

Cinderella

AR Word Game

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PROJECT IDEA: AR-BASED WORD GAME

ELEMENT

EXPLORATION + WORD-MANIPULATING

[Player EXPLORE the space for useful objects.]

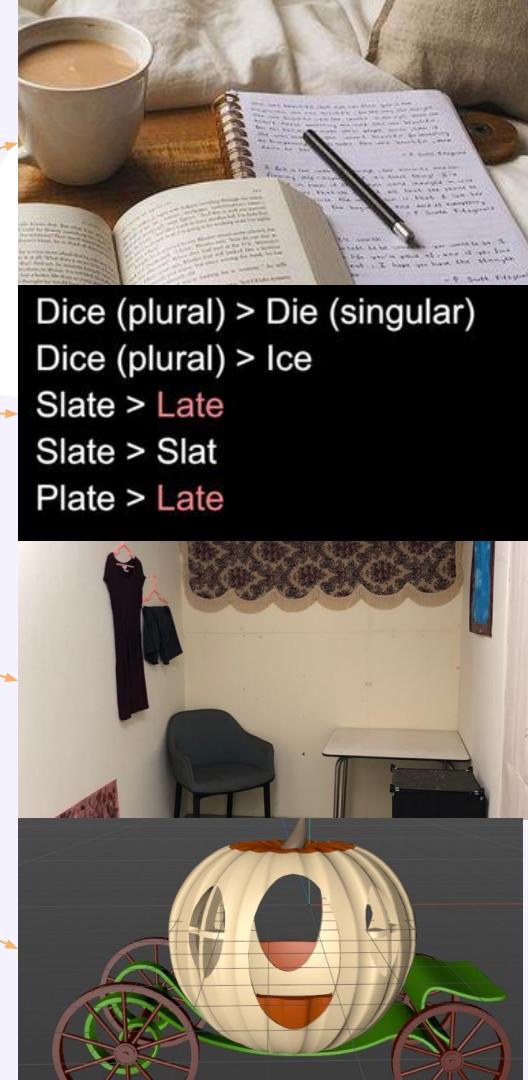


[Form certain WORDS to reach the goals.]



WHAT HAVE WE DONE...

1. Write a story - Cinderella To A Ball
2. Design a set of word combinations
3. Set up Cinderella's room
4. Prepare real objects for the game
5. Collect & model virtual objects
6. Scan the room with iPad (LiDAR Camera)



WHAT HAVE WE DONE...

.....

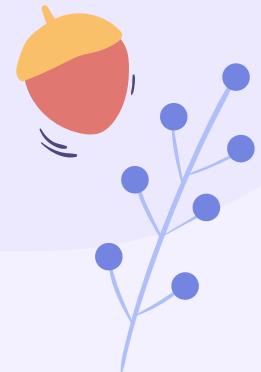
7. Program the game in Unity:

- Setting up the scene
- Word-remover
- Interacting with the virtual objects
- Scripting with logic bricks

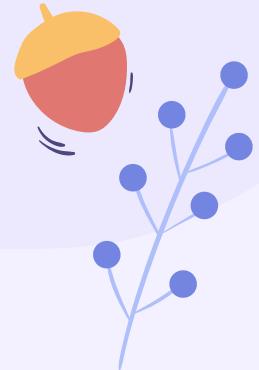
8. Deploy to Hololens!



AND A LOT OF
TRIAL & ERROR!!!



SO HERE IS OUR
FINAL OUTCOME...



STORY TIME!

.....

You are Cinderella.

The masquerade ball is coming in a few hours, you need to find yourself a proper outfit and a method of transportation in order to attend the ball!



STORY TIME!

.....

The Fairy Godmother has blessed you with **magic** that let you be able to turn virtual objects into REAL objects!



HOW TO PLAY?

Player has to **search** around the room to find different objects and **modify** the name of the objects with their **fingers**.

HTTPS://MEGA.NZ/FOLDER/IZKYHDPD#BZH

L03UODIQFIGOD _RBXVG

RULES - WAYS TO WIN

.....

