Character assignment 6 - Rigging and animation

UW CSE490j summer 2023
Instructor: Dave Hunt

Introduction

In this assignment we will start from the costume model with skin weights from the previous assignment. We will export from Maya to Unity where we will build a control rig and author idle and emote animations.

Start from the skinned gray model scene from the previous assignment

Save it as a new file named *assignment_6_export.ma*

Part 1, Exporting from Maya into Unity

1. **Prepare the scene for export**
    a. Delete any keyframes Delete → All by Type → Channels
    b. Go to the bind pose Skin → Go to Bind Pose
    c. Make sure the skin weights are working correctly
    d. Delete any extraneous objects in the Outliner, there should only be the skeleton and model(s)
2. **Export FBX**
    a. Select the skeleton and model(s)
    b. File → Export Selection… file type: FBX

        i. Name the export after your character (for example, sly.fbx)
3. **Open your Unity project**
4. **Set the project settings to use 4 influences for skin weights**
    a. Edit → Project Settings → Quality → Skin Weights **4 Bones**
5. **Import the character FBX into your project**
    a. Create a new asset folder structure for your character Assets/Assignments/Characters/Sly/**Models**
    b. Drag and drop the FBX from Windows Explorer or Mac Finder into the new **Models** folder

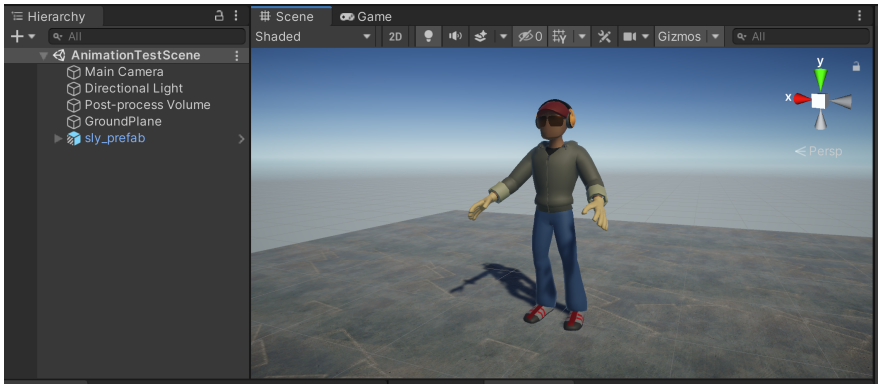
End of part 1.

Part 2, Setting up for animation

We will set up the required components for animation on the character and build a simple environment for creating new animation clips. You can later bring in additional objects into this scene for reference while animating.

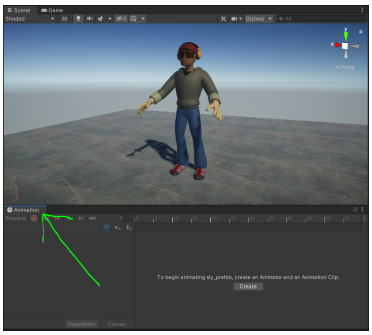
2.1, Make an animation test scene

1. Open the project template sample scene from **Scenes/SampleScene**
2. Save a copy of the scene as **Scenes/AnimationTestScene**
3. In the scene Hierarchy delete **Example Assets**
4. Create a plane for the ground GameObject → 3D Object → Plane
    a. Set the plane's position to [0,0,0] and name it *GroundPlane*
    b. Assign the ground material **Assets/ExampleAssets/Ground_Mat**
5. Drag and drop your character FBX into the scene
    a. Set the position to [0,0,0]
    b. Drag the character from Hierarchy into your Project view into a new folder for prefabs Assets/Assignments/Characters/Sly/**Prefabs**
    c. In the Create Prefab pop-up window press Prefab Variant and rename it charactername_prefab (sly_prefab)
    d. Replace your character in the scene with the prefab
        i. Delete your character from the scene Hierarchy
        ii. Drag the prefab into the scene at [0,0,0]
6. Save the animation test scene

