

Build An Interactive Claw Machine Experience with SparkAR

Overview

In this tutorial, you will learn how to build an interactive claw machine experience in sparkAR. The idea is that users can control the claw by using their face movements instead of their hands. When they feel they get the right position, they can drop the claw by opening the mouth. And after the users succeed in catching the toys, they will be rewarded by dressing up the accessories that they caught.

Topics will be covered:

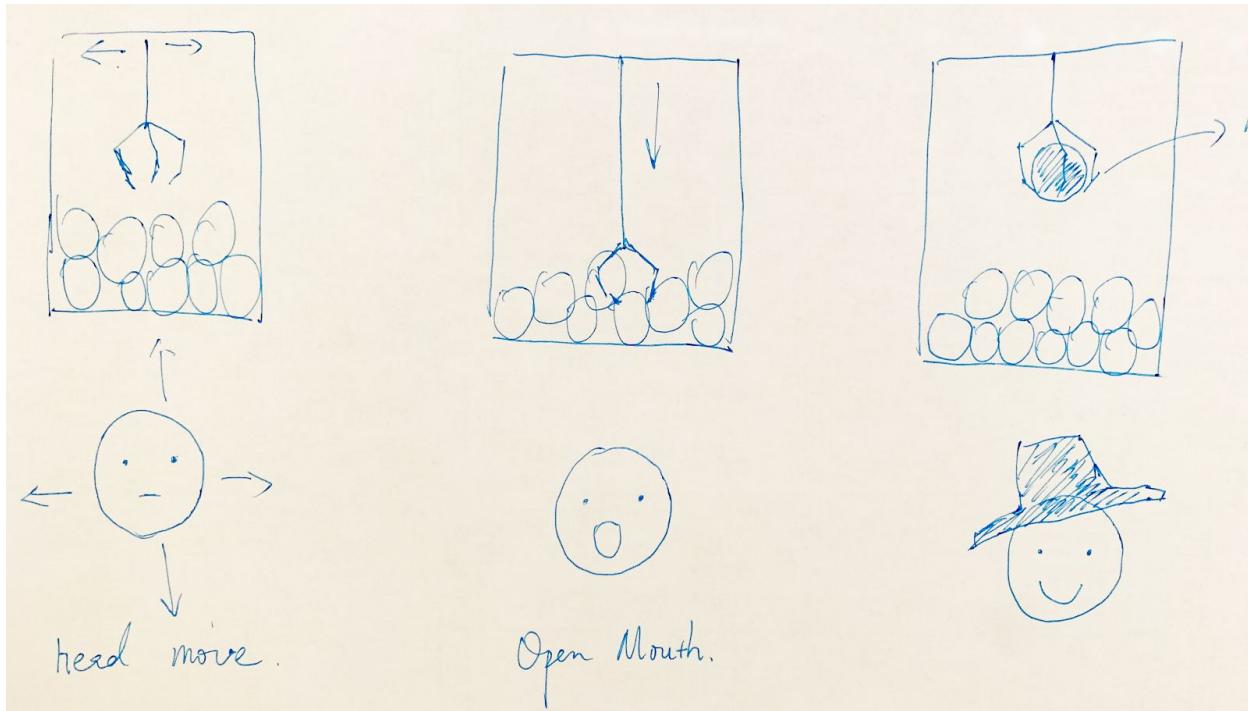
- Design the user interaction flow
- Preparing 3d model with animation and import into sparkAR
- Using face and mouth to control animation
- Design interaction and break down into function module by using sparkAR patch editor
- Set communication between patch editor and script

Prerequisites

- Download sparkAR editor: <https://sparkar.facebook.com/ar-studio/download/>
- Download the sample project, including both the finished and unfinished versions.

Storyboard

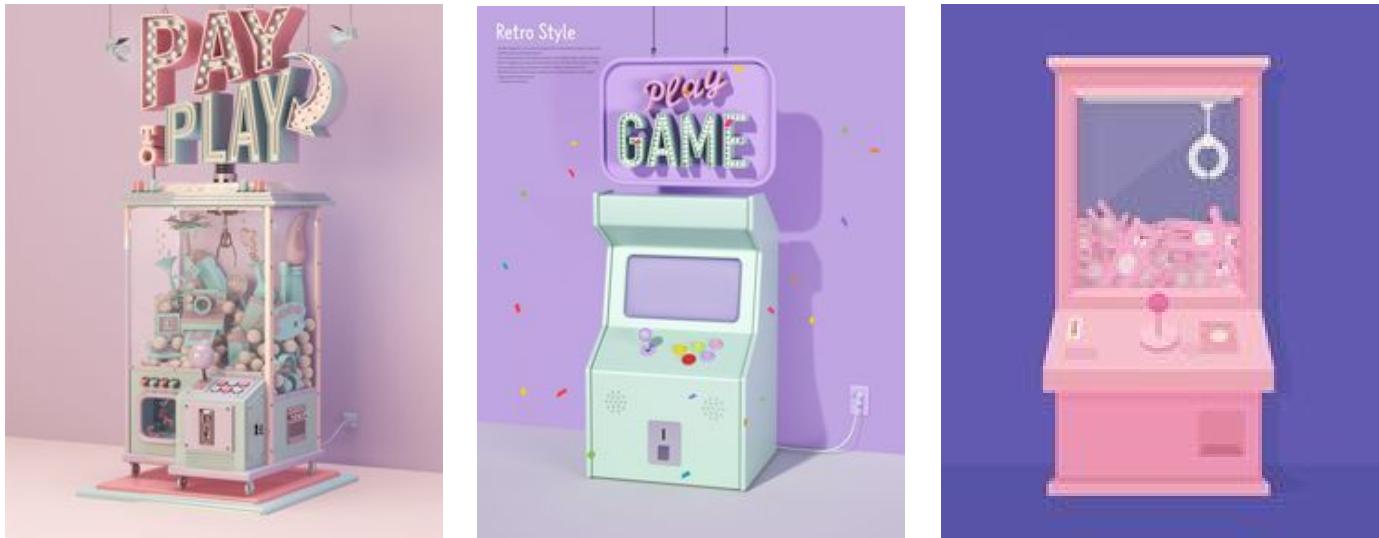
I usually would like to draw a simple storyboard to illustrate the process of the experience, this will help make an initial and abstract plan in your mind. As shown below, the experience can be simplified as moving your head to control the claw, open mouth to drop the claw, catch the target toy and drag it up.



Visual Art

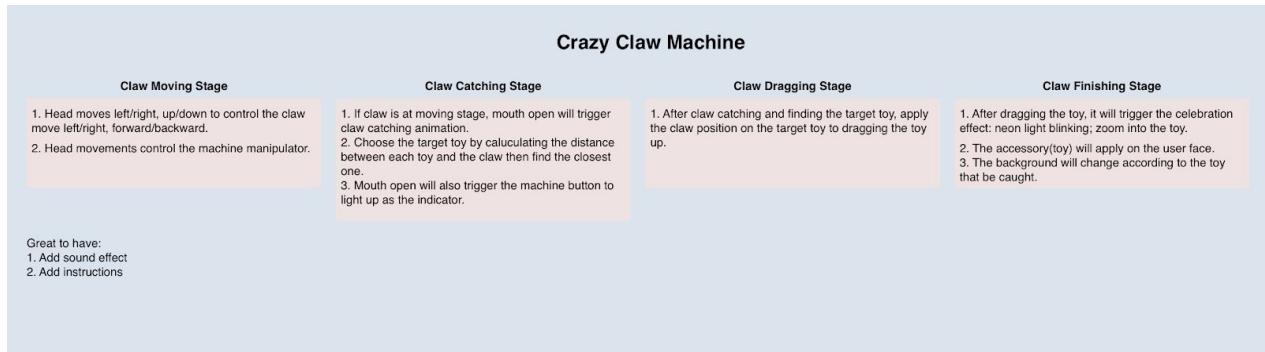
Also, it's better to make an artboard as the inspiration for 3d models and visual style. Here is the link to my art board on Pinterest.

<https://www.pinterest.com/anyemelody1209/sparkar/>



User Flow

Based on the storyboard, here we design a more detailed user flow to direct the whole experience. The whole process can be broken down into four stages, and there will be different interactions and behaviors under each stage.



Getting Started in SparkAR

Open the unfinished project from the assets folder. All the needed assets have been already imported into the project, you will find

1. Claw Machine
2. Claw with animation clip
3. Other 3D accessories
4. A selection of textures

Moving stage

If you refer to the user flow above, the function under this moving stage are:

1. Head moves left/right, up/down to control the claw move left/right, forward/backward
2. Head movements control the machine manipulator.

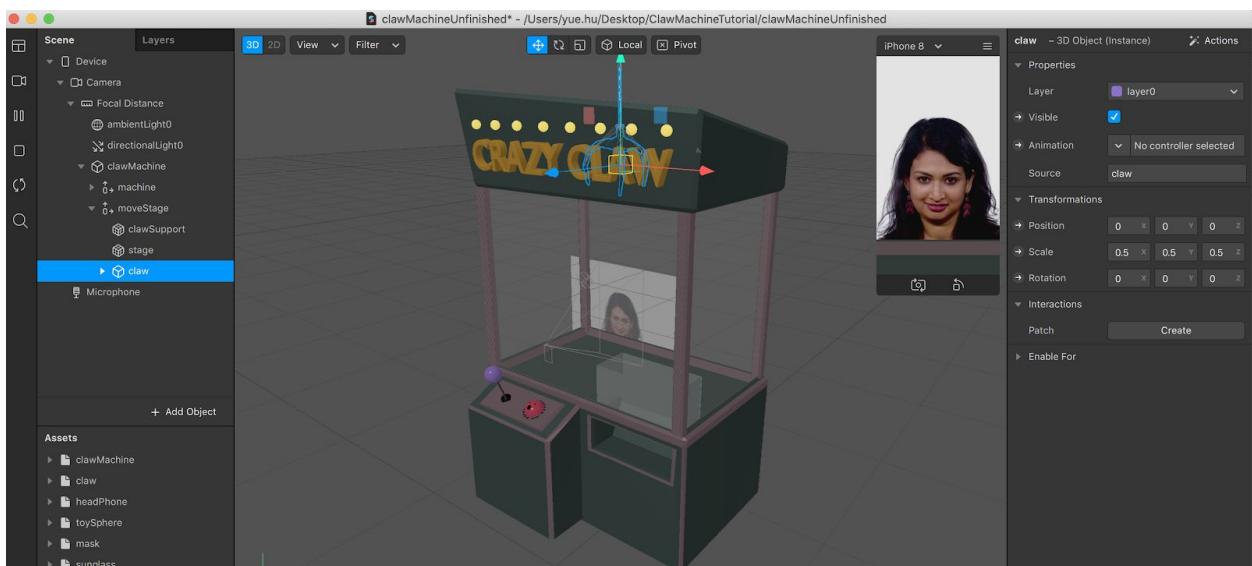
And all these interactions are based on the face tracker in SparkAR Studio.

Instruction:

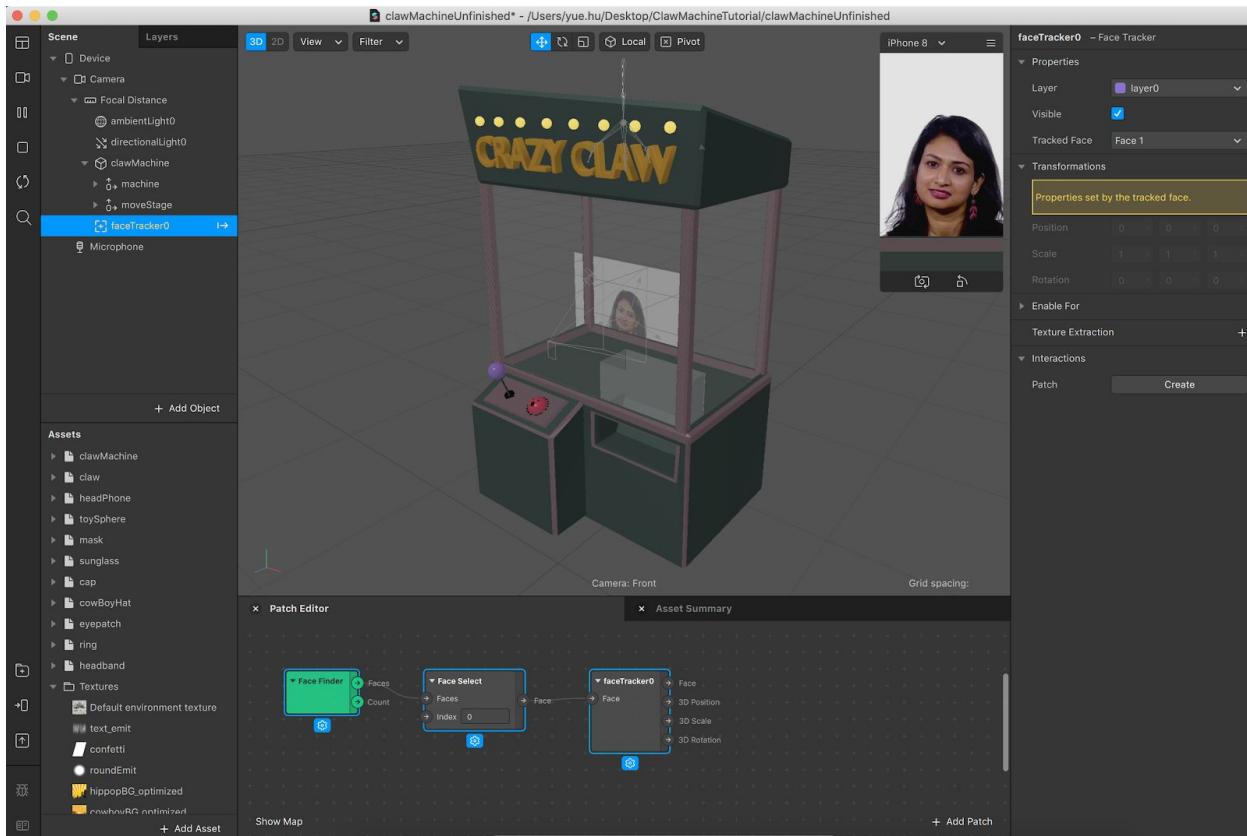
1. Import the claw machine model, delete other child objects just keep the machine, and moveStage. Rename machine object to machineFrame just to distinguish the objects. And we can tweak the position of the clawMachine to (-0.06, -0.2, -2.2) to see the object in the preview.