Complete the *outfit* :

Ballgown(must),

AND

Collect at least **three** of the following objects(words) of
Lipstick, Heels, Earrings, Hat, necklace

AND

Get a *transportation* :

Keywords:

car + fuel OR pumpkin + cart + pony OR shortcut

→ *Reach a Happy Ending!*



RULES - WAYS TO LOSE

Being late to the *ball* :

Turn plate to late

Turn dice to die

→ *Reach a Bad Ending...*



WORD ARCHIVE

Real Objects:

Clip, Stick, Ball, Gown, Hemmels, Chard, Pump, Kin, Chart, Peony, Funnel, Pear, Rings, Hearth, Sneck, Glace, Shorts, Cut, Dice, Slate, Plate

Virtual Objects:

Lip, Lipstick, Ballgown, Heels, Card, Car, Pumpkin, Cart, Pony, Fuel, Ear, Earrings, Heart, Heat, Hat, Neck, Lace, Necklace, Short, Shortcut

Prepare script to instruct players

IF player combines words

[sfx_words-combine]

ELSE IF player obtains a valid object

[sfx_words_transform]

ELSE

[Hmm, I don't think that works.] OR

[Try again.] OR

[I'm not sure about that.]

IF player does nothing for 60 seconds && there are object(s) that have not been interacted with

[Stuck, are we? Try finding other objects.]

IF player does nothing for 60 seconds && there are no objects left

[If you reach a dead-end, you can always restart.]

[Restart] (skips tutorial)

WHAT HAVE WE COME THROUGH...

TECHNICAL
DIFFICULTIES

TECHNICAL DIFFICULTIES...

1: Object Recognition

1- OBJECT RECOGNITION

What we tried:

Using **YOLOv3** :)

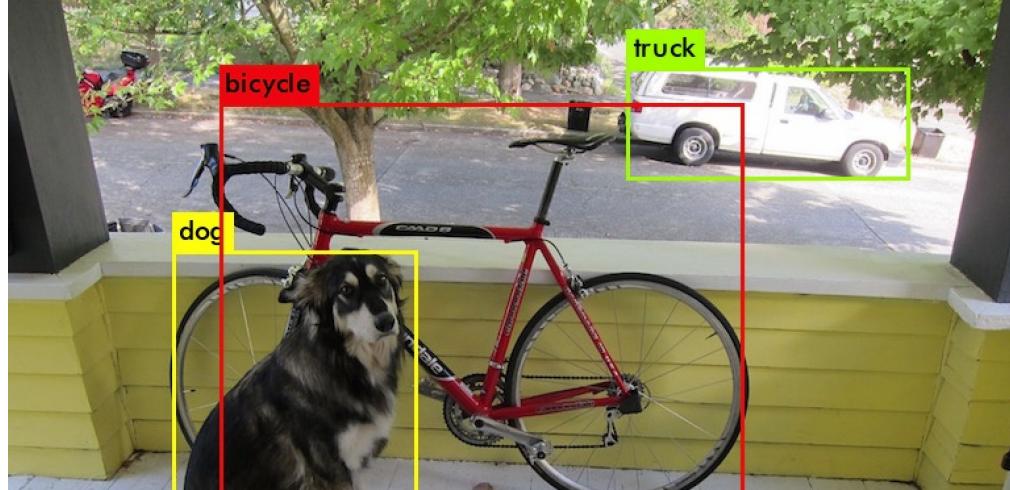
Using **Vuforia Object Scanner** :)

What we got:

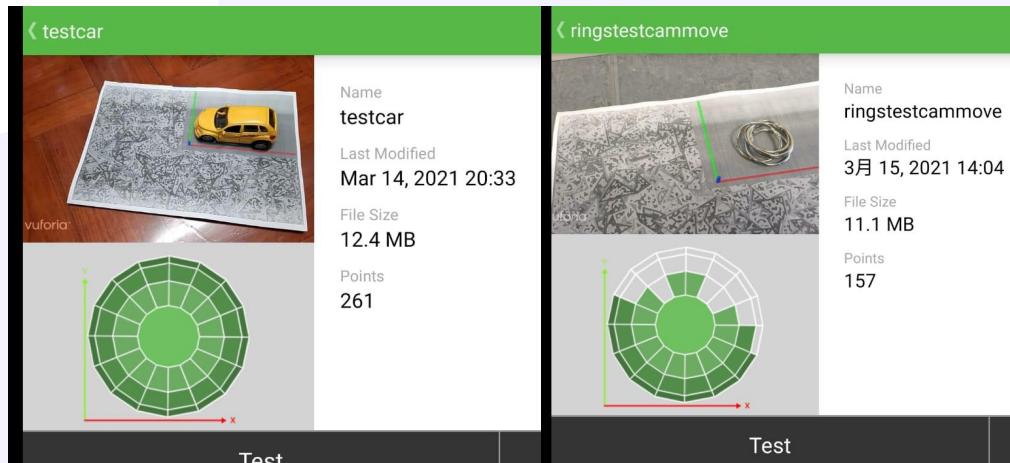
YOLOv3 - Too rush to learn and a bit complicated :(