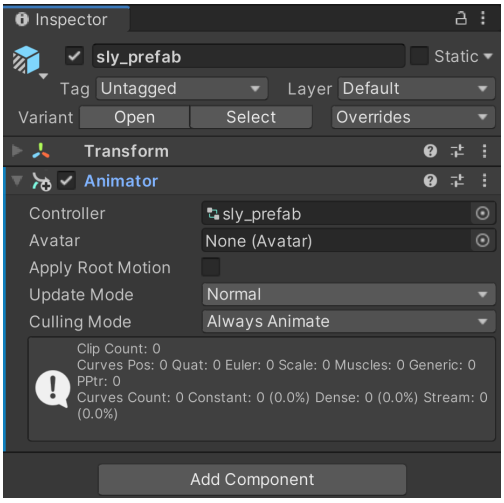


2.2 Set up the Animator component and make a new clip

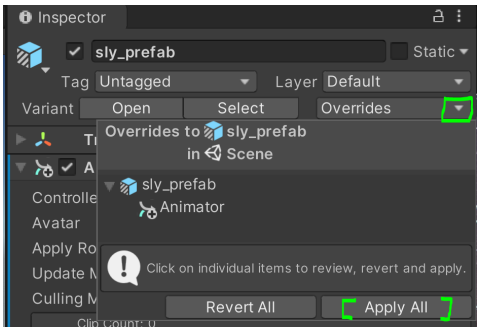
1. Open the **Animation Window** Windows → Animation → Animation
    a. Dock the Animation Window below the Scene view so it is easy to work with both



2. Automatically set up the Animator component and create a new clip
    a. Select your character prefab in the scene Hierarchy
    b. in Animation Window press Create
        i. In the browse window make a new folder for your character animations Assets/Assignments/Characters/Sly/**Animations**
        ii. Name the new clip **Idle** and save it in the new Animations folder
    c. Notice that this automatically sets up your prefab. On the top level GameObject there is now an **Animator** component with a **Controller** mapped to it. In the Animation Window the Idle **Animation Clip** is now loaded.



d. Apply the overrides to your prefab variant
    i. With your character prefab selected in the scene Hierarchy go to the Inspector and click on the Overrides drop-down menu



    ii. Click Apply All to save the new Animator component with the prefab

End of part 2.

Part 3, Building the control rig

The control rig will be used for authoring new animation clips. We will assign constraints from the Animation Rigging package to the skeleton in order to make it easier to pose and work with in the Unity scene.

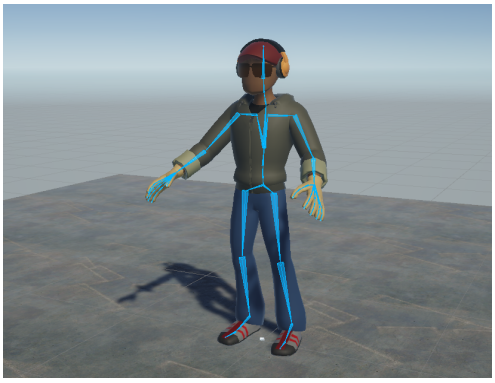
3.1 Install the Animation Rigging package

1. Open **Package Manager**
    a. Window → Package Manager
    b. Set the packages list to Unity Registry
2. Check to make sure **Animation Rigging** is installed

3.2 Auto-setup Bone Renderer

1. Select the character prefab in the scene Hierarchy

2. Auto-setup **Bone Renderer**
    a. Animation Rigging → Bone Renderer Setup
    b. Customize the color, shape and size of the bones



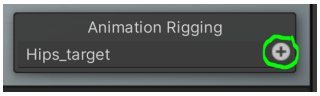
3. Apply all overrides to your prefab variant
    a. Select the character prefab in scene Hierarchy
    b. In the Inspector go to Overrides and Apply All

3.3 Auto-setup Rig Builder

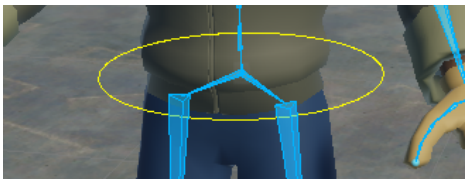
1. Select the character prefab in the scene Hierarchy
2. Auto-setup **Rig Builder**
    a. Animation Rigging → Rig Setup
    b. Notice that this added the **Rig Builder** component and a new GameObject child named Rig 1 with a **Rig** component that is mapped to the **Rig Layers** list
    c. Rename Rig 1 to **ControlRig**
3. Apply all overrides to your prefab variant (same as step 3.2, 3 above)

