Shared Worlds

DESIGN 6400 - Graduate Design Studio

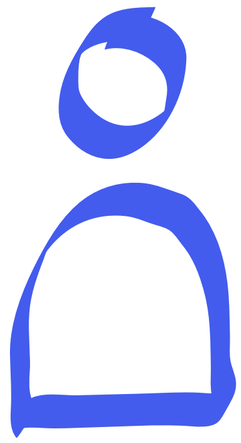
Instructor: Matthew Lewis

Sebastian King

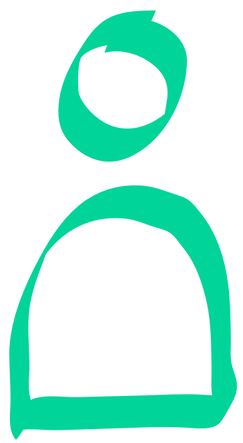
Joshua Antolovic

Alberto Vega

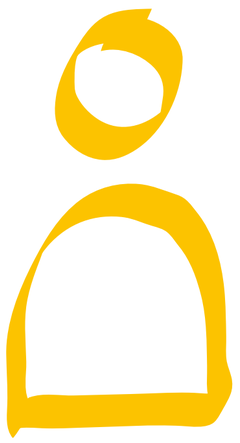
The team



Sebastian



Josh



Beto

Unity coding

iOS Building

Board notes

Documentation

Testing