Vuforia Object Scanner -

1. Some objects cannot be scanned properly :(
2. Not sensitive or even fail to recognise the objects :(
3. Takes a long time to recognize objects :(



YOLO(ABOVE) ; VUFORIA SCAN (BOTTOM)



WE DEAL WITH THE TRACKING
PROBLEM FOR **11 WEEKS**,

AND WE ENDED UP REMAINING **1 WEEK** TO
DEAL WITH OTHER PROBLEMS...

so

WHAT IS THE SOLUTION...

WHAT WE FINALLY APPLIED...

~ Using Initial Setup ~

INITIAL SETUP

First step (1):

Scan the room by using **Vuforia Area Target**

- ❖ Use ARKit enabled devices with inbuilt LiDAR sensors (such as the iPhone 12 Pro)



INITIAL SETUP

.....

Second step (2-1):

- Place the objects at the right spots

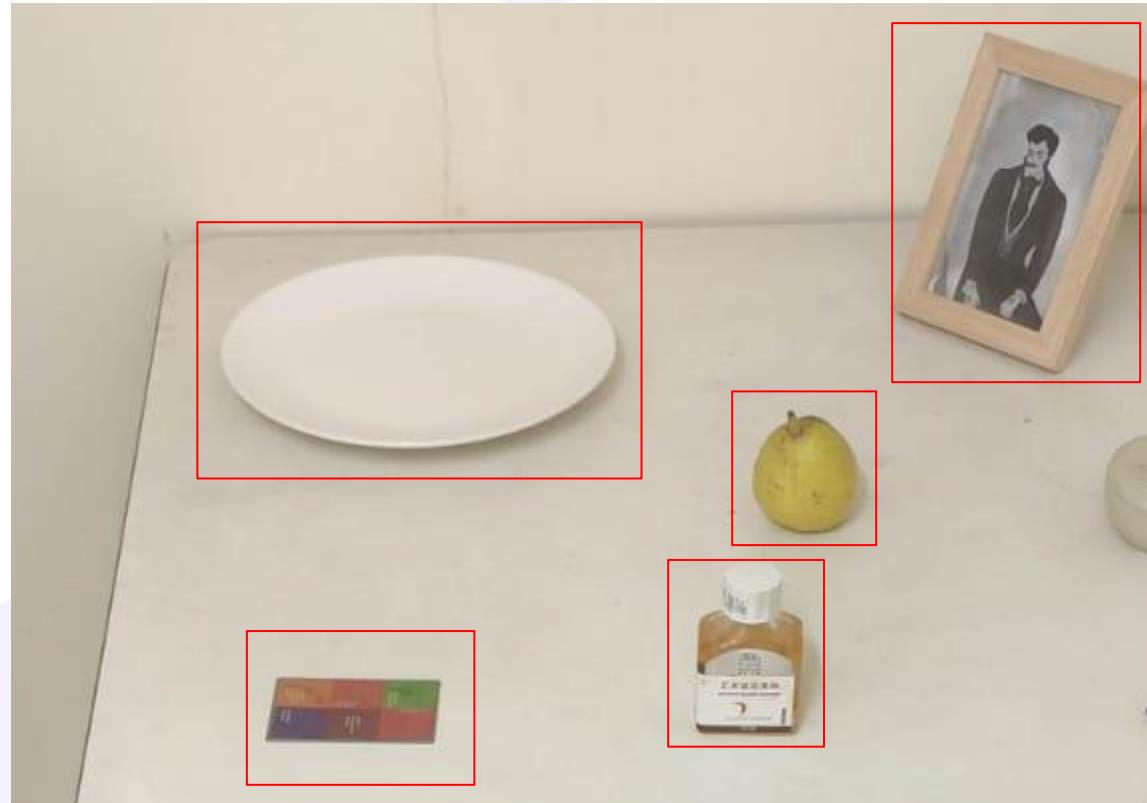


INITIAL SETUP

.....