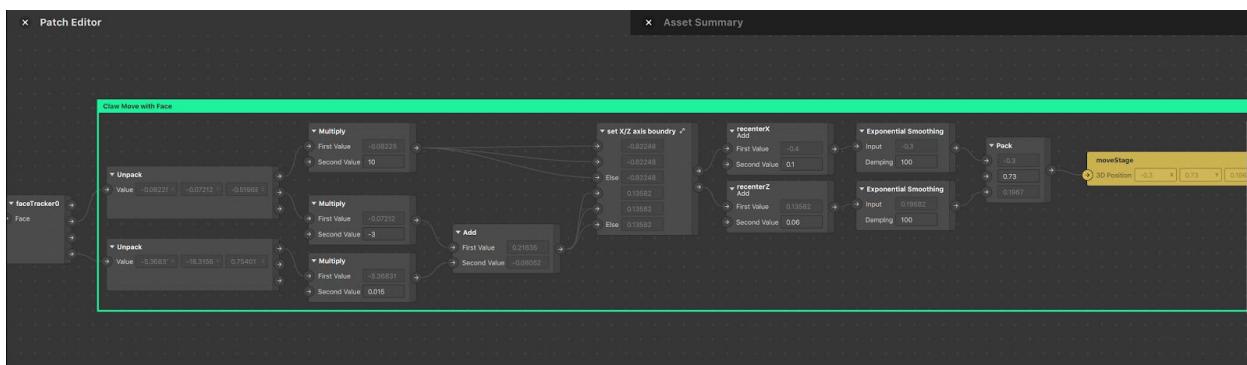
- Import the claw model, put it under clawMachine -> moveStage, set claw scale to (0.5, 0.5, 0.5)



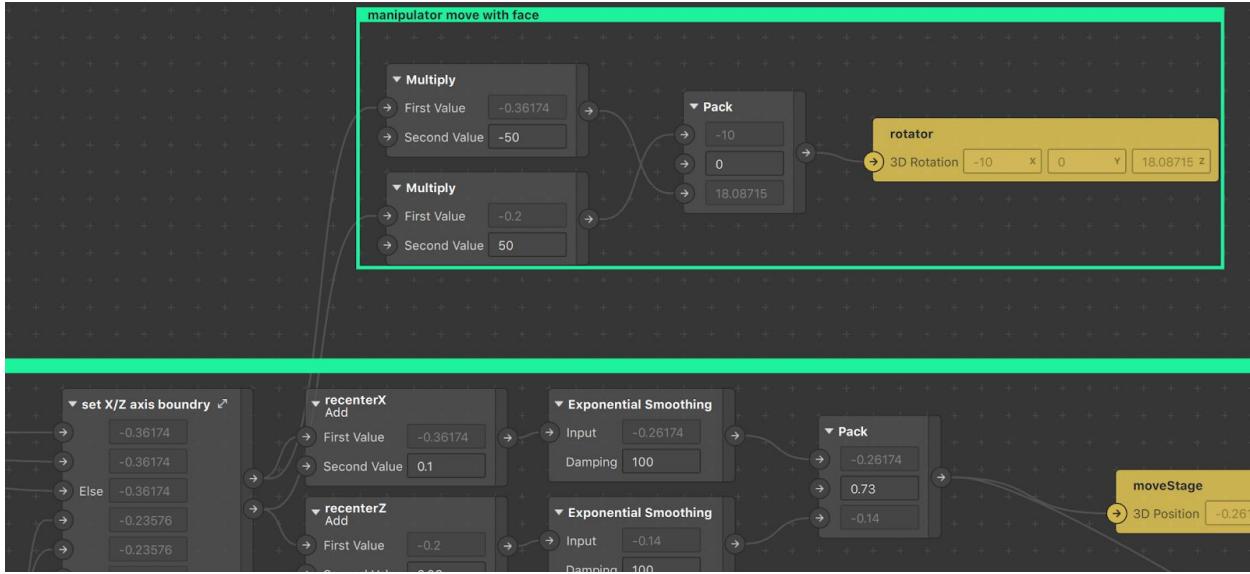
- Click Add Object, Select faceTracker
- After you see the faceTracker in the Scene Panel, drag the object into the patch editor. (can find the patch editor from menu -> View -> Show/Hide Patch Editor)



- Drag the lines out from faceTracker 3D Position and 3D Rotation, and apply some math calculations to control the claw moveStage's position. And if you use your own camera for live preview, you will see the claw moveStage starts moving with your head within the claw machine boundary.



- We use the same x and z values that calculated above to control the claw machine rotator as well. The rotator is in clawMachine->machineFrame->manipulator->rotator



Catching Stage

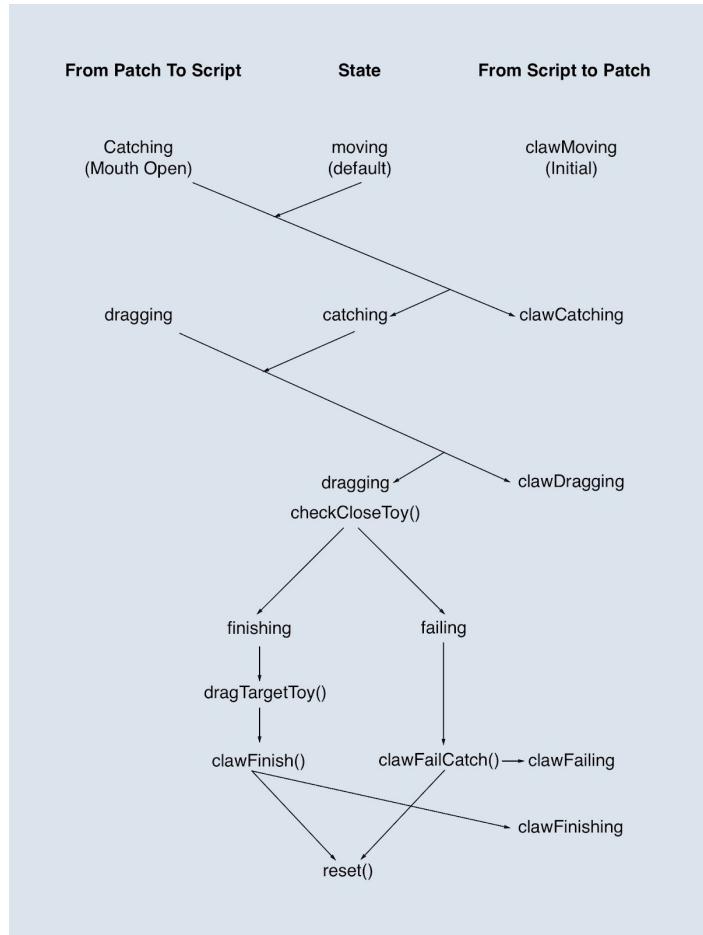
1. If it is at the moving stage, then opening the mouth will trigger claw catching animation.
2. If it is at the moving stage, then opening the mouth will trigger the machine button to light up.
3. Stage will change from moving to catching.
4. Choose the target toy by calculating the distance between each toy and the claw to find the closest one.

Instruction:

1. Build Script and Restart/Initial function

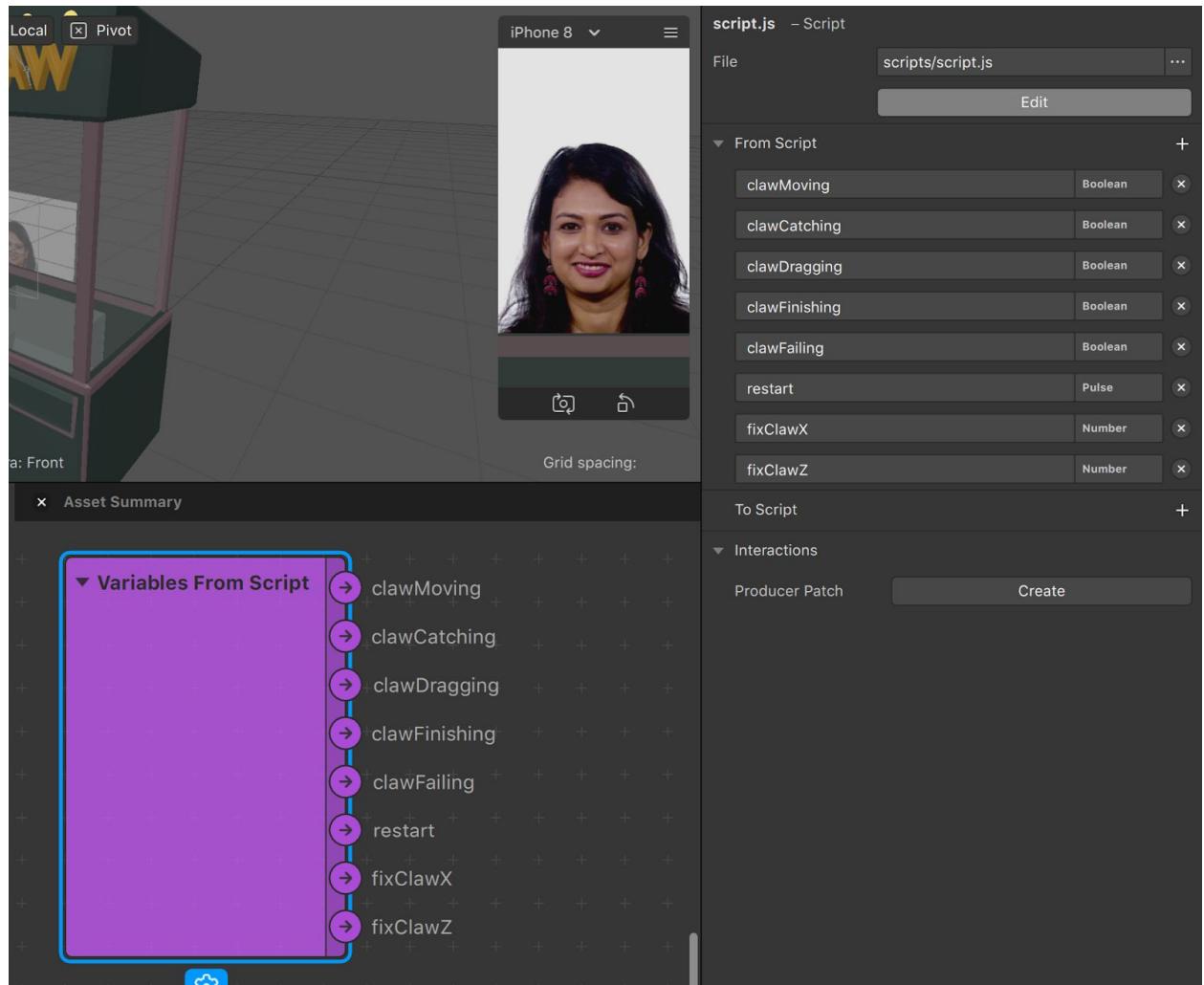
Since we need callbacks after each stage finishes and trigger the next stage to begin.

We start to build the script and set variables to help pass the state signals between these stages. For understanding easier and making the logic clearer, I draw this diagram below to help illustrate the communications between the patch and script.



Click **Add Asset → Script**, then you will see a new script be created in your assets.

Then, we create 5 **boolean** variables called “clawMoving”, “clawCatching”, “clawDragging”, “clawFailing” and “clawFinishing” to represent the five stages. And a **pulse** variable “restart” to shoot a pulse signal every time starting the experience, and two **Number** variables called “fixClawX” and “fixClawZ” to record the claw position. Then drag the script into the patch editor and you will see the script patch with all the variables that we just created.



After creating these variables, we open the `script.js` in a code editor like Visual Studio Code, and start writing our first restart function!