3.4 Add a hips control

1. Create a new GameObject child below *ControlRig* for the hips
    a. Right-click *ControlRig* and Create Empty and name it **Hips**
2. Align the Hips position to the root joint
    a. Select *Hips*
    b. Ctrl-select *center_root_bind_joint*
    c. Align position with Animation Rigging → Align Position
    (Note: in this case we do not want to align rotation so that it stays oriented in world space, which will help with animation authoring)
3. Add a **Multi-Parent Constraint**
    a. Select *Hips* and in the Inspector click Add Component
    b. In the pop-up window browse for Animation Rigging → Multi-Parent Constraint
    (note: we will set up the Multi-Parent Constraint in step 5 below)
4. Create a target for controlling the hips
    a. Create a new GameObject child below *Hips* named **Hips_target** (step 1 above)
    b. Select *Hips_target* and add a visual rig effector by clicking the **plus** button in the Animation Rigging panel in the bottom right corner of Scene view



   c. Expand the arrow on the left side and customize the display options
      i. Shape can be customized to look like any mesh in your project. There are several included **effector shapes** that are good to use for rigging. Click the circle button in the Shape field and type “effector” to filter for these shapes. A circle effector is a good shape to use for the hips.
      ii. Set Color to yellow
      iii. Set Size to 0.5
5. Set up the Multi-Parent Constraint
   a. Select *Hips* in the scene Hierarchy and lock the Inspector
   b. Assign *center_root_bind_joint* as the Constrained Object
   c. Assign *Hips_target* as the Source Object
   d. In the Settings tab set Maintain Offset to **Rotation**
   e. Unlock the Inspector
6. Test the hips control
   a. Select *Hips_target* and in the Animation Window press Preview
   b. Try moving *Hips_target* and the character should follow it. You can get back to the original pose by setting translate and rotate to [0,0,0]

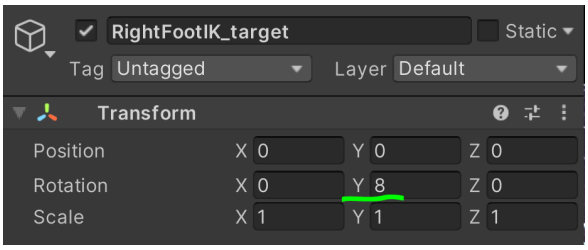


3.5 Add IK controls to the legs

1. Create a new GameObject child below *ControlRig* and name it **RightFootIK**
   a. Align the *RightFootIK* position to the right foot joint
      i. First, select *RightFootIK* and second, select *right_foot_bind_joint*
      ii. Click Animation Rigging → Align Position
2. Add a **TwoBoneIK Constraint**
   a. Select the RightFootIK object and click Add Component
   b. In the pop-up window browse to Animation Rigging → Two Bone IK Constraint
3. Auto-setup the TwoBoneIK Constraint
   a. Select the *RightFootIK* object
   b. Lock the Inspector
   c. Assign the *right_foot_bind_joint* to the TwoBoneIK Tip field
   d. In the TwoBoneIK context menu (3 dots) click Auto Setup from Tip Transform
      i. Notice that this auto-assigns the bones and creates targets
   e. Unlock the Inspector
4. Add visual effectors to the IK targets and align them the to the bones
   a. Select the *RightFootIK_target* (child of *RightFootIK*)

b. In the Animation Rigging effector window click the **plus** button
c. Assign the Box Effector in the Shape field. (filter for “effector” in the pop-up)
d. Align *RightFootIK_target* to the foot joint
    i. First, select *RightFootIK_target* and second, select the *right_foot_bind_joint* and click Animation Rigging → Align Transform

    Note: if your foot joint is correctly oriented in world space you will see the *RightFootIK_target* with rotations at zero except for the Y axis. This makes it easy to get back to zero with the foot straight forward, while also having the bind pose in a more natural looking orientation. (If your rotation values are different don’t worry, it won’t be graded down)