Second step (2-2):

- Mark the **placement** of real objects

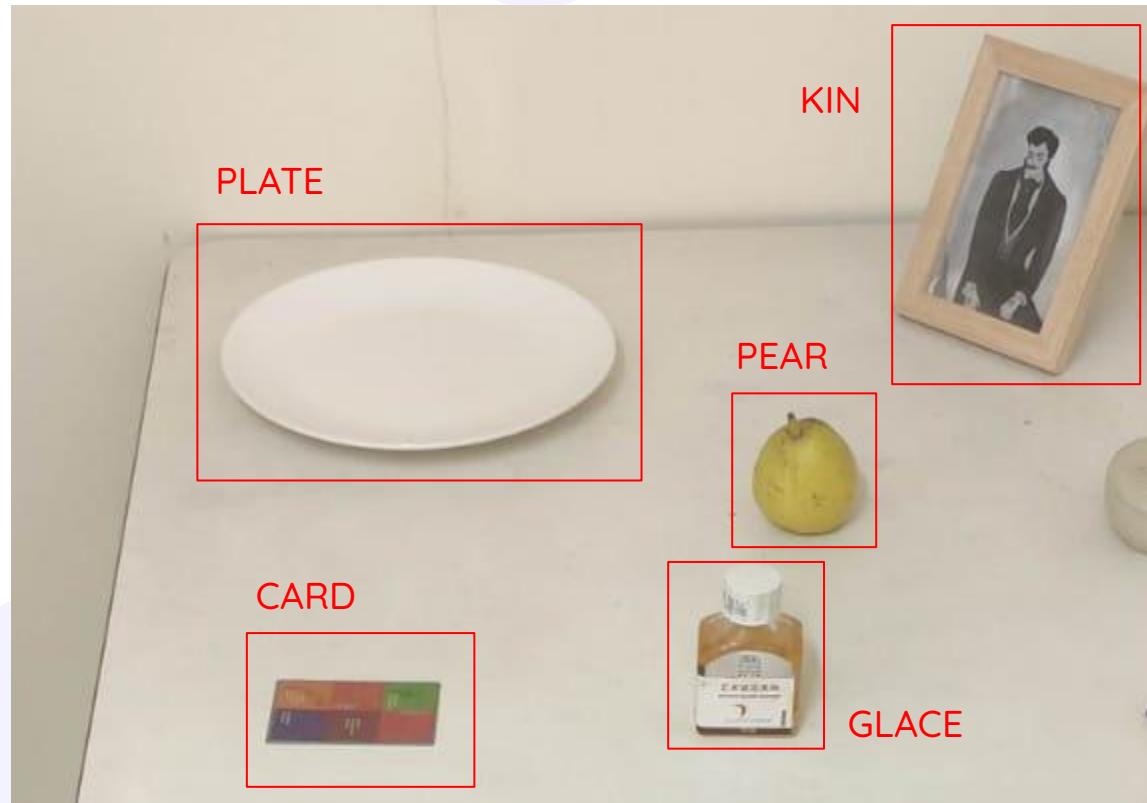


INITIAL SETUP

.....

Second step (2-3):

- Give each of them an ID



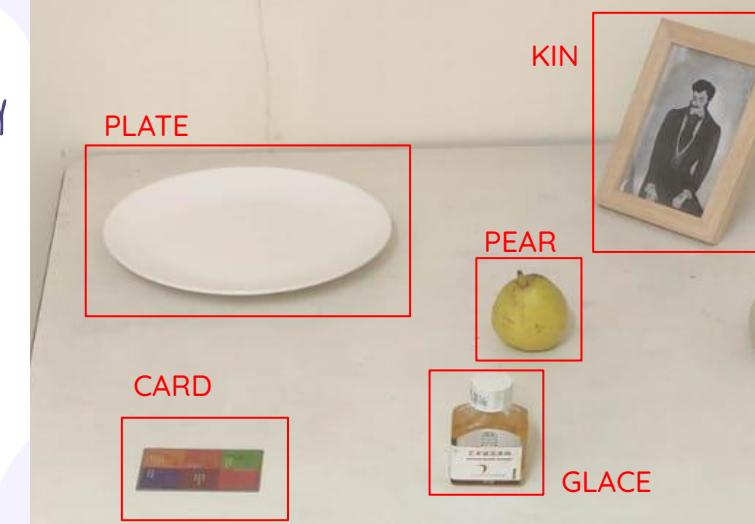
INITIAL SETUP

.....