We firstly add the needed library in there along with the variables that we created.

```
JS script.js  X
Users > yue.hu > Desktop > ClawMachineTutorial > clawMachineUnfinished > scripts > JS script.js > ...
13 // For projects created with v87 onwards, JavaScript is always executed in strict mode
14 //=====
15
16 const Scene = require("Scene");
17 const Reactive = require("Reactive");
18 export const Diagnostics = require("Diagnostics");
19 const Time = require("Time");
20 const Patches = require("Patches");
21
22 let clawMoving = "clawMoving";
23 let clawCatching = "clawCatching";
24 let clawDragging = "clawDragging";
25 let clawFailing = "clawFailing";
26 let clawFinishing = "clawFinishing";
27 let restart = "restart";
28 let fixClawX = "fixClawX";
29 let fixClawZ = "fixClawZ";
30 let currentState = null;
31 let preState = null;
32
```

Then we created the function to set the stages' states and the init function to initial these variables at every beginning of the game.

```

***** function to set the stages *****/
function setPatchState(a, b, c, d, e) {
    Patches.inputs.setBoolean(clawMoving, a);
    Patches.inputs.setBoolean(clawCatching, b);
    Patches.inputs.setBoolean(clawDragging, c);
    Patches.inputs.setBoolean(clawFailing, d);
    Patches.inputs.setBoolean(clawFinishing, e);
}

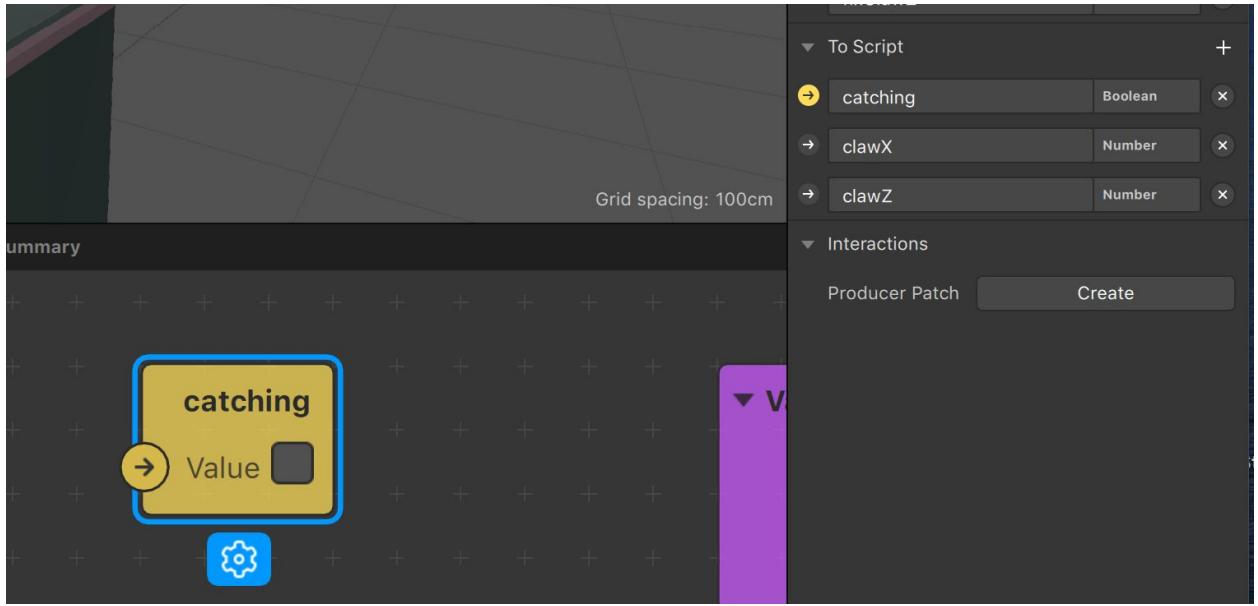
***** function to init the experience *****/
function init() {
    //shoot pulse when the experience restart
    Patches.inputs.setPulse(restart, Reactive.once());
    //set the active stage to clawMoving at the beginning
    setPatchState(true, false, false, false, false);
    currentState = "moving";
    preState = currentState;
    //reset the claw postion to (0,0)
    Patches.inputs.setScalar(fixClawX, 0);
    Patches.inputs.setScalar(fixClawZ, 0);
}

init()

```

2. Set “Catching” Stage

After setting up the script, let's see the “catching” stage and interactions. As it described in the above diagram, we will create a **boolean** “catching” from patch to editor to get the “Open Mouth” signal and send it to script. Then activate the consumer patch by clicking the arrow next to the variable.



Drag the “Mouth Open” patch from the **faceTracker’s Face** node, and connect the “Mouth Open” with our customized patch “catching”.



Then we pass the real time “catching” signal from patch to the script by writing the function in the script.

```
//update the openMouth realtime from the patch//
let openMouth;
Patches.outputs.getBoolean("catching").then((event) => {
  event.monitor().subscribe(function (values) {
    openMouth = values.newValue;
  });
});
```

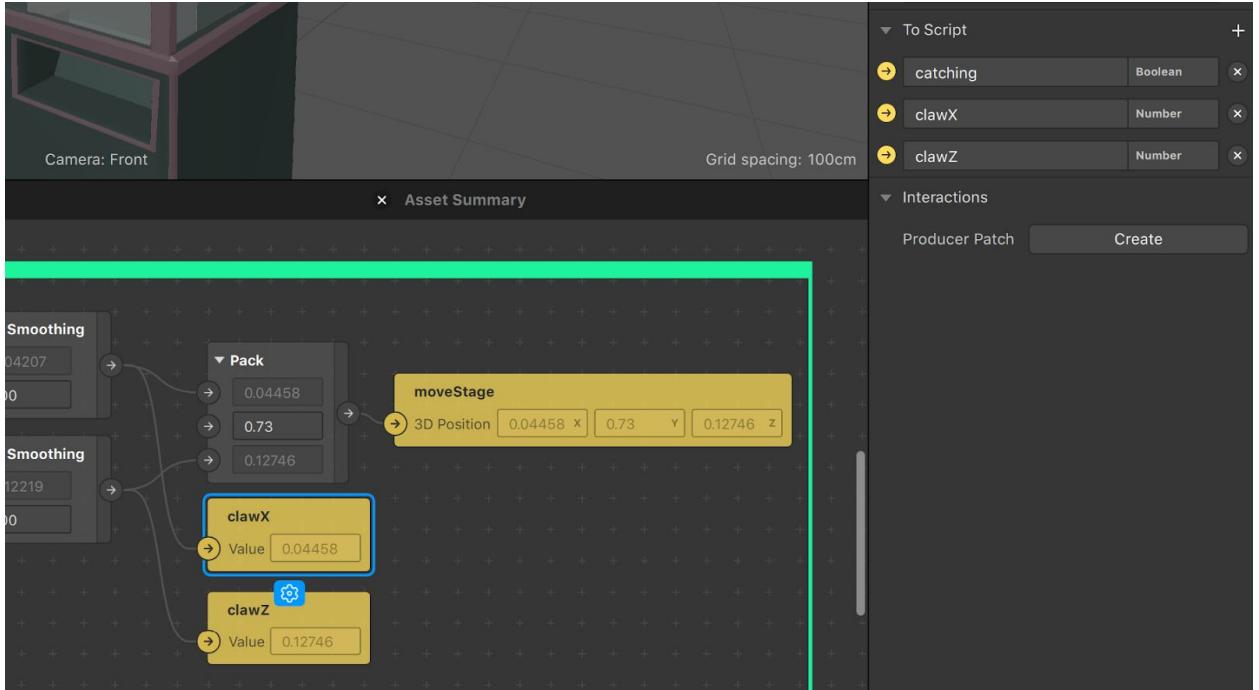
After getting the value, we need to record the claw X and Z position before it drops down and plays the catch animation.

```
function update(){
  //check the state then switch to catching//
  if (openMouth && currentState === "moving") {
    setPatchState(false, true, false, false, false);
    currentState = "catching";
  }
  //lock the claw x and z position
  if (currentState === "catching" && preState === "moving") {
    let posX = Patches.getScalarValue("clawX").pinLastValue();
    let posZ = Patches.getScalarValue("clawZ").pinLastValue();
    preState = currentState;
    Patches.setScalarValue(fixClawX, posX);
    Patches.setScalarValue(fixClawZ, posZ);
  }

  Time.setTimeout(update, 50);
}

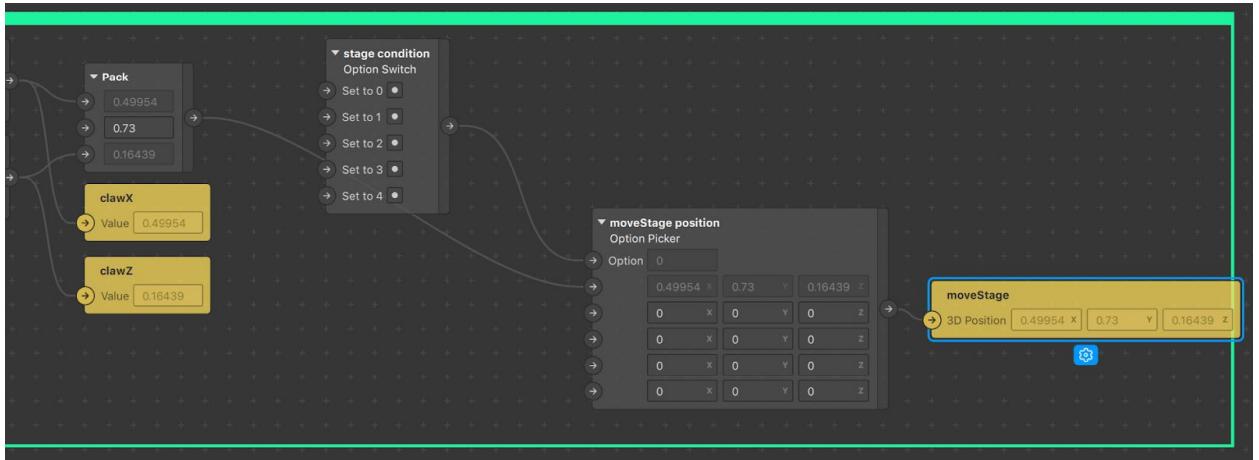
init()
update()
```

At the same time, we connect the customized clawX and clawZ values with the moveStage in the patch editor to get the values.

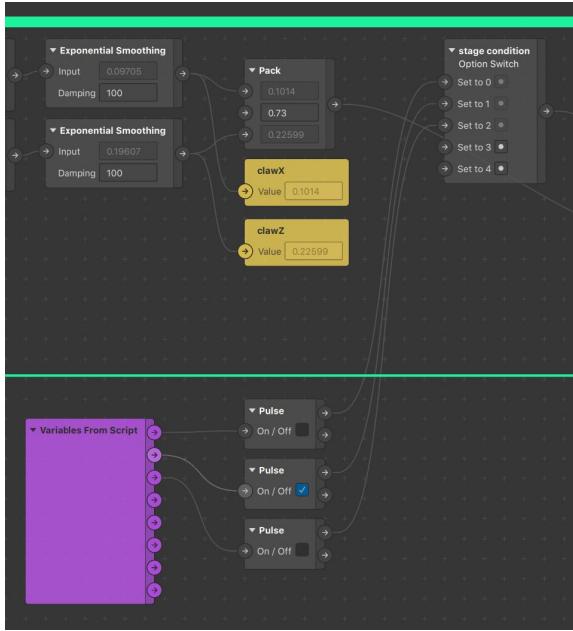


3. Set the Script values to Control Moving Stage

We insert the **Option Switch** and **Option Picker** to switch the moveStage position under different stages' condition.

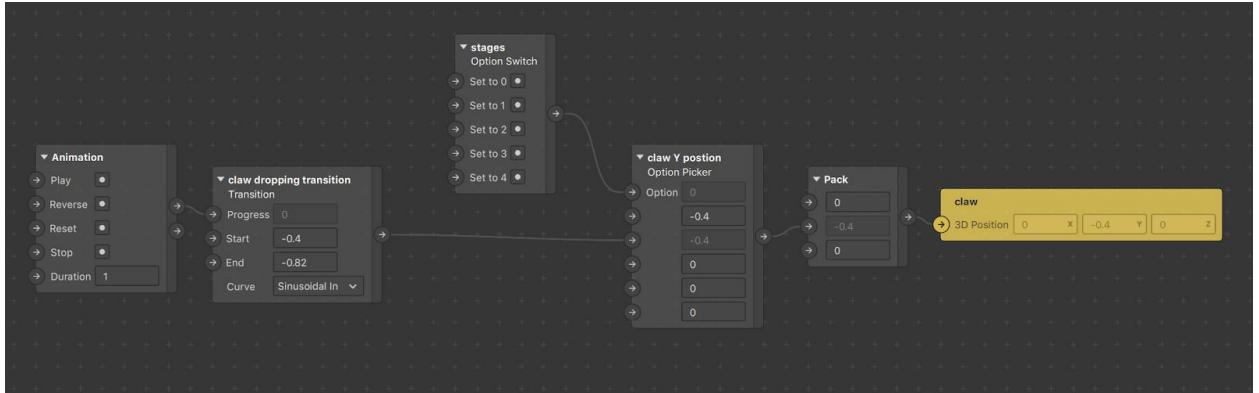


Connect the stages' condition from script to set the option one by one.

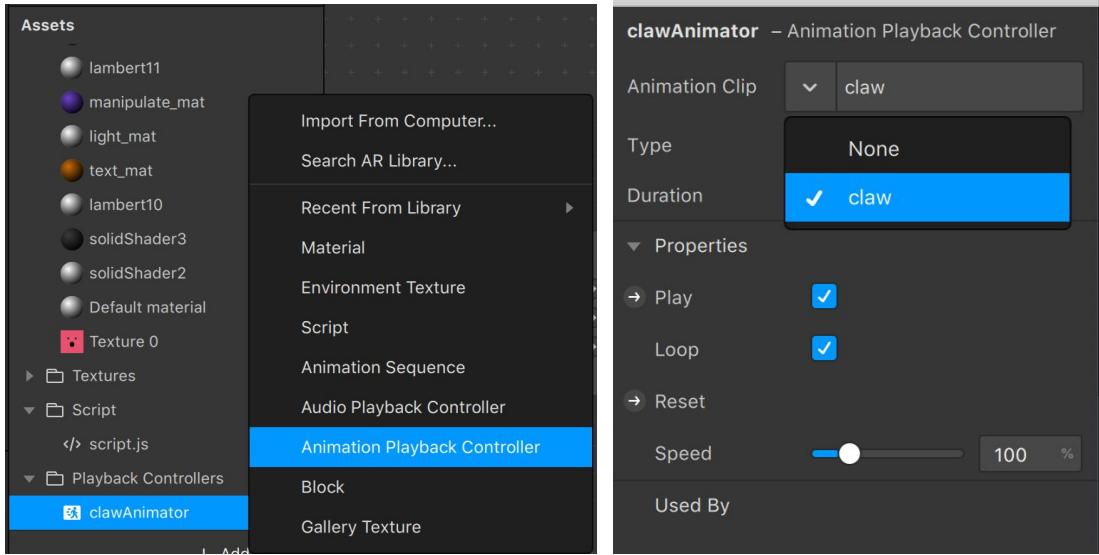


4. Set Claw Catching Action

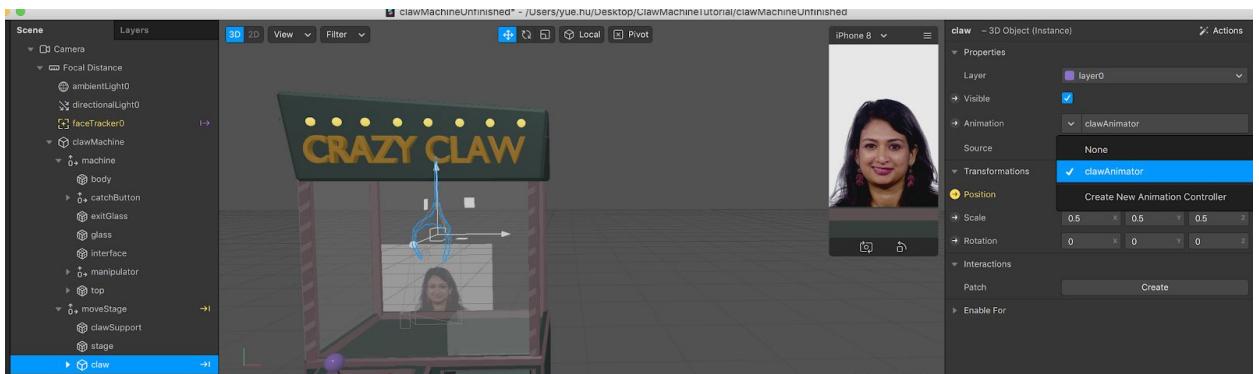
After the preparation, let's build the first action after the stage changes to catching. We firstly control the claw object to drop along the Y axis.