2D assets

Quill assets

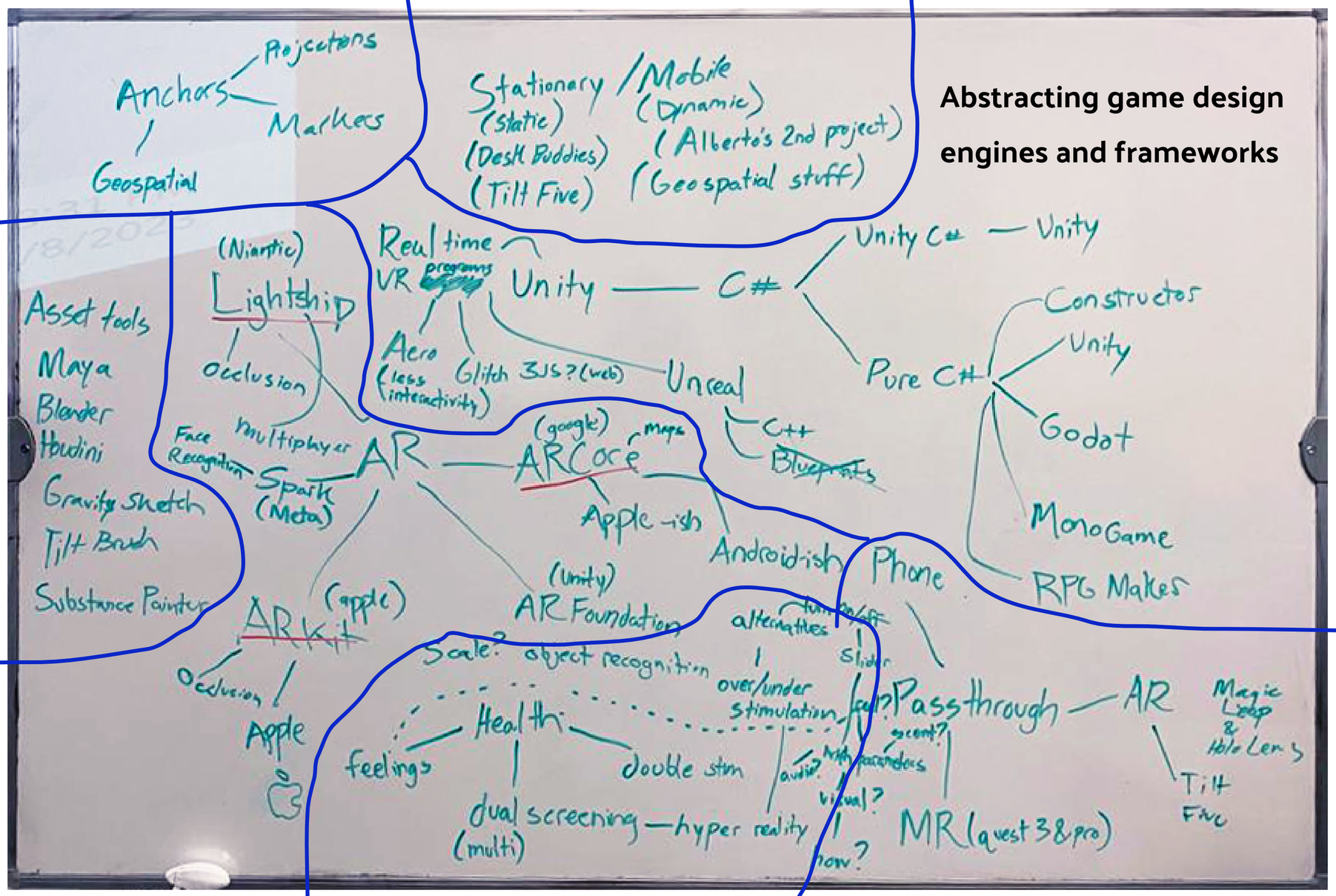
Common interests

Ways that scale define AR

Tracking strategies

Abstracting game design engines and frameworks

Asset creation tools



Connecting and understanding AR frameworks

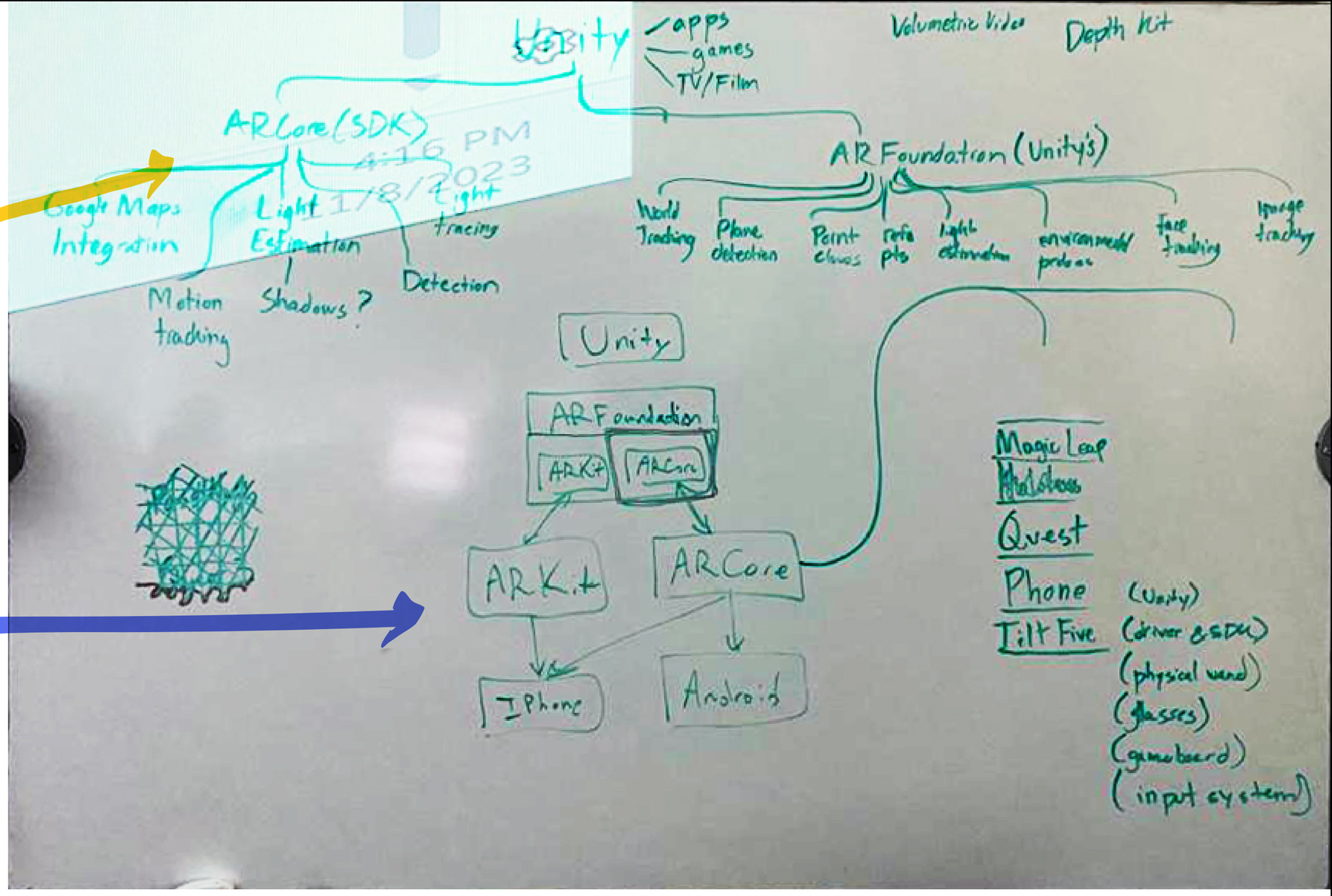
Concepts about health and stimulation as it relates to technology