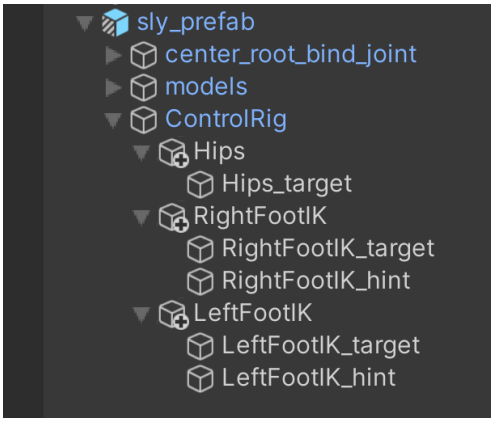


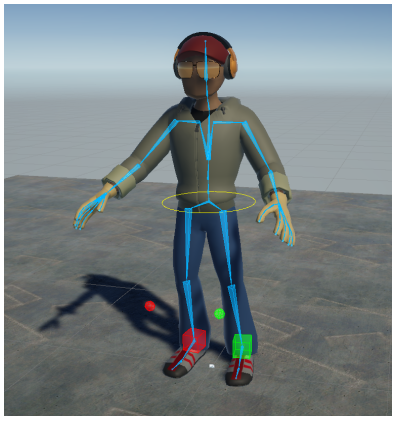
e. Customize the effector display options for *RightFootIK_hint*
    i. Set the Shape to Ball Effector
    ii. Set the Size to 0.05
f. Align *RightFootIK_hint* to the knee joint
    i. First, select *RightFootIK_hint* and second, select the *right_lowerleg_bind_joint* and click Animation Rigging → Align Transform
    ii. Move it forward in Local mode
    iii. Set the *RightFootIK_hint* rotation to [0,0,0]

5. Repeat step 3.5 for the left leg and make the target colors green

3.5 Finishing the control rig

1. The control rig should now look something like this





2. Apply all overrides to your prefab variant
    a. Select your character prefab root GameObject (*sly_prefab*)
    b. In the Inspector click the Overrides drop-down and Apply All
3. Save the AnimationTestScene
    a. File → Save

End of part 3.

Save screenshots of your control rig to your Miro board to turn in with your assignment. This should include a screenshot of the character in Scene view with the skeleton (BoneRenderer) and rig controls visible as well as a second screenshot of the prefab Hierarchy as shown above.

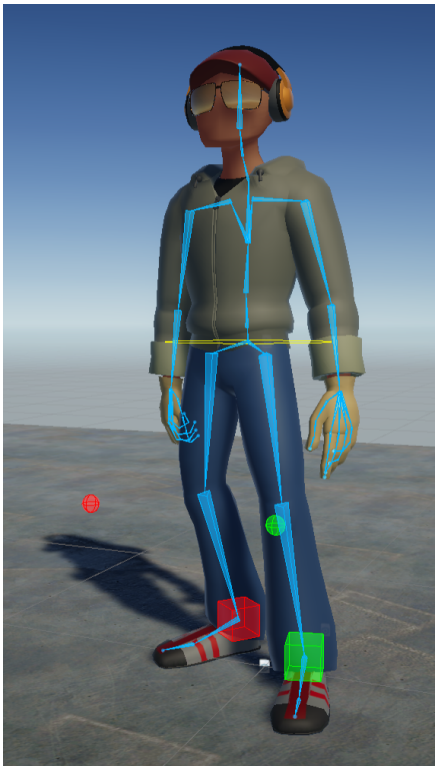
Part 4, Authoring an idle animation

The idle animation plays when the character is standing around doing nothing in particular. There is subtle movement for breathing and swaying slightly while staying balanced. It is common in games for this to be a short looping clip where variety can be added with separate idle variant clips that play randomly. Here we will create the base idle animation to start with.

Tip: Refer to the Animation Window Shortcuts PDF for additional controls and options.