Then we add a new animation controller and named it “clawAnimator”, assign the “claw” clip to this animator.

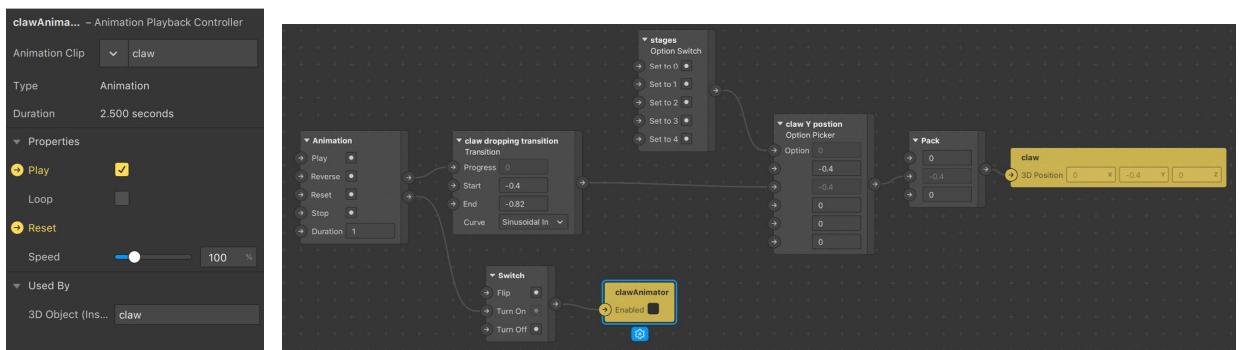


After setting up the animator, we want to assign it to the claw object in the Scene. You will see the claw is playing the catching animation.

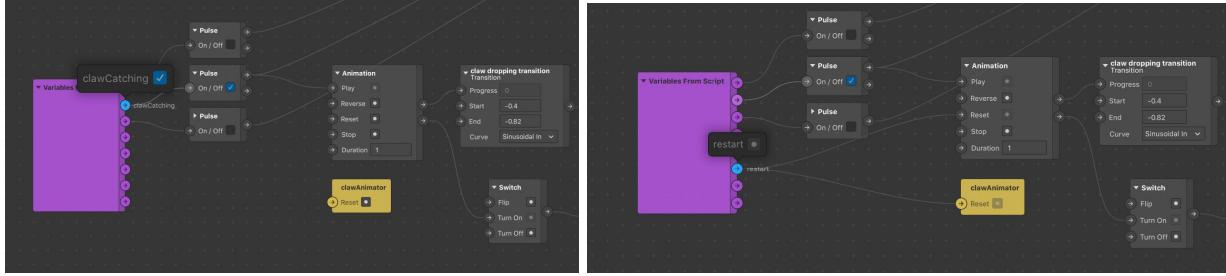


Next, let's navigate to the clawAnimator and bring **Reset** and **Play** into the patch editor by clicking the arrow next to the function, don't forget to disable the loop function since we just want the animation to play once every time catching.

And we want the claw catching animation after it drops, so we **switch on** the **Play** after the dropping animation is completed.

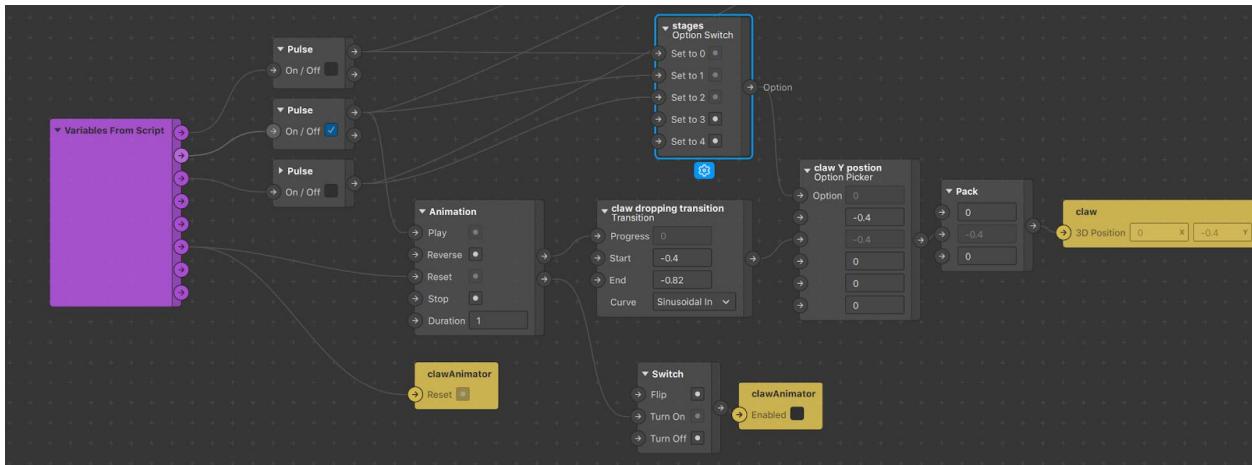


Connect the **clawCatching** condition from the script to **Play** the dropping animation, and **Restart** condition to **Reset** both the dropping animation and **clawAnimator**.



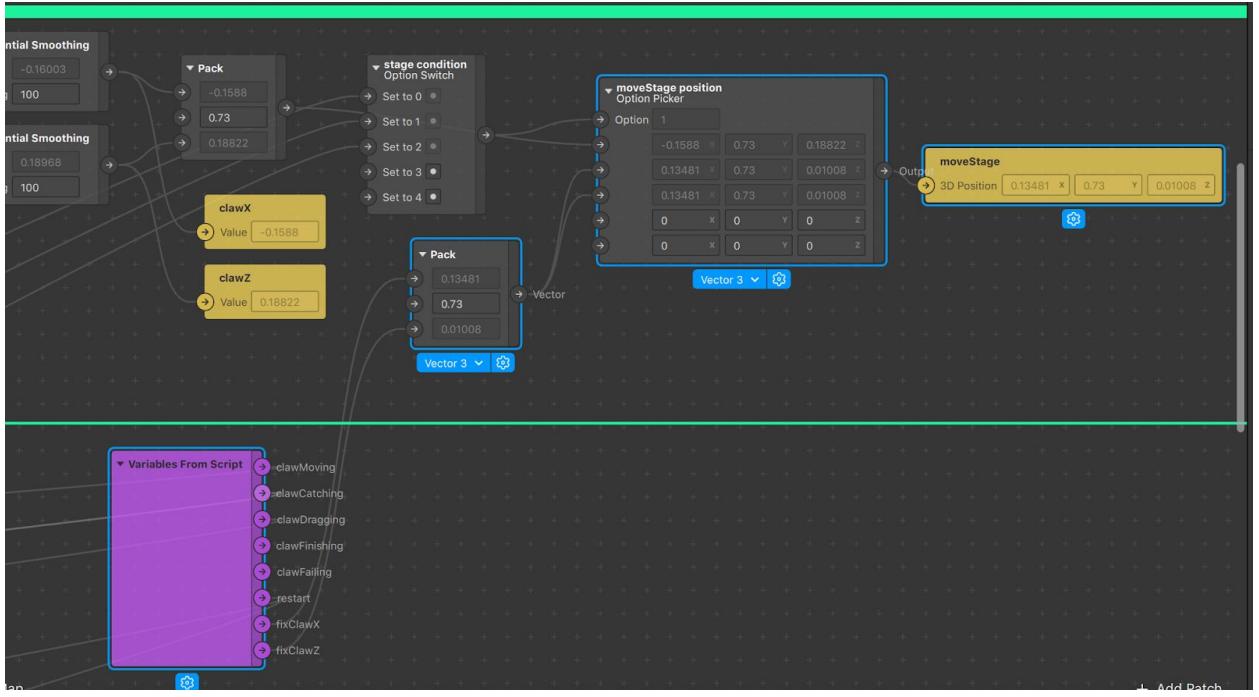
5. Set the Script values to Control Catching Stage

Connect the three stages from the script to switch the options for the claw Y position. If you preview the effect, you will find now the claw is moving following your face, and when you open your mouth, the claw will drop and play the catching animation. However, you will also notice that the movingStage is dropping with the claw, so we're gonna fix that problem in the next step.



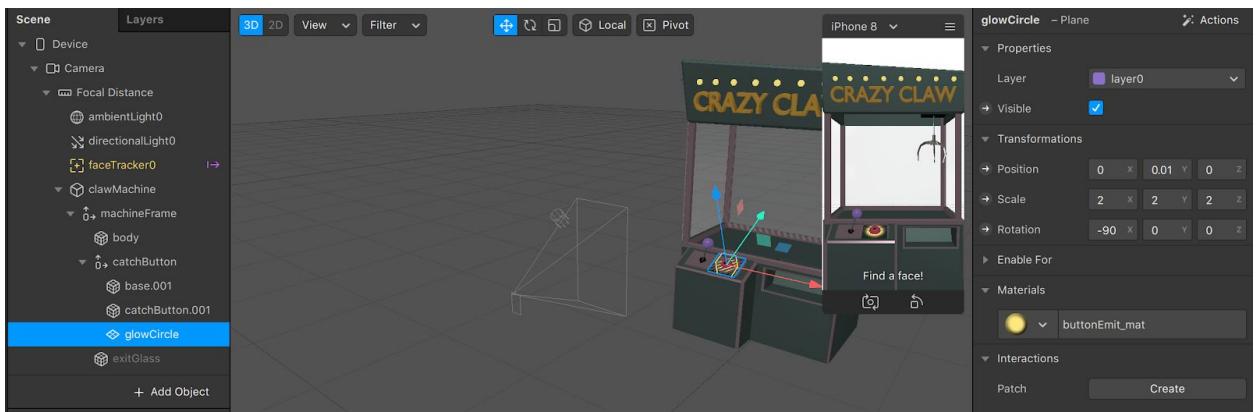
6. Lock the moveStage position when start catching

The moveStage's position needs to be locked when the user chooses a good spot and opens his mouth to trigger drop the claw. That is why we need variables **fixClawX** and **fixClawZ** to record the position. Since we already pass the real time clawX and clawZ patch values to the **fixClawX** and **fixClawZ** in the script function, what we need to do next is connect the two values from script and set it as the moveStage position in the patch editor. And now if you try in the preview, you will find the moveStage is locked at the position where you stopped and dropped the claw.

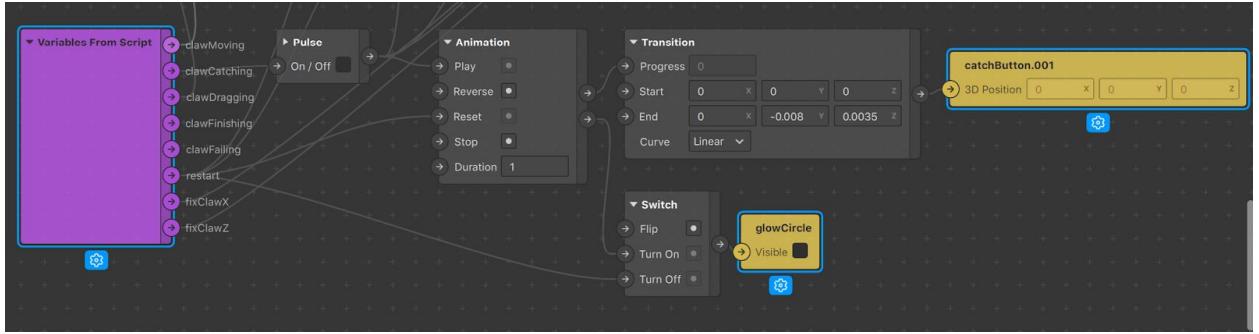


7. Play Button light up

Firstly, in the scene let's add a new **plane** object, rename it to **glowCircle**, and put it inside of **clawMachine** -> **machineFrame** -> **catchButton**, reset the transformation (parameters are in the screenshot) to match the **catchButton** position. And also build a material by using the **roundEmit** texture for it.



Then, we set the animation in the patch editor to make the button be pushed down and enable the glow object when the stage goes to catching and dropping the claw.



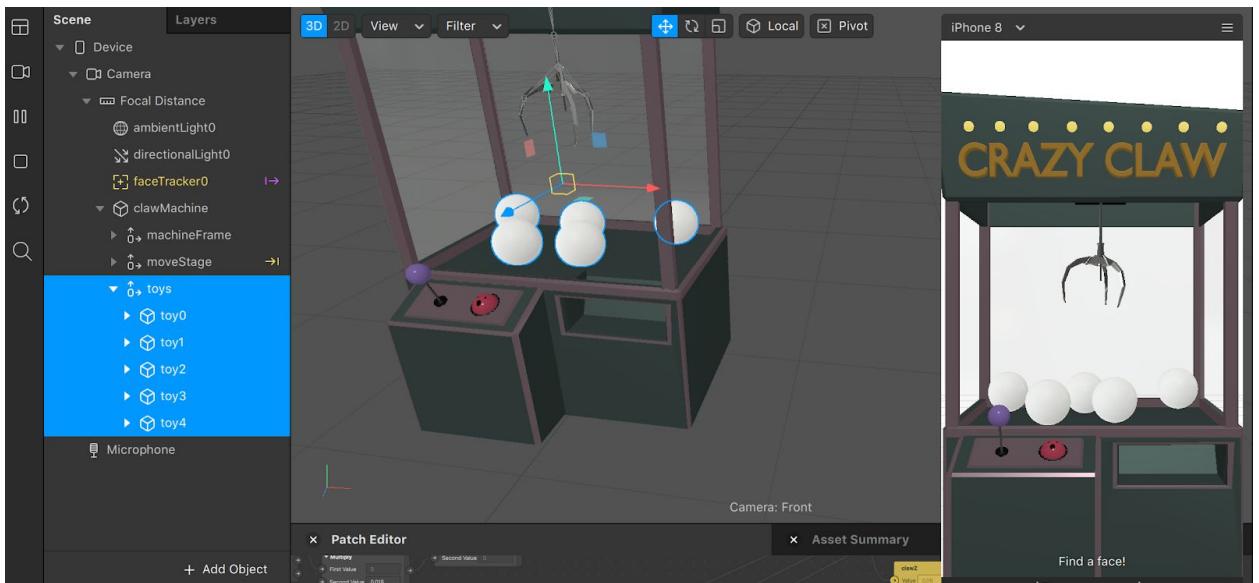
8. Set toys in the scene

We know after dropping the claw, we actually want to catch our target toy. So firstly, let's set up the toys in the scene.