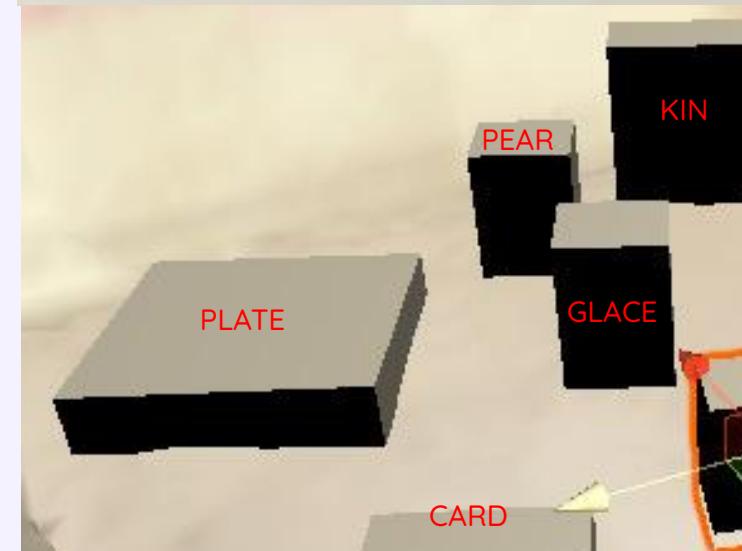
Third step (3):

- Place **cubes** at corresponding places in **Unity** and give them IDs

REALITY
SETUP

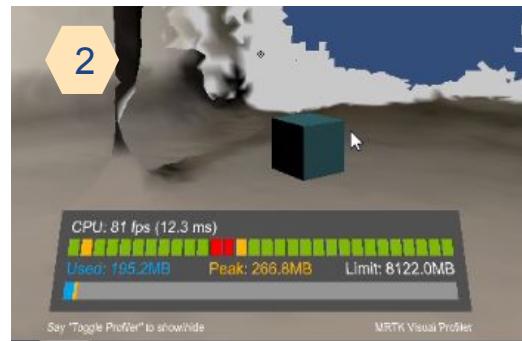


UNITY
SETUP



LIKE THIS...

.....



1st step:

- place the object
- give it an ID

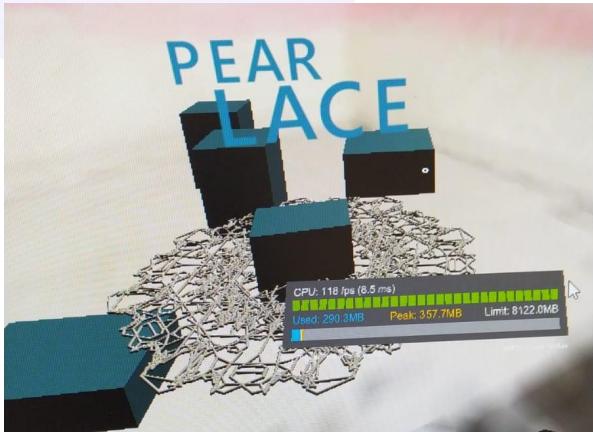
2nd step:

- create a cube in Unity
- place it at corresponding spot

3rd step:

- give the cube a corresponding ID
- make it interactable

LIKE THIS...



Last step: make the cubes **invisible**

→ so when you are touching **real objects**, you are also interacting with the **virtual cubes**

→ enable **interactions** between real world and virtual world

TECHNICAL DIFFICULTIES...

2: Area Scanning

AREA SCANNING

1. No proper scan of rear part of room

→ Space needed is bigger than expected.
Sometimes Hololens lost track of objects
in rear-side.

2. We don't own a device with LiDAR
scanner

→ Share device with other group.
No time to rescan the area needed

Special thanks to the group sits
behind to us :)



Rear part of room to show “transportation mode”

TECHNICAL DIFFICULTIES...