Types of AR devices

We decided to focus on understanding how **Unity** relates to the different **AR frameworks** and their capabilities.

We started outlining the different features of **ARCore** and **AR Foundation**.

It wasn't immediately clear how these features were connected, so we drew a second diagram trying to understand how **Unity** connected with the **AR SDKs** we were finding



Key Takeaways

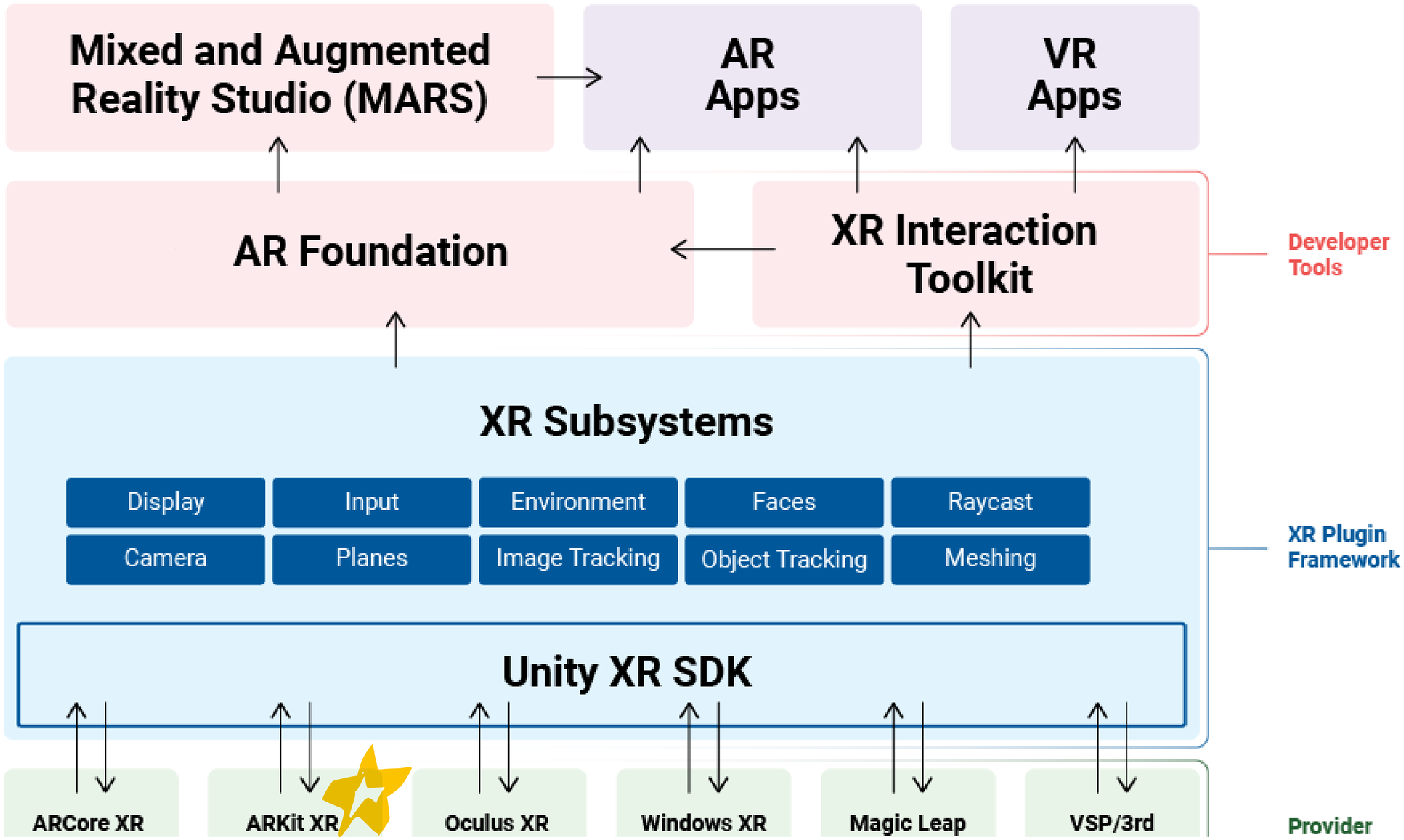
AR Foundation is a package that acts as a layer between Unity and several **AR SDKs** so that they can communicate