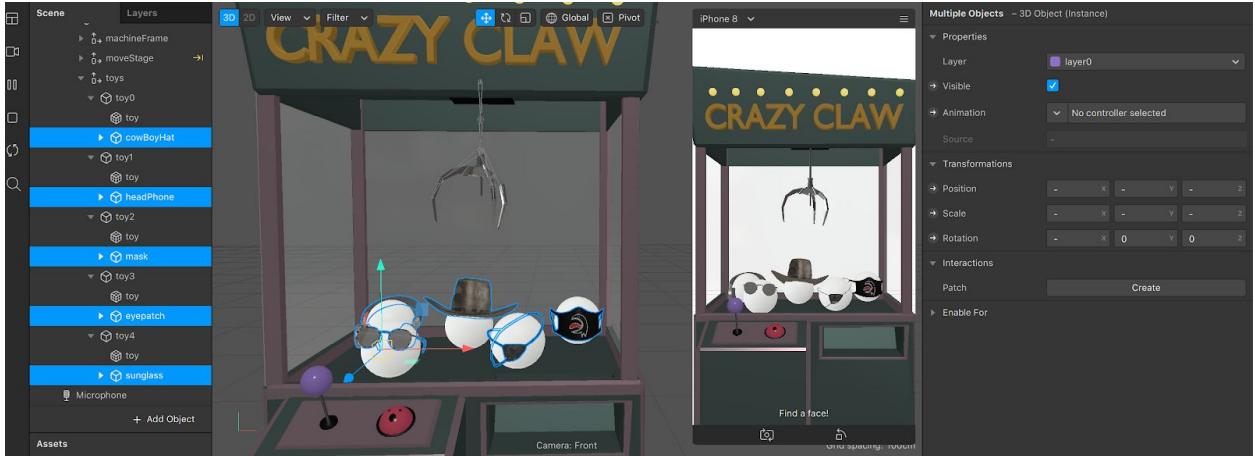
We add a **Null Object** and rename it to **toys**, put it under the **clawMachine** object.

Then we drag the **toySphere** from the **Assets** to the scene and put it under **toys**.

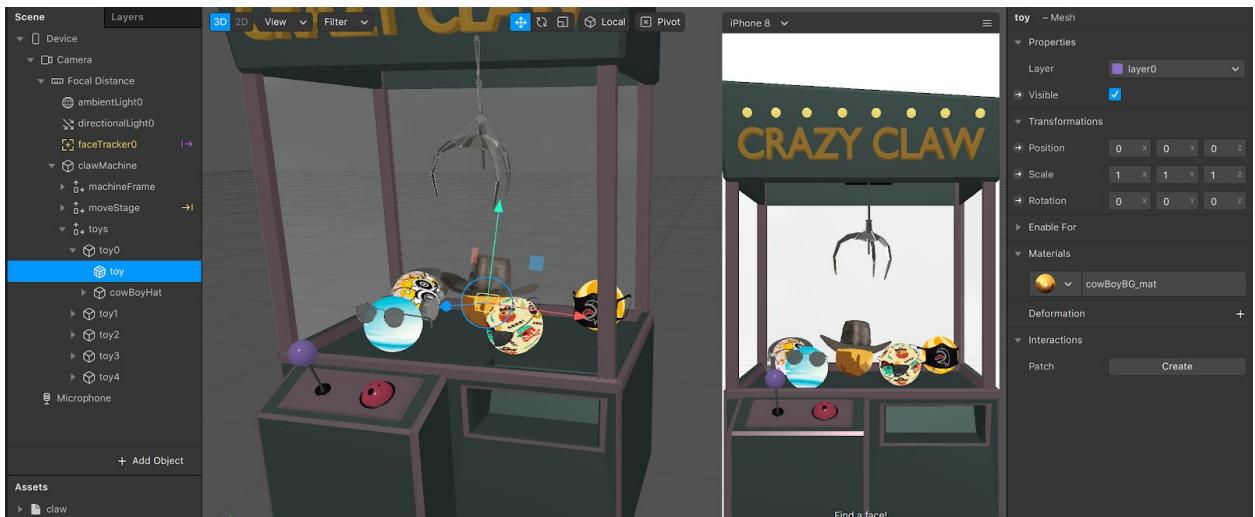
These spheres are holders of the accessories, we are gonna place five different toys in the machine, so let's repeat and place five **toySphere** in there. And we rename them followed by **toy0**, **toy1**, **toy2**, **toy3**, **toy4** and **toy5**. Set each **toySphere** scale to (0.5, 0.5, 0.5), and tweak their positions to place them in the machine properly.



Choose accessories from the assets and insert them into each sphere holder. And adjust the transformation of the accessories to make them suit perfectly on the **toySphere**.



After that, we create corresponding materials for each sphere.



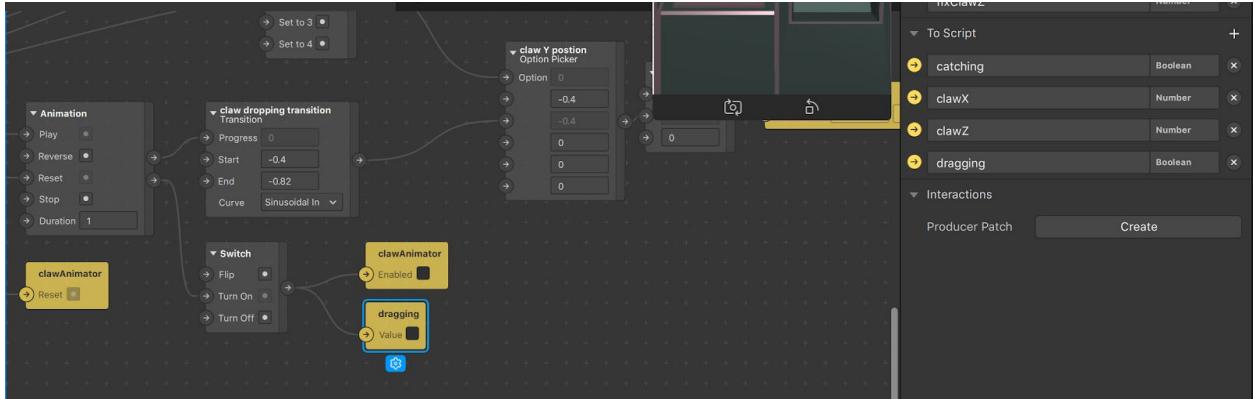
Dragging Stage

During this stage, we will find the closest toy, if the closest toy is within the minimum distance threshold then succeed in dragging the toy up. Otherwise fail to catch a toy, the claw will go up.

Instruction

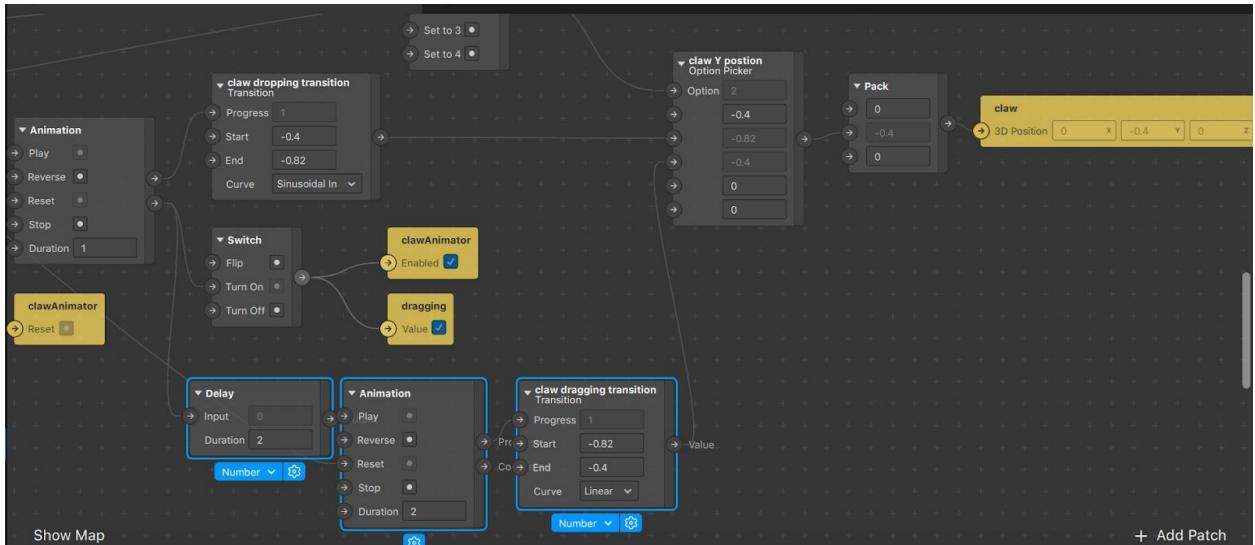
1. Create Dragging variable and send to script

Let's create a boolean variable called **Dragging** under the script.js **To Script**. Then we create the variable patch by clicking the arrow on the left. And we connect it in the patch editor to make it be triggered at the same time as the clawAnimator is enabled.



2. Claw dragging back

In the patch editor, set the animation to drag the claw up when it comes to the dragging stage. If you preview the effect, you will find the claw will go down and play the catching animation, and drag up after finishing the animation.



3. Find the closest toy

Let's write some codes in the script.js to find the closest toy when the stage comes to dragging.

3.1 Get the dragging signal from the patch, and create a variable to hold the signal.

```

//get the clawDrag signal from the patch//
let clawDrag;
Patches.outputs.getBoolean("dragging").then((event) => {
  event.monitor().subscribe(function (values) {
    clawDrag = values.newValue;
  });
});

```

3.2 In update function, write the module that is executed when it comes to the dragging stage.

```

function update(){
  //check the state then switch to catching//
  if (openMouth && currentState === "moving") {...}
  //lock the claw x and z position
  if (currentState === "catching" && preState === "moving") {...}
  //go to claw Drag stage
  if (clawDrag && currentState === "catching") {
    setPatchState(false, false, true, false, false);
    checkCloseToy();
    preState = currentState;
    currentState = "dragging";
  }

  Time.setTimeout(update, 50);
}

```

3.3 The checkCloseToy function

Before writing the function to check the closest toy, define the global variables that will be needed in the function.

```
//variables for toys
let toys = [];
let targetToyNum = "targetToyNum";
let targetToy = null;
let originTargetToyY = 0;
let startClawHeight = 0;
let failToCatch = null;
```

Clarify the const that navigate to the objects in the scene.

```
/*
***** find object from the scene *****/
const clawMachine = Scene.root.find("Focal Distance").find("clawMachine");
const moveStage = clawMachine.child("moveStage");
const claw = moveStage.child("claw");
```

Write the function to check the closest toy by calculating the distance between the claw position and each of the toys and find the closest one.

```

function checkCloseToy() {
    let minDis = 100;
    let moveStageX = moveStage.transform.x.pinLastValue();
    let moveStageZ = moveStage.transform.z.pinLastValue();
    let dis = 0;
    for (let i = 0; i < toys.length; i++) {
        let toyPosX = toys[i].transform.x.pinLastValue();
        let toyPosZ = toys[i].transform.z.pinLastValue();
        dis = Math.pow(moveStageX - toyPosX, 2) + Math.pow(moveStageZ - toyPosZ, 2);
        dis = Math.sqrt(dis);
        if (dis < minDis) {
            targetToy = i;
            minDis = dis;
        }
    }
    //judge if the closet toy is too far
    minDis < 0.08 && !toys[targetToy].hidden.pinLastValue()
        ? (failToCatch = false)
        : (failToCatch = true);
    Diagnostics.log(minDis + " " + failToCatch);
    if (!failToCatch) {
        toys[targetToy].transform.x = moveStageX;
        toys[targetToy].transform.z = moveStageZ;
        originTargetToyY = toys[targetToy].transform.y.pinLastValue();
        startClawHeight = claw.transform.y.pinLastValue();
        checkCaughtToy();
    }
}

```

3.4 Set and check the toy type

Since our accessories include the types that we wear on head, eyes and mouth, in order to not overlap the same type of accessories we classify them at the beginning and check the type everytime catch a new toy.