4.1 Setup

1. Open the AnimationTestScene
2. Open the **Animation Window** and dock it below Scene view in the Unity editor
3. Select the character prefab root in scene Hierarchy and lock Animation Window
4. Set the Animation Window to the *Idle* clip (this was created in step 2.2)
5. Expand the full skeleton in the scene Hierarchy (alt-click *center_root_bind_joint*)

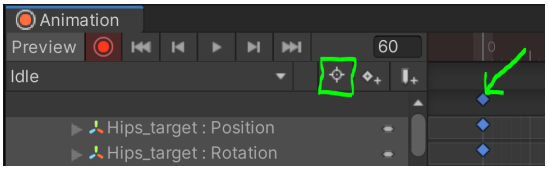


4.2 Set the idle pose

1. Set a key on everything on frame 0
    a. In the Animation Window press Record (red circle button)
    b. Select all of the bones
        i. In the Inspector right-click Position and Add Key
        ii. Also Add Key for Rotation
    c. Select all of the rig controls (Hips_target, RightLegIK_target, RightLegIK_hint...)
        i. In the Inspector right-click Position and Add Key
        ii. Also Add Key for Rotation
2. Create the idle pose on frame 0
    a. Translate the hips downward slightly
    b. Translate and rotate the foot IK controls to be in a relaxed standing position
    c. Rotate the upper body into a relaxed pose

4.3 Copy and paste the first pose to the end pose

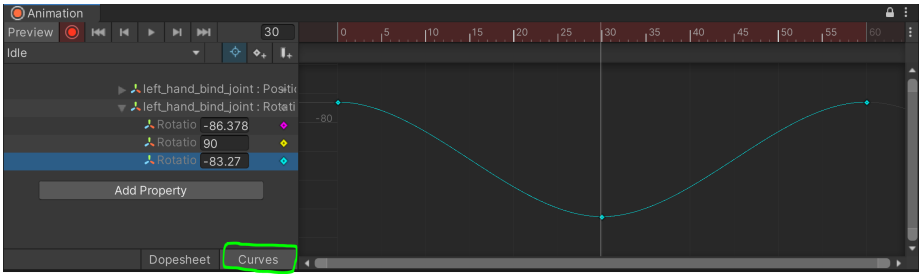
1. In the Animation Window Dopesheet turn off Filter by Selection to show all keys



2. Select the keys on frame 0 and ctrl-c to copy
3. Move forward in time to frame 60 and ctrl-v to paste
    a. Tip: expand the time range using the mouse wheel

4.4 Offset the pose in the middle

1. Move back to frame 30
2. Offset the pose: slightly drop the hips, rotate the chest, shoulders head and arms
3. Press **Play** in Animation Window to see the looping idle animation
    a. Lengthen or shorten the animation based on what looks good for your character
4. Adjust the curves to get the desired look and feel for the idle motion
    a. Switch to the Curves tab in Animation Window



Tip: hold shift when moving keys to move in only one axis

b. Work with these 3 keys first to get the right amount of motion variance before adding more keys
c. Keep checking how it looks by pressing Play and viewing from all angles
d. Add more keys to offset parts of the body over time and adjust tangents to make the motion look smooth and natural

End of part 4.

Save a screenshot of your idle pose to your Miro board to turn in with your assignment.

Also capture an animated gif of your idle animation and add it to your Miro board. You can use whichever method you want for capturing an animated gif. A good recommendation is ScreenToGif because it is free, cross-platform and has good options for screen capturing.

Part 5, Authoring an emote animation

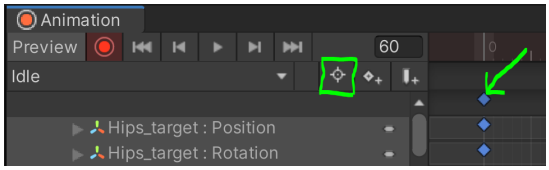
Next we will be making a short animation to express an emotion. It is based on the idle pose and can be played on command during gameplay. This should be very simple and not require the hands contacting anything or the feet leaving the ground. For example, a wave hello motion is a good choice for this section of the assignment. You can be creative and choose something that works well for your character but please don't make it too long or complicated.