AR Foundation has support for **ARKit and ARCore, as well** as a list of devices

Different AR SDKs **have their own intended devices and limitations**

XR system diagram

Source: Unity Documentation / Manual



- Officially supported platforms
- Verified Solutions Partners
- Innovators

Schedule (?)

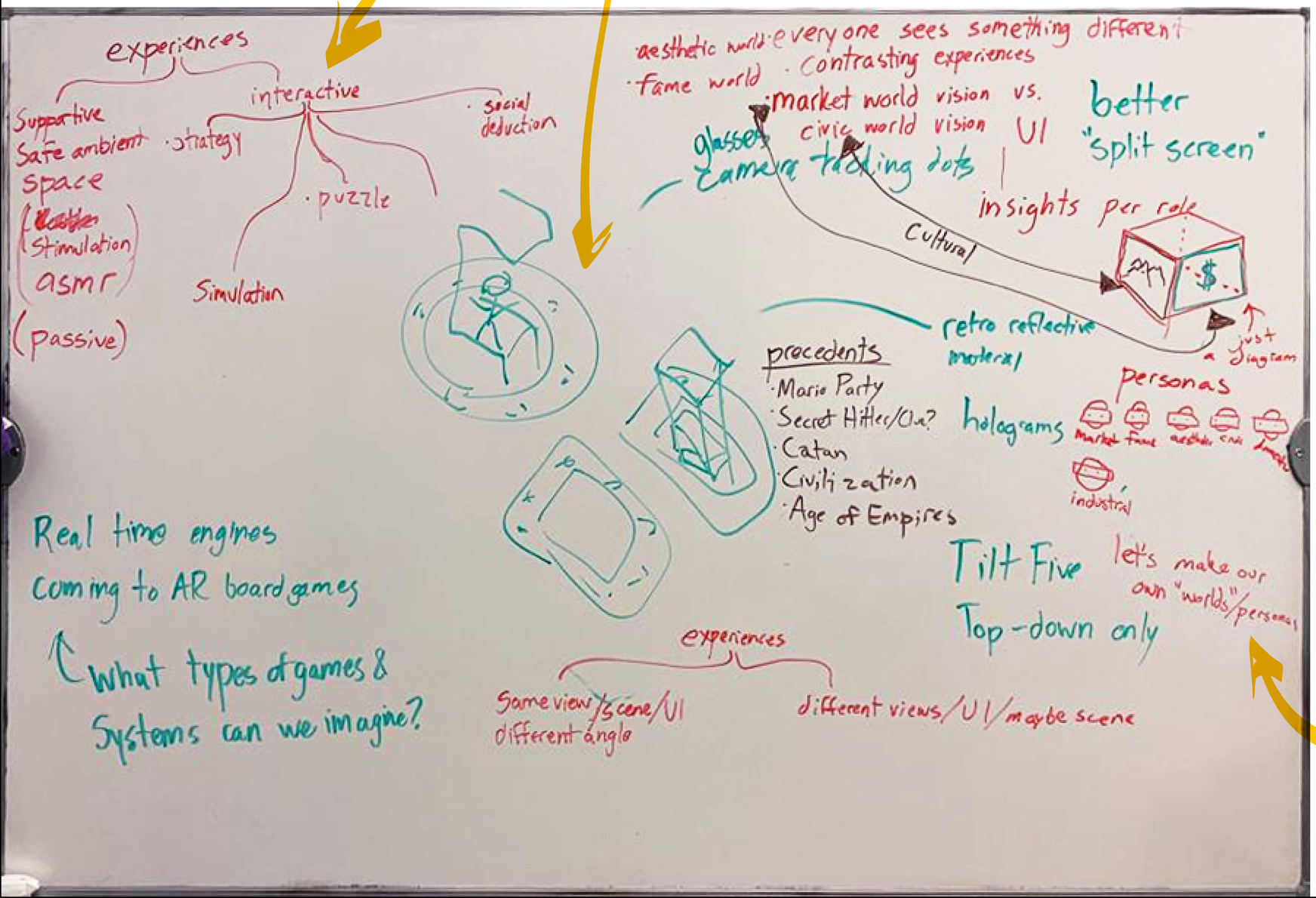
O44

	A	B	C	D	E	F	G
1			Start Task	In Progress	Finished		
2							
3			Week 1: 11/6 - 11/10	Week 2: 11/13 - 11/17	Week 3: 11/20 - 11/21	Week 4: 1127 - 12/1	Week 5 - 12/4 (Presentation)
4			Reference sheets				
5						Presentation Slides	
6	Documentation		Research*				
7							
8				Figma Diagrams			
9		Figma Diagrams		User Journey (part of diagrams)			
10				other diagrams here			
11	Organization/Design						
12							
13					Tile Fabrication		
14		Classic Design			Digital asset creation		
15							
16							
17							
18							
19							
20							
21							
22							
23							
24				Learning AR Foundation/Unity Editor			
25				Lightship			
26				Phones into dev mode			
27		Setup		Build Prototyping (loading applications onto phone stuff)			
28				Image Tracking			
29				Multiple Image tracking			
30				Game object management			
31					Linking multiple gameobjects to one image		
32					UX/UI		
33	Technical stuff	Scripting Tasks			Multiplayer?		
34							
35							
36							

What would our AR experience look like?

Themes and game strategies we wanted to explore.

Game spaces can be defined with different AR placemats (though this wasn't something we would be able to do with the **Tilt Five**).



We wanted to combine ideas of **spatial AR representation, territory, and perspectives**

- Could we use the toolkit laid out by Sébastien Proulx and assign roles to players? How would we differentiate what the **different roles** see?
- Would the space be **static or a simulation** like builder-type games?
- We came up with an idea about **unique perspectives being shown through different AR glasses**, as well as potentially being determined by position around the play space. Each player would see the 'world' differently.

Technical Medium Considerations

Tilt Five?

We would be restricted to a stationary space and only one pair of glasses but maybe there could be some perspective tricks or asynchronous gameplay?

ARCore or ARKit?

Instead of a defined AR space maybe we make a phone app where users can build worlds?