Define the global variables that will be needed in the function.

```
//variables for checking repeat type of accessory
let usedHead, usedEye, usedFace;
let preType = null;
let removeHead = "removeHead";
let removeFace = "removeFace";
let removeEye = "removeEye";
```

Write the function to set the toy type one by one. Then execute it inside of **init** function

<pre>function setToys() { for (let i = 0; i < 5; i++) { let name = "toy" + i; let toy = clawMachine.child("toys").child(name); if (i == 0 i == 1) { toy.type = "head"; } else if (i == 2) { toy.type = "face"; } else if (i == 3 i == 4) { toy.type = "eye"; } toys.push(toy); } usedEye = false; usedFace = false; usedHead = false; preType = null; }</pre>	<pre>***** function to init the experience *****/ function init() { //shoot pulse when the experience restart Patches.inputs.setPulse(restart, Reactive.once()); //set the active stage to clawMoving at the beginning setPatchState(true, false, false, false, false); currentState = "moving"; preState = currentState; //reset the claw postion to (0,0) Patches.inputs.setScalar(fixClawX, 0); Patches.inputs.setScalar(fixClawZ, 0); //set toy types setToys(); }</pre>
--	--

Write the function to check the previous toy type

```
function checkCaughtToy() {
    if (toys[targetToy].type == preType) {
        switch (toys[targetToy].type) {
            case "head":
                Patches.inputs.setBoolean(removeHead, true);
                break;
            case "face":
                Patches.inputs.setBoolean(removeFace, true);
                break;
            case "eye":
                Patches.inputs.setBoolean(removeEye, true);
                break;
        }
    } else if (toys[targetToy].type != preType) {
        switch (toys[targetToy].type) {
            case "head":
                if (usedHead) Patches.inputs.setBoolean(removeHead, true);
                break;
            case "face":
                if (usedFace) Patches.inputs.setBoolean(removeFace, true);
                break;
            case "eye":
                if (usedEye) Patches.inputs.setBoolean(removeEye, true);
                break;
        }
    }
    if (toys[targetToy].type == "head") usedHead = true;
    if (toys[targetToy].type == "eye") usedEye = true;
    if (toys[targetToy].type == "face") usedFace = true;
    preType = toys[targetToy].type;
}
```

4. Drag the target toy

According to the above function, we can already find the closest toy, then write the function to drag the target toy.

```
function dragTargetToy() {
    Patches.inputs.setScalar(targetToyNum, targetToy);
    let deltaHeight = claw.transform.y.pinLastValue() - startClawHeight;
    toys[targetToy].transform.y = originTargetToyY + deltaHeight + 0.03;
}
```

5. In the update function, write the module to go to the next stage after checking the closest toy.

```
function update(){
    //check the state then switch to catching//
    if (openMouth && currentState === "moving") {...}
    //lock the claw x and z position
    if (currentState === "catching" && preState === "moving") {...}
    //go to claw Drag stage
    if (clawDrag && currentState === "catching") {
        setPatchState(false, false, true, false, false);
        checkCloseToy();
        preState = currentState;
        currentState = "dragging";
    }
    //go to finishing state
    if (currentState === "dragging" && !failToCatch) {
        preState = currentState;
        currentState = "finishing";
    }
    //go to failing state
    if (currentState === "dragging" && failToCatch) {
        preState = currentState;
        currentState = "failing";
    }
    //drag the target toy
    if (currentState === "finishing" && preState === "dragging") {
        Time.setTimeout(dragTargetToy, 2000);
    }
}
```

After these steps, when you try in the preview, you will find the target toy can be caught when it's close enough, otherwise, you will fail and catch nothing. Next it will come to our final stage setting, thank you for sticking till now, we are almost there!

Finishing Stage

1. In this finishing stage, let's firstly write two functions to set the stages. And put inside the update function.

```
function update(){
    //check the state then switch to catching/
    if (openMouth && currentState === "moving") {...}
    ...
    //lock the claw x and z position
    if (currentState === "catching" && preState === "moving") {...}
    ...
    //go to claw Drag stage
    if (clawDrag && currentState === "catching") {...}
    ...
    //go to finishing state
    if (currentState === "dragging" && !failToCatch) {...}
    ...
    //go to failing state
    if (currentState === "dragging" && failToCatch) {...}
    ...
    //drag the target toy
    if (currentState === "finishing" && preState === "dragging") {
        Time.setTimeout(dragTargetToy, 2000);
        Time.setTimeout(clawFinish, 4000);
    }
    ...
}

function clawFinish() {
    setPatchState(false, false, false, false, true);
    preState = currentState;
}

function clawFailCatch() {
    setPatchState(false, false, false, true, false);
    Time.setTimeout(init, 2000);
}
```

2. Improve the init function

Add codes to reset parameters when restart the experience.

```

function init() {
    //shoot pulse when the experience restart
    Patches.inputs.setPulse(restart, Reactive.once());
    //set the active stage to clawMoving at the beginning
    setPatchState(true, false, false, false, false);
    currentState = "moving";
    preState = currentState;
    //reset the claw postion to (0,0)
    Patches.inputs.setScalar(fixClawX, 0);
    Patches.inputs.setScalar(fixClawZ, 0);
    //set toy types
    setToys();
    //put the target toy back
    if (targetToy !== null && !failToCatch) {
        //hide last time target
        toys[targetToy].hidden = true;
        targetToy = null;
    }
    originTargetToyY = 0;
    startClawHeight = 0;
    Patches.inputs.setScalar(targetToyNum, 100);
    failToCatch = null;
    //reset these variables
    Patches.inputs.setBoolean(removeHead, false);
    Patches.inputs.setBoolean(removeFace, false);
    Patches.inputs.setBoolean(removeEye, false);
}

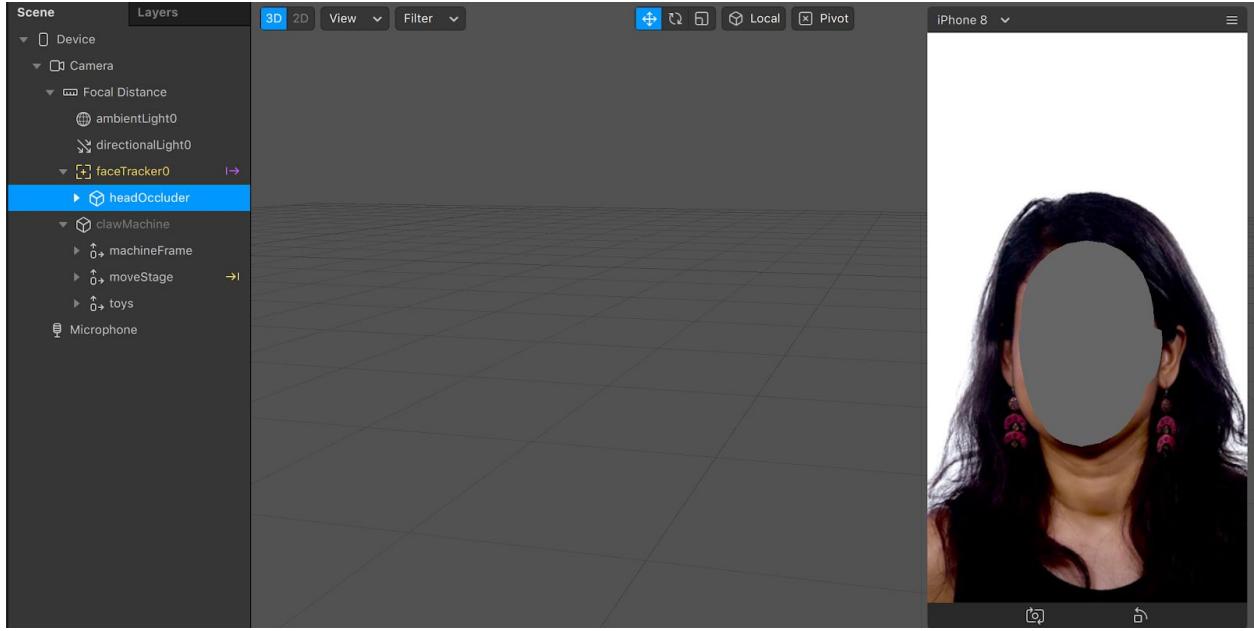
```

3. Set the accessories on face

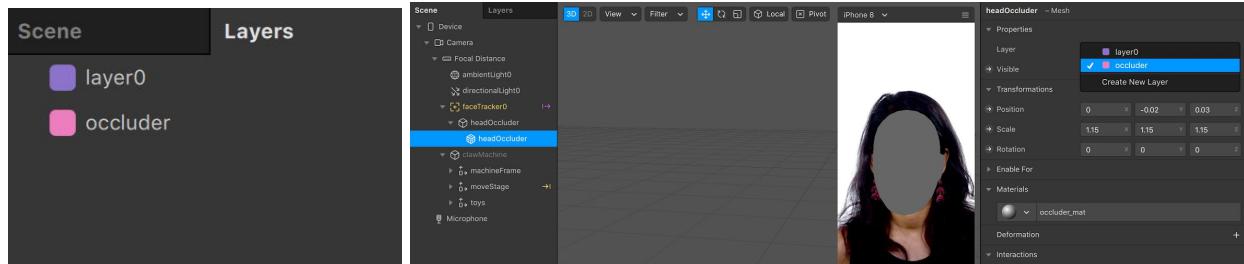
The accessories we set above are for catching, and next we will set the accessories to apply on the face.

3.1 Add headOccluder

Firstly, try to download the headOccluder from the sparkAR reference assets. (<https://sparkar.facebook.com/ar-studio/learn/articles/people-tracking/face-reference-assets#whats-included-in-the-face-reference-assets>) And bring it in the assets. Drag the headOccluder under the **faceTracker0** in the scene.

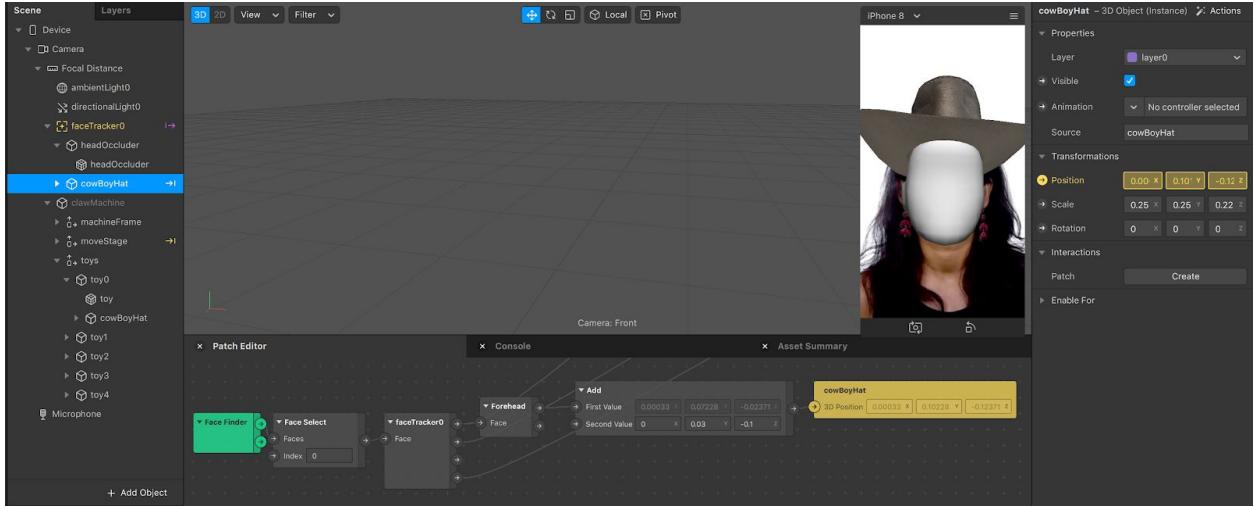


Then we build a new layer called occluder, put this layer underneath layer0, and assign the headOccluder layer to occluder. And you can tweak the headOccluder transformation to make it match more seamlessly with your head.

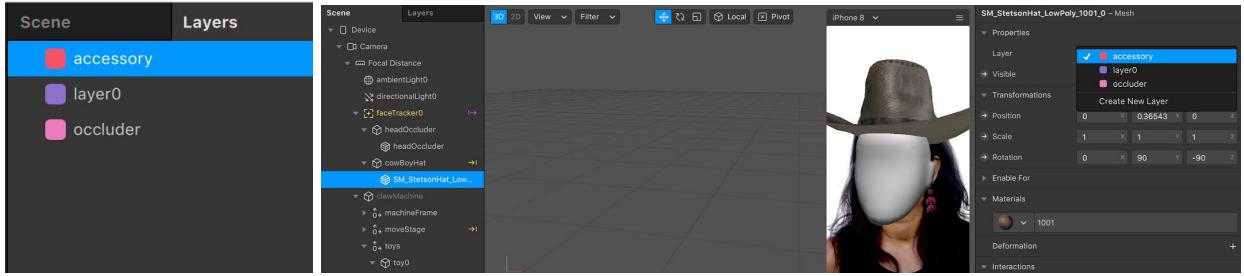


3.2 Add and Apply Accessory on Face

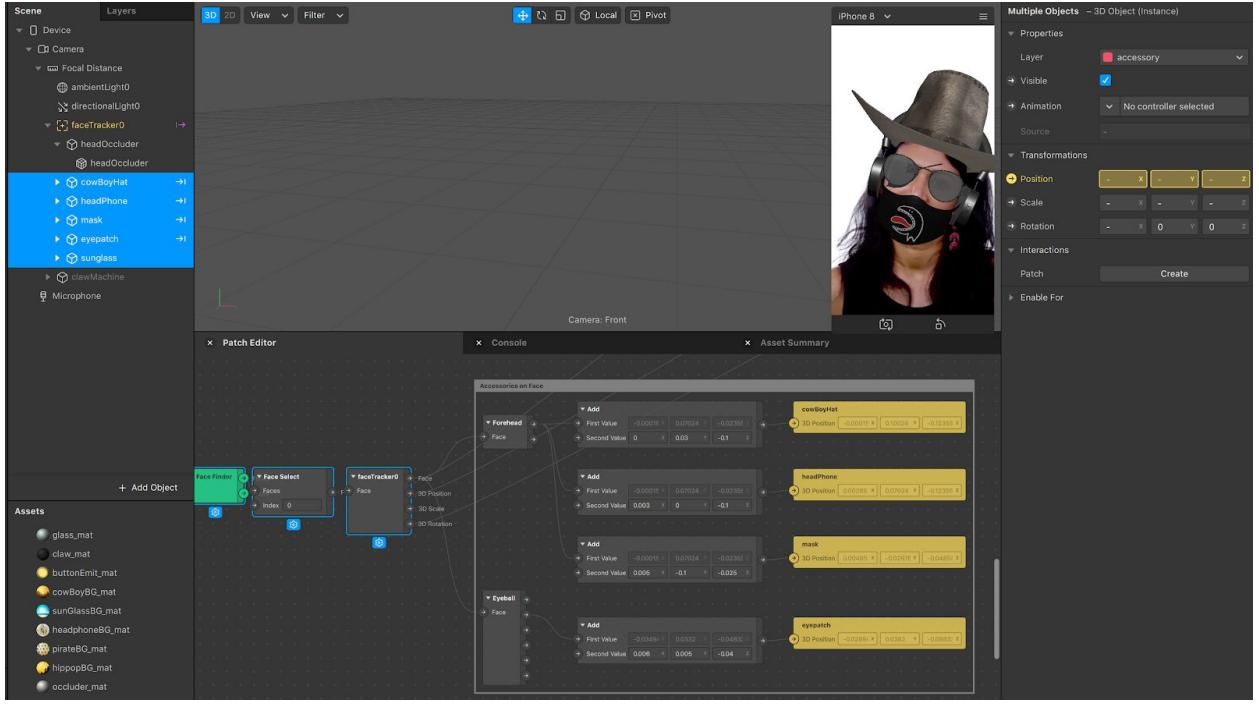
What we do next is bring the accessories that we put under the machine into the scene again under the **faceTracker0**. For example, we put the cowboy hat under the first toySphere, so we bring another cowboy hat from the asset into the scene under **faceTracker0**. Adjust the scale to (0.25,0.25,0.22). Then connect and apply some offset of the position with faceTracker's forehead in the patch editor.