3: Word Manipulator

ORIGINAL DESIGN - KEYBOARD



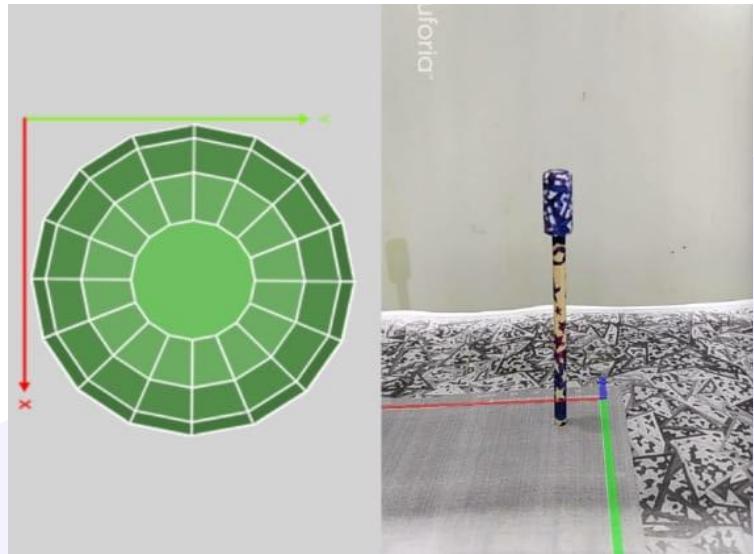
ALTERNATIVE METHOD - MAGIC WAND

EXPECTATION:



ALTERNATIVE METHOD - MAGIC WAND

REALITY:



Cannot track the wand **sensitively**:

→ background color, lighting and shading, and coordinates
(with respect to the origin on paper) affects the scan

ULTIMATE METHOD - MRTK TOUCH INTERACTION

- Separate the text object into individual letter objects (prefab using TextMesh Pro)
- Apply touchable and grabbable (MRTK)



WE GOT 1 WEEK TO DO ALL THE

CODING

STUFF

CODING STUFF...

1. Spawning letters

SPawning LETTERS

.....

Writing a script to make a new instance of an interactable letter for each word
Each instance of the letter will send a message to its parent if it is touched

```
void spawnLetters()
{
    for (int i = 0; i < word.Length; i++)
    {
        char c = word[i];

        Vector3 pos = spawnPos.position;
        pos.x += (i - (word.Length - 1) / 2) * letter_distance;
        pos.y += hover_distance;
        GameObject spawned = (GameObject)Instantiate(spawnee, pos, transform.rotation);
        spawned.transform.SetParent(scaler.transform);
        spawned.name = c.ToString();
        TMP_Text textmesh = spawned.GetComponent<TMP_Text>();
        textmesh.text = c.ToString().ToUpper();

    }
}
```

CODING STUFF...

2. Scaling Problems

SCALING PROBLEMS

.....

The spawned letters take the scale of all its parents!

So... spawned an additional empty parent that isolate the rest of spawned letters and objects

```
void spawnScaler()
{
    scaler = (GameObject)Instantiate(empty_scaler, spawnPos.position, transform.rotation);
    scaler.transform.SetParent(transform);
    scaler.transform.localPosition = new Vector3(0f, 0f, 0f);
}
```

CODING STUFF...

3. Validating Touch (Letter)

VALIDATING TOUCH

.....
Arrays storing all valid words

```
string[] validObjects = { "chart", "cart" , "hart", "hat"};
string[] validWords = { "cart" , "art", "chat", "cat" , "at"};
```

Example:
//Modifying word “chart”

```
public void processTouch(string touchedletter)
{
    Debug.Log("you touched the letter: " + touchedletter);
    string newWord = word.Replace(touchedletter, string.Empty);
    bool newWordFormed = false;
    foreach (string validObj in validObjects)
    {
        if (newWord == validObj)
        {
            word = newWord;
            destroyLetters();
            spawnLetters();
            newWordFormed = true;
            transform.parent.gameObject.name = newWord + "_parent";
            GameObject.Find("sfx_words-transform").GetComponent< AudioSource >().Play();

            if (newWord == "cart") caseCart();
            if (newWord == "hart") caseHart();
            if (newWord == "hat") caseHat();
        }
    }
    if (!newWordFormed)
    {
        bool isValid = false;
        foreach (string validWord in validWords)
        {
            if (newWord == validWord)
            {
                Debug.Log("Whelp, the wand isn't able to make everything, you see.");
                GameObject.Find("vo_gamestart_no object available").GetComponent< AudioSource >().Play();
                isValid = true;
            }
        }
    }
}
```

CODING STUFF...

4. Updating Object names

UPDATING OBJECT NAMES

.....

Had difficulties accessing variables in another object's script

So...update Object names for further interactions

Example:
//Modifying word "chart"

```
word = newWord;
destroyLetters();
spawnLetters();
newWordFormed = true;
transform.parent.gameObject.name = newWord + "_parent";
GameObject.Find("sfx_words-transform").GetComponent< AudioSource >().Play();

if (newWord == "cart") caseCart();
if (newWord == "hart") caseHart();
if (newWord == "hat") caseHat();
```

CODING STUFF...

