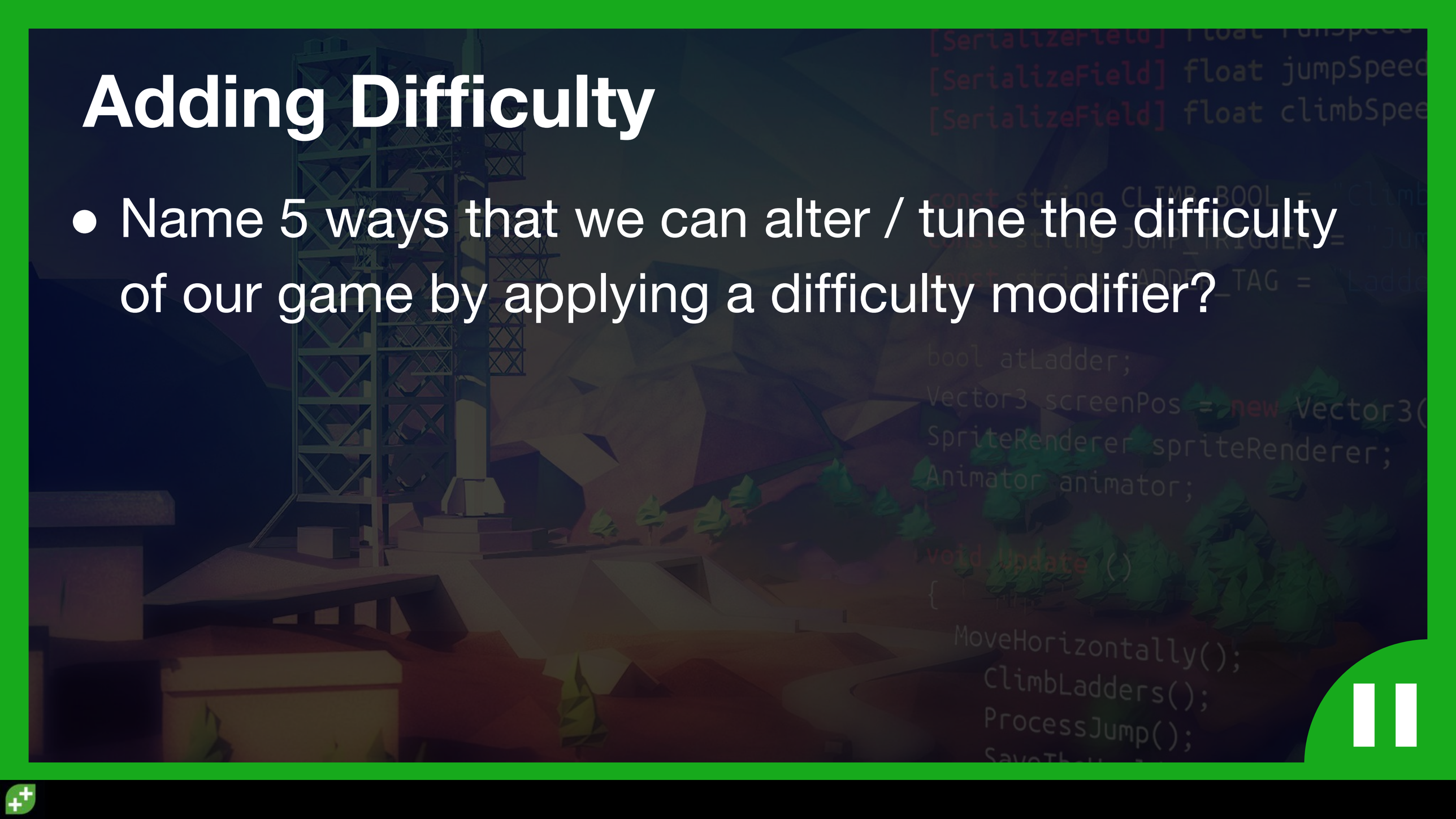
Add Difficulty Levels

Adding Difficulty

- Name 5 ways that we can alter / tune the difficulty of our game by applying a difficulty modifier?



Big Challenge - Add Difficulty

- Pick on thing to modify with difficulty
- Hook up your difficulty slider
- Save to PlayerPrefs
- Modify the difficulty based upon selected difficulty
- Test your gameplay

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Quick Bug Fix - Win Condition

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Tidy Hierarchy = Tidy Mind

Do The Same For Projectiles

- Have our projectiles parented to a projectile game object

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Tuning Our Core Gameplay

Tips For Tuning Game

- Experiment
- Equate things back to a common metric
  - Standard hits to kill
  - Benchmark character
- Be extreme, not subtle
  - Gnome 10 damage vs Cactus 8 damage = boring
  - Gnome 50 damage vs Cactus 8 damage = interesting
- Let the player fail

Create A Tuning Matrix

	Cactus	Gnome	Trophy	Stone	Lizard	Fox
Cost	50					
Hitpoints	50					
Damage	50					

Create A Tuning Matrix

	Cactus	Gnome	Trophy	Stone	Lizard	Fox
Cost	50	150	50	80	-	-
Hitpoints	50	50	20	250	500	300
Damage	50	200	0	0	20	40

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Add Star Cost To Button

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Creating Level Progression

Tips For Designing Progression

- Each level, introduce something new to the player
  - New defender
  - New attacker
  - New challenge
  - New feature
- Aim to give the player between 2 to 5 choices at any one point in time
- Ensure at least 1 successful path per level

How Many Resources To Give?

- Options:
  - Guess, play, then give more or give less next time
  - Play with infinite stars then note how much it actually cost and when it cost that
  - Try to create a formula for spawned enemies (hits to kill) and cost to buy the fire power needed to kill them

My First 5 Levels

- Level 1: Learn to buy cactus defender
- Level 2: Learn to buy trophies
- Level 3: Learn to buy gravestones
- Level 4: Learn that foxes can jump
- Level 5: Learn that Gnomes have big damage

Create Your Levels

- Create levels with progression for the player
- Make the game as long or short as you like
- Share your game with us!

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Glitch Garden Wrap Up

END OF SLIDES