Create a new **layer** called **accessory**, move the layer above the **layer0**. Then assign the cowboyHat object under this layer.

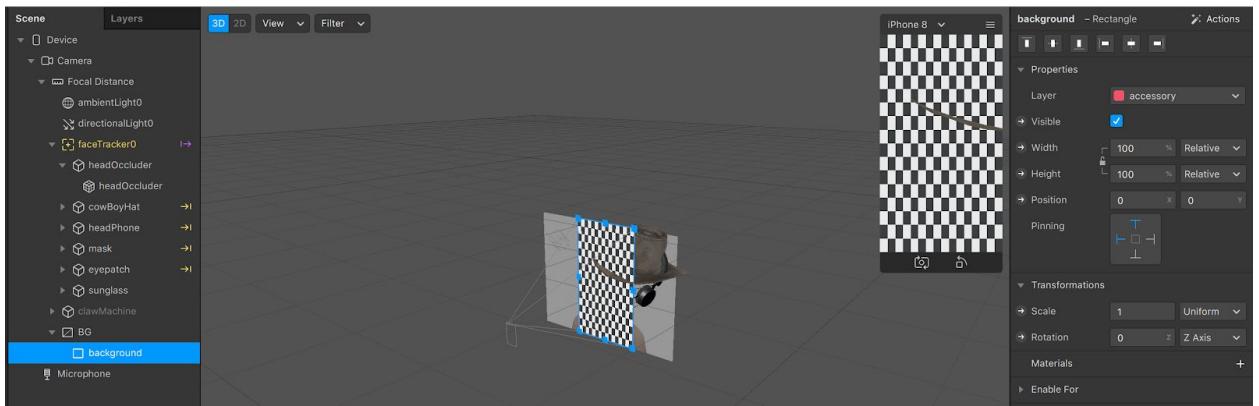


Repeat step 9.2, and bring the rest 5 accessories into the scene under the **faceTracker0**, adjust the transformation to fit on the face properly and assign them under the accessory layer. After you feel them in good position, you can tweak the opacity of the **headOccluder**'s material to 0.

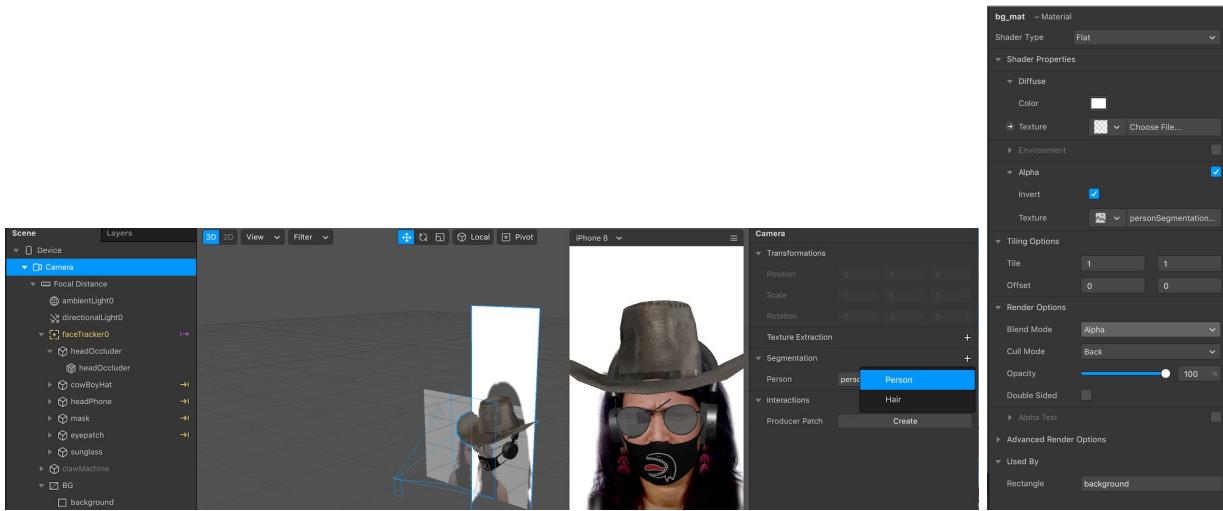


3.3 Add background

Add a **Rectangle** object in the scene, you will see a canvas with a rectangle be created. Let's rename the canvas as BG and the rectangle as background. Set the canvas to World space mode, change position to (0,0,-0.25), scale to(0.0011, 0.002, 0.002). Then set the background size as Fill Width and Fill Height.

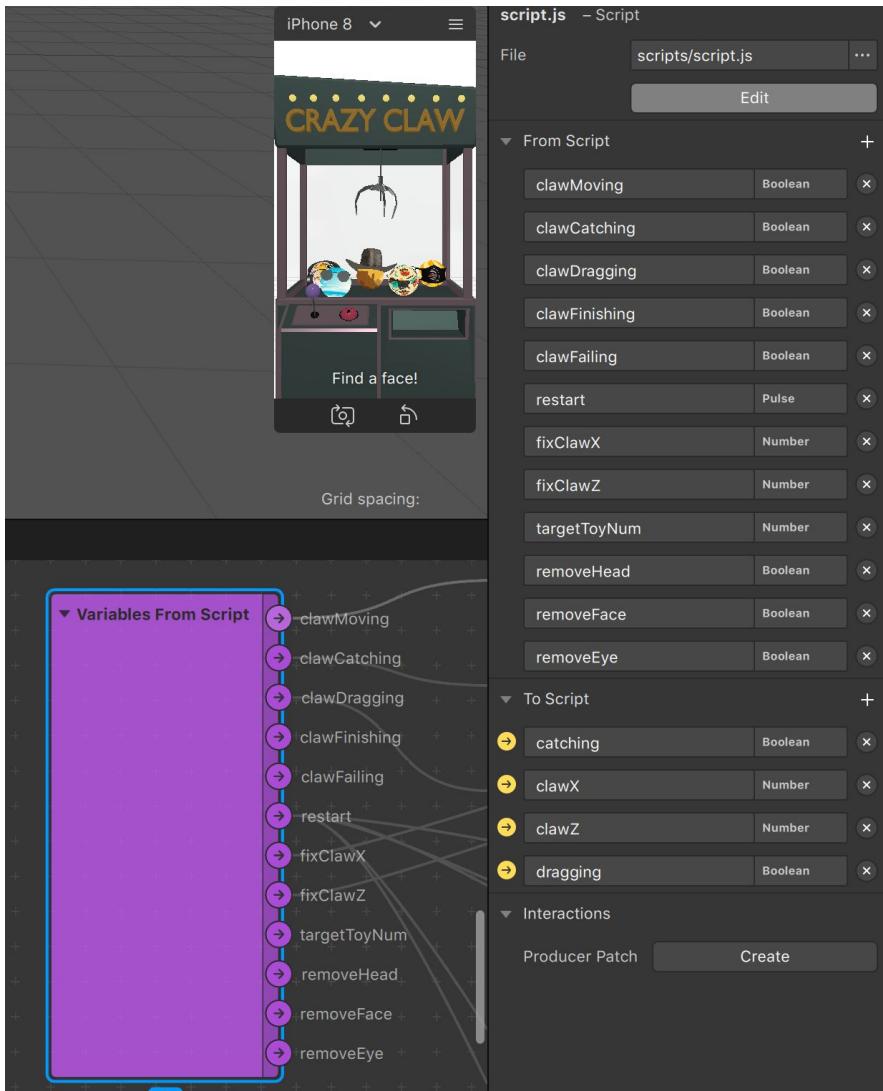


Click at the Camera object and generate a **personSegmentationMaskTexture** from it. Then create a new material for the background, set the shader type to flat and enable Alpha and invert. Assign the **personSegmentationMaskTexture** to the alpha texture.



4. Create variables that send From script

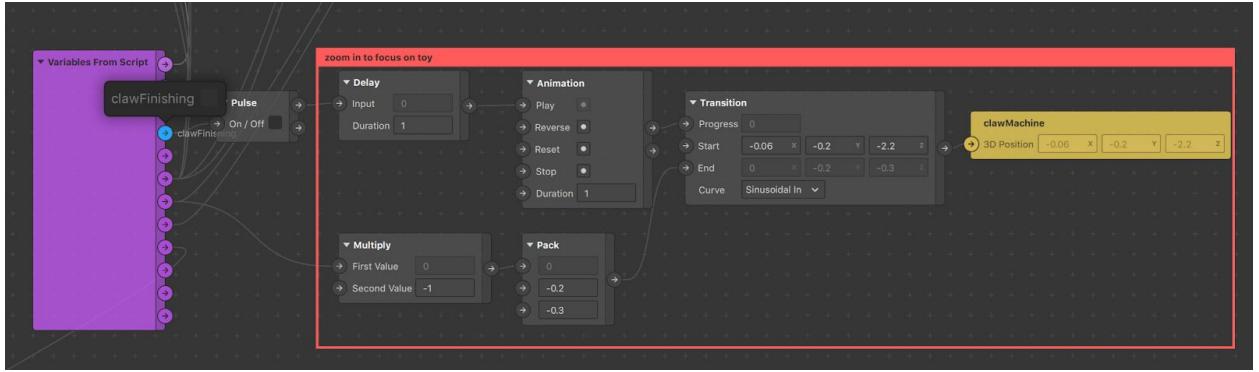
Create a **Number** variable called **targetToyBum** under the **script.js From Script**. And three **boolean** variables named **removeHead**, **removeFace** and **removeEye**. You will find these variables shown at the **script patch**.



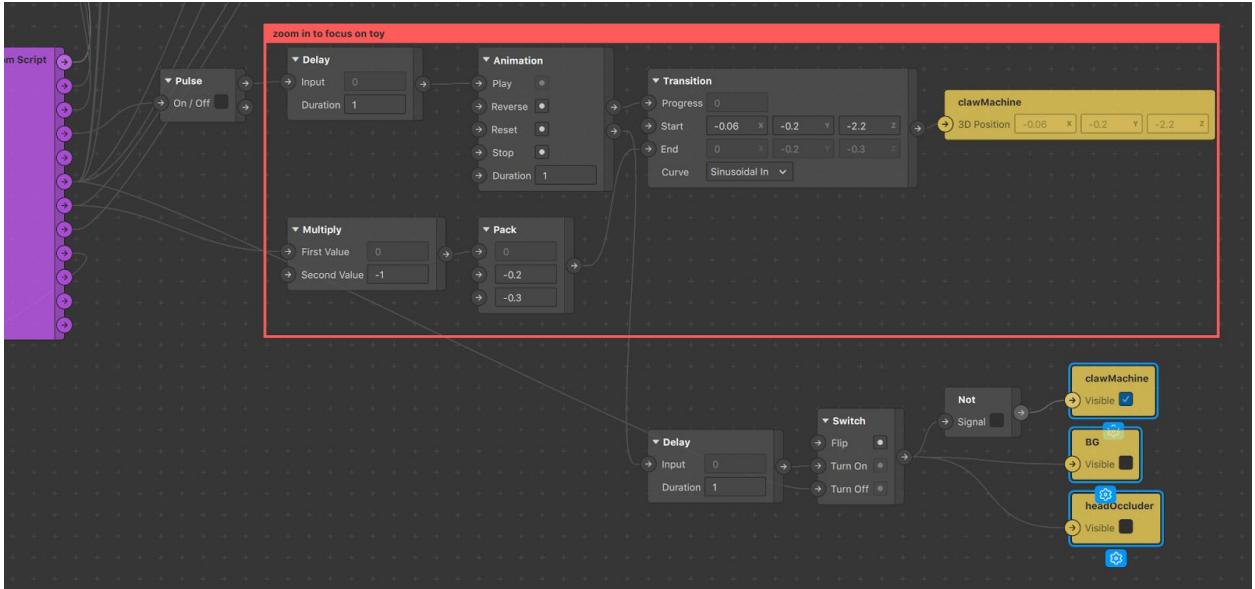
4. Build the logic to enable accessory in patch editor

4.1 Zoom in to focus on the toy

We use the finishing signal from the script to zoom in the claw machine position and make the camera focus on the toy that is caught.