5.1 Create a new clip

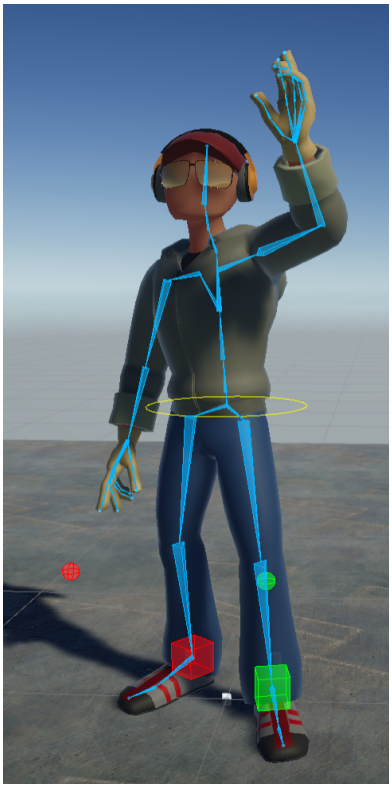
1. Click on the clip drop-down menu where Idle is currently displayed
2. Click the Create New Clip… command
3. Browse for the Animations folder and name it after the motion. For example: *Wave*

5.2 Copy the idle pose into the first and last frames of the emote animation

1. Load the Idle clip in Animation Window from the drop-down menu
2. Turn off Filter by Selection to display all keys



3. Select all keys and press ctrl-c to copy
4. Load the emote clip in Animation Window from the drop-down menu
5. Press Record in Animation Window (red circle button)
6. On frame 1 press ctrl-v to paste
7. Move forward in time to frame 60 and press ctrl-v again to paste another key



5.3 Set the emote pose

1. Move the time slider to frame 30 or about half-way through your animation
2. Make sure Animation Window is still set to Record
3. Set the new keyframe pose for the emote
    a. Translate and rotate the hips
    b. Rotate the bones on the upper body
    c. Adjust the foot IK controls if necessary, but try to keep it simple for this animation

5.3 Add keys for in-betweens

1. Press Play in Animation Window to see the motion
2. Switch to Curves in Animation window and adjust keys
3. Set more keys to offset the motion on different parts of the body
4. Modify the tangents of the keys to create smooth and natural interpolation between poses

End of part 5.

Save a screenshot of your emote pose to your Miro board to turn in with your assignment.

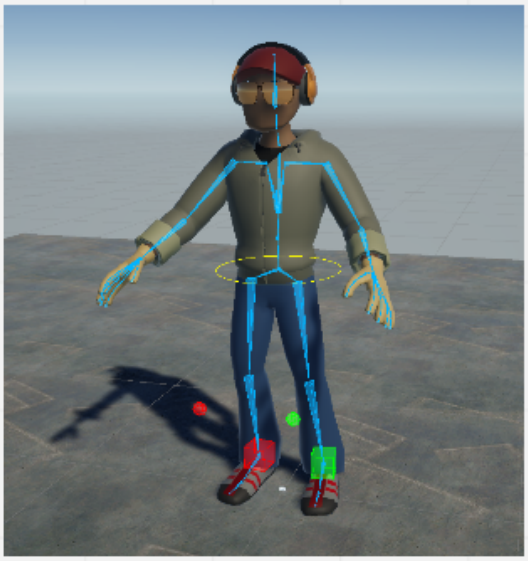
Also capture an animated gif of your emote animation and add it to your Miro board.