5. Collision Detection

DETECTING COLLISION

.....

Using OverlapSphere instead of Object Collision

- ❖ Normal physics collider:
If collision happen → Objects repel each other
- ❖ OverlapSphere collider:
Detects if another object's collision box is within its radius.

```
void checkCollision()
{
    int layerMask = 1 << 8;
    Collider[] hitColliders = Physics.OverlapSphere(transform.position, collision_distance, layerMask);

    if (hitColliders.Length > 0)
    {
        collided(hitColliders);
    }
}
```

CODING STUFF...

6. Winning / losing logic

WINNING / LOSING LOGIC

.....

Used an empty with script to control all conditions

Used GameObject.Find to see if certain objects have been created to trigger winning / losing voice overs

```
if (ballgown != null)
{
    int things = 0;
    if (lipstick != null) { things++; }
    if (heels != null) { things++; }
    if (earrings != null) { things++; }
    if (hat != null) { things++; }
    if (necklace != null) { things++; }
    Debug.Log("things:" + things);
    if(things >= 3)
    {
        if (!beauty)
        {
            if (!travel)
```

```
GameObject ballgown = GameObject.Find("ballgown_parent");
GameObject lipstick = GameObject.Find("lipstick_parent");
GameObject heels = GameObject.Find("heels_parent");
GameObject earrings = GameObject.Find("earrings_parent");
GameObject hat = GameObject.Find("hat_parent");
GameObject necklace = GameObject.Find("necklace parent");
```



USER -FRIENDLY DESIGN

1.

VOICE - OVER PLAYER GUIDE

ROLE-PLAY

+

HUMOROUS

+

STEP - BY - STEP GUIDANCE

VOICE -OVER PLAYER GUIDE

[Blue]: game guide/alerts on top left part of screen
[Pink]: combined objects
[Italic]: voice-over (Fairy Godmother)
[subscript]: audio to trigger

INTRO

[Read the letter!]

STEP-BY-STEP GUIDANCE

Voice-over plays.

Fairy Godmother: My dearest Cinderella,

I am truly blessed to have watched you grow into the amazing woman you are today. However, I am afraid that one day I won't be here for you anymore. The masquerade ball is coming in a few days/hours, so it's the perfect time/chance for you to spread your own wings! I have left you something that may aid you while I'm away.

*With Love,
Your Fairy Godmother]*

[Bibbidi-bobbidi-boo! You've been blessed with magic!]

Player puts down the letter.

STEP-BY-STEP GUIDANCE

TUTORIAL

[Come along, dear! Let us practice some basic magic. Try touching the Pear on that table (with one finger?).]

IF player walks toward the table and touches the pear with their index finger.

[sfx_object-touched]
Pear pops up!

IF player touches other game objects
Nothing should happen?

[Well done! Now try touching a letter.]

IF player touches P, then

[sfx_word-transform]
[Wonderful! I wonder what goes with ear?]

ELSE
[Hmm, I don't think that works.]

Player proceeds to interact with other objects.

IF player does not touch Rings within 30 seconds, then
[What about those Rings on the couch?]

IF player does not combine ear with Rings within 20 seconds, then
[Try holding the ear close to the Rings]

GAME END

STEP-BY-STEP GUIDANCE

IF player reaches **Goal 1** and **Goal 2**

[sfx_game-won]
[bgm_bibbidi-bobbidi-boo] ON LOOP
|
*[Ooh, well done, well done! I knew you could do it.
Marvellous work! Turns out I wouldn't need to worry about
you / you're ready to fly on your own after all.]*

2.

OBJECT LUMINANCE

OBJECT LUMINANCE

Weakness of Hololens2

- Image is blurry and dimmer on the screen



Original Test Pattern



Hololens 2 (LBS)

SOLUTION : MAKE OBJECT MATERIAL GLOW

BEFORE



- Lower color brightness
- Harder to see in bright light environment

AFTER



- Higher color brightness
- Clearer to see in bright light environment



3.

AR OVERLAY

2- AR OVERLAY

.....

We want to **VISUALIZE** player's **progress** of the game → A **DUMMY** to show Cinderella's outfit





DO YOU WANNA TRY?