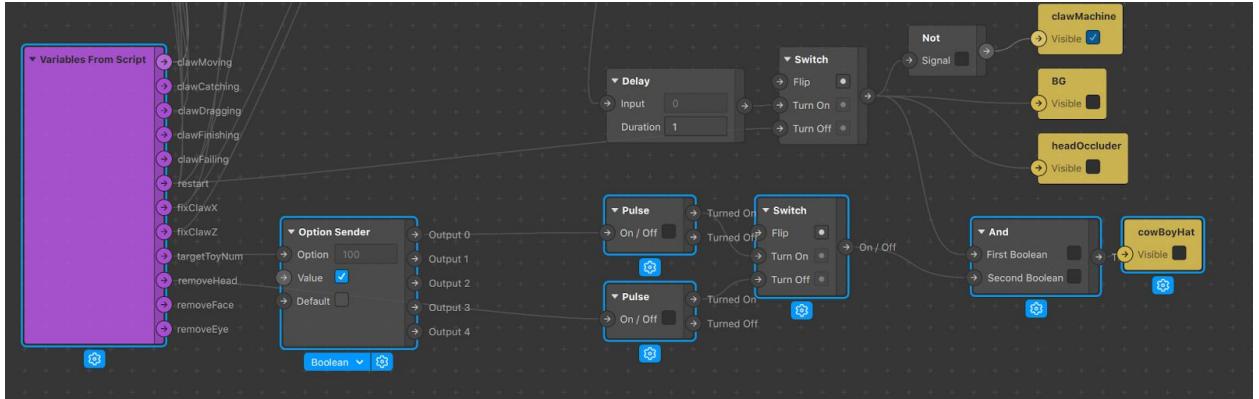


4.2 Disable claw machine and enable BG and headOccluder after zoom in to focus on the caught toy.

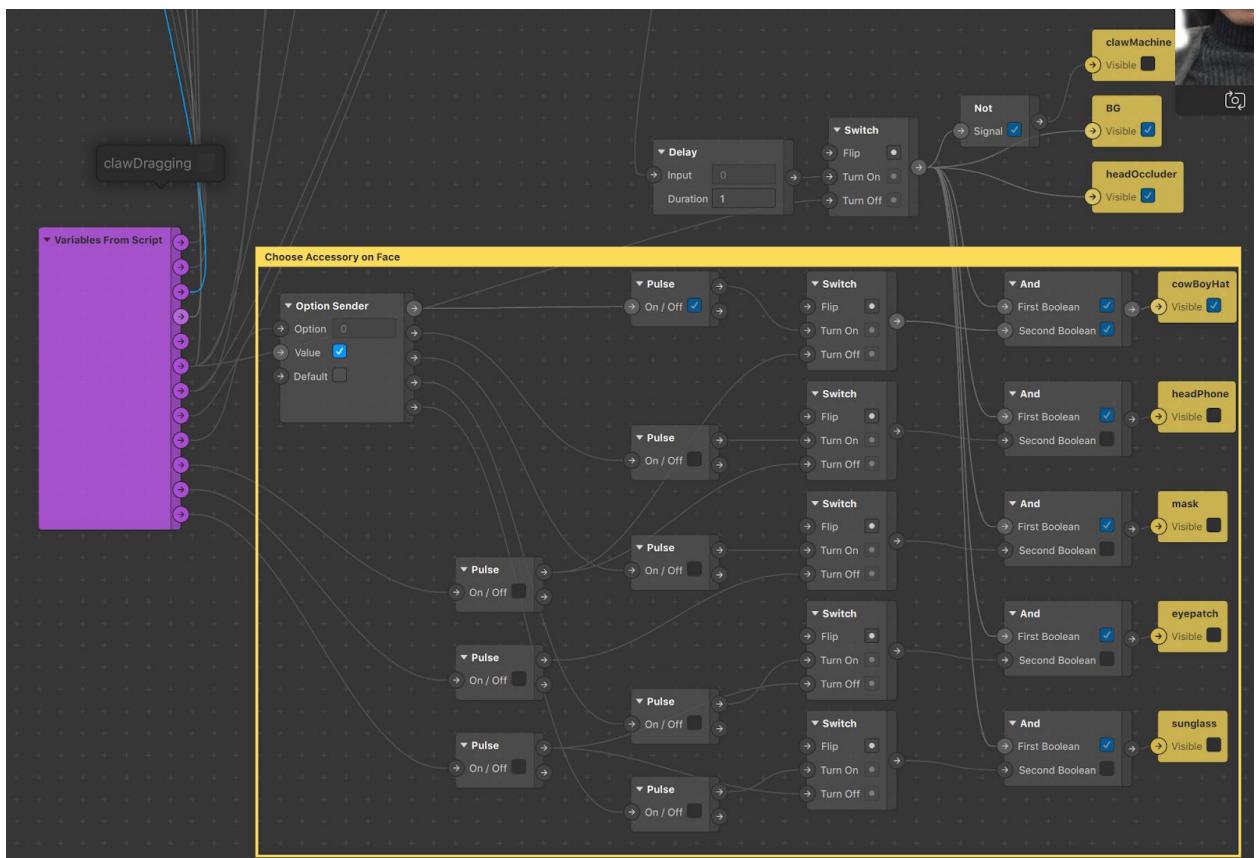


4.2 Choose accessory and apply on Face

In order to enable the correct accessory and apply on the face, we need to check two main conditions. Firstly, if the headOccluder is enabled, secondly, the **targetToyNum**. For example, if the user catches the toy0, then the **targetToyNum** will be 0, the toy assigned under it is cowBoyHat. If the headOccluder is enabled also, then we can enable the corresponding toy cowBoyHat accessory on the face. Moreover, we need to check the **removeHead** condition from the script to determine if the accessory needed to be disabled because of repeating type.

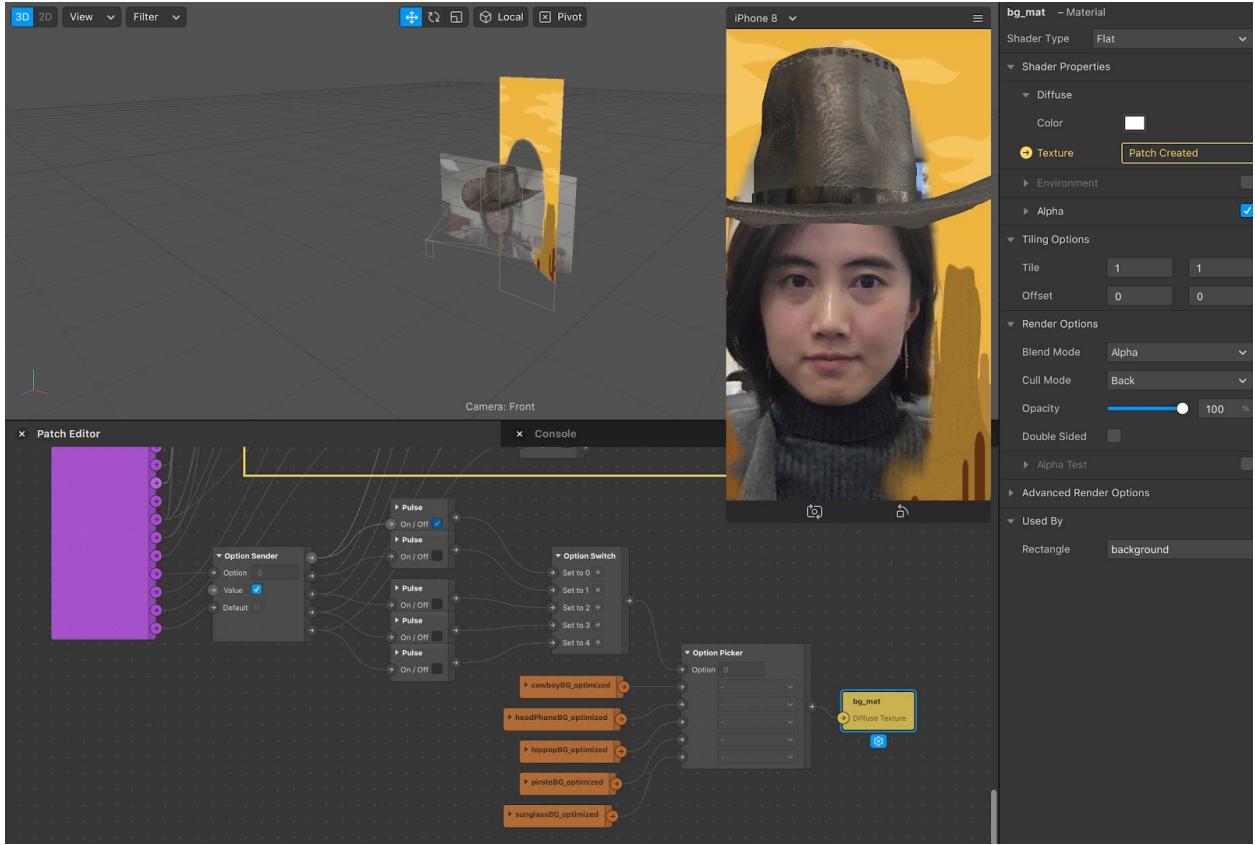


Follow the rules above and we can finish setting the rest four accessories.



4.3 Choose environment texture and apply on the background

We also want the background texture to be changed according to the toy sphere's material that is caught. So we set an option picker for the background material texture, and switch between these texture options according to the `targetToyNum` from the script.

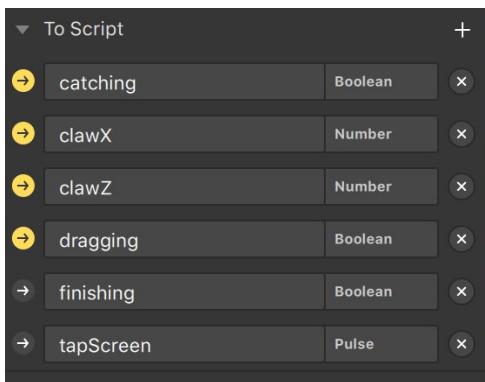


5. Game Finish and Restart

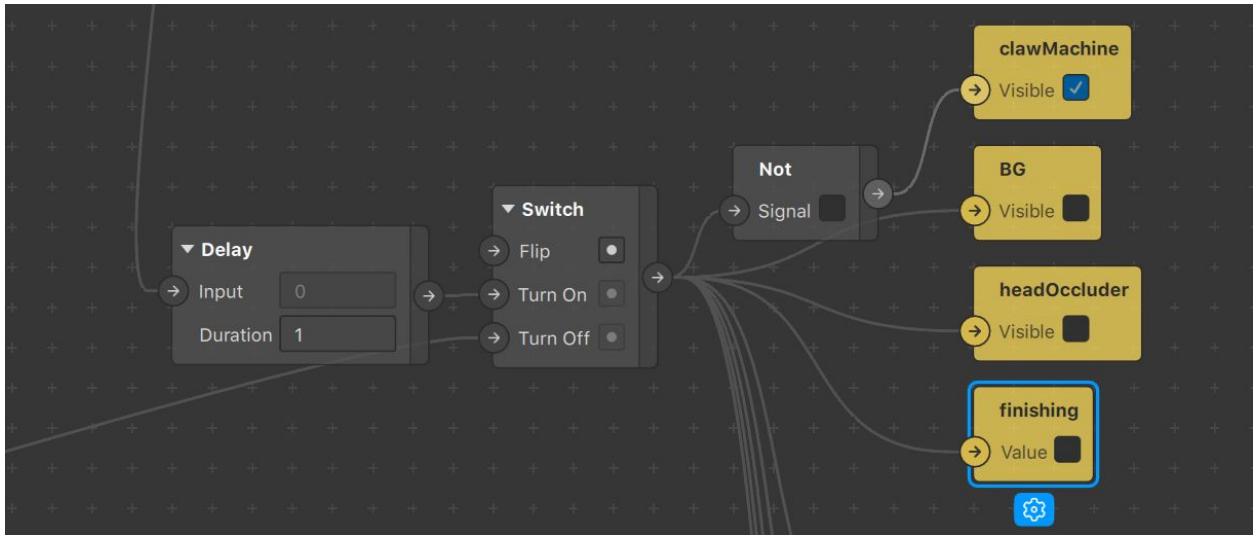
Until now, you have already finished one complete claw machine experience! Try in the preview to catch a toy and see how the accessory you caught is applied on your face. If you try more time, you will notice there seem to be some bugs for restarting the game, so we are gonna create some functions to complete the restart function.

5.1 Create variables send to Script

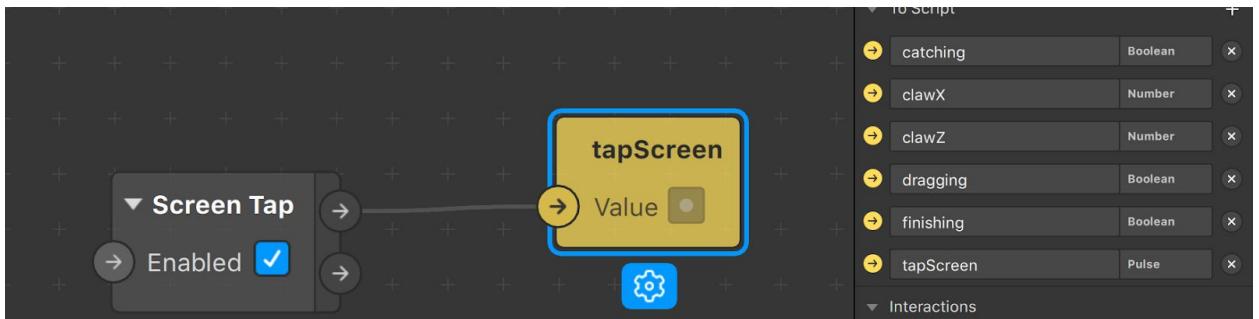
Click script.js in **Assets**, and in the inspector **To Script** panel, create a **Boolean** variable called **finishing** and a Pulse **boolean** named **tapScreen**.



Click the arrow at the left of the **finishing** variable and create a patch in the editor. And connect it with the same place when it turns on the headOccluder and the BG object.



Click the arrow at the left of the **tapScreen** variable and create the patch in the editor. Right click in the patch editor to find a patch called **Screen Tap**. Connect **Screen Tap -> Gesture State** with **tapScreen** variable patch.



5.2 Set function in Script for restart

```
//get the finishing signal from the patch
let gameFinish;
Patches.outputs.getBoolean("finishing").then((event) => {
  event.monitor().subscribe(function (values) {
    gameFinish = values.newValue;
  });
});

//get the tapScreen signal from the patch and detect if the game is finished
Patches.outputs.get_pulse("tapScreen").then((event) => {
  event.subscribe(() => {
    if (gameFinish) {
      init();
    }
  });
});
```