Grading Rubric

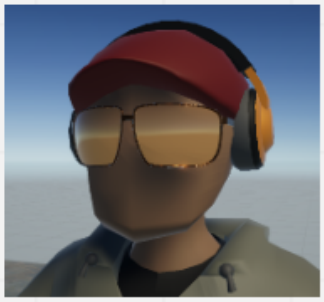
Criteria	**Achievement levels**			
	level 1	level 2	level3	level4
Control rig format: images [Miro]	20 points: (0 incorrect) Rig has controls for hips, feet and knees with effector shapes and colors. Hierarchy shows correct rig setup	18 points: (1 incorrect) Rig has controls for hips, feet and knees with effector shapes and colors. Hierarchy shows correct rig setup	16 points: (2+ incorrect) Rig has controls for hips, feet and knees with effector shapes and colors. Hierarchy shows correct rig setup	0 points: files were missing
Idle pose format: image [Miro]	20 points: (0 incorrect) Character is standing in relaxed pose with feet offset and hands/fingers hanging downward.	18 points: (1 - 2 incorrect) Character is standing in relaxed pose with feet offset and hands/fingers hanging downward	16 points: (3+ incorrect) Character is standing in relaxed pose with feet offset and hands/fingers hanging downward	0 points: files were missing
Emote pose format: image [Miro]	20 points: (0 incorrect) Character is posed to express an emotion, feet are in the same basic location as idle	18 points: (1-2 incorrect) Character is posed to express an emotion, feet are in the same basic location as idle	16 points: (3+ incorrect) Character is posed to express an emotion, feet are in the same basic location as idle	0 points: files were missing
Idle animation format: animated gif [Miro]	20 points: (0 incorrect) A looping animation that starts and ends on the same pose. Subtle motion for breathing and staying on balance	18 points: (1 incorrect) A looping animation that starts and ends on the same pose. Subtle motion for breathing and staying on balance	16 points: (2+ incorrect) A looping animation that starts and ends on the same pose. Subtle motion for breathing and staying on balance	0 points: files were missing
Emote animation format: animated gif [Miro]	20 points: (0 incorrect) A short animation to express an emotion that starts and ends on the idle pose.	18 points: (1 incorrect) A short animation to express an emotion that starts and ends on the idle pose.	16 points: (2+ incorrect) A short animation to express an emotion that starts and ends on the idle pose.	0 points: files were missing

Character assignment 6 - rigging and animation

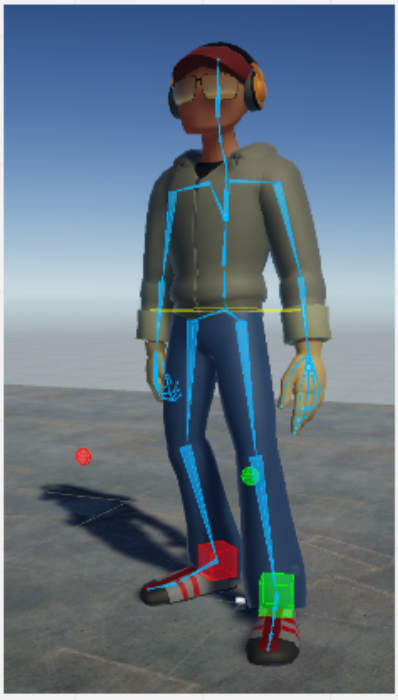
Control rig



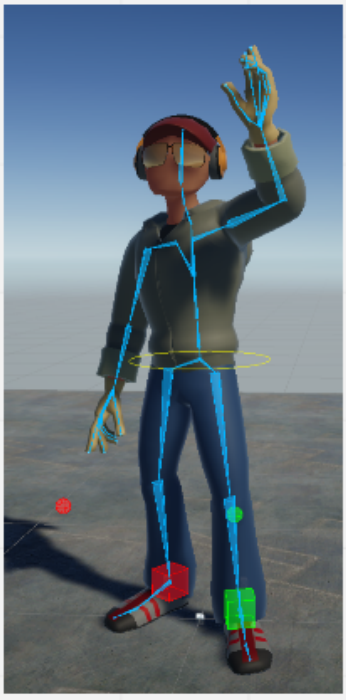
Cool sunglasses 😎



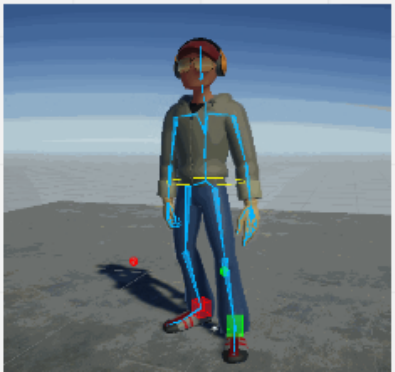
Idle pose



Emote pose



Idle animation



Emote animation