Maybe image tracking could be used?

Niantic Lightship?

What if there was some sort of geospatial aspect to the game? What resources are available for making multiplayer?

First ideas

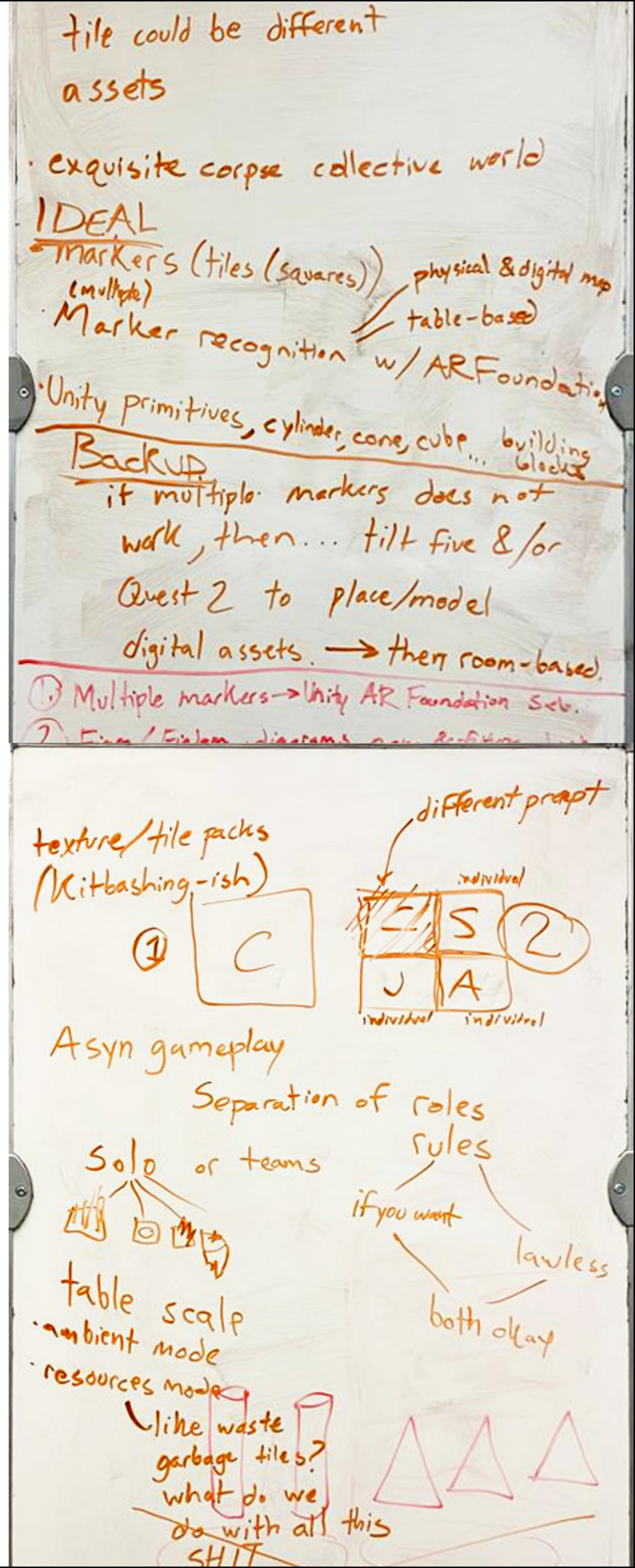
- Use of **tiles** to build out spaces
- **Individuals** get their own spaces to build, would there also be a **communal** space (and how would that work)?
- Will we use any sort of **asynchronous gameplay** (i.e. players with different roles and different gameplay loops)?
- How game-like do we want the experience to be? More ambient?
- Still deciding between Quest and Tilt 5, we would need to test both

exquisite corpse

Jake and Dinos Chapman

Kit bashing

Theo Triantafyllidis



Learning route

Balance: Ideas / time / technical requirements

What kind of prototype can we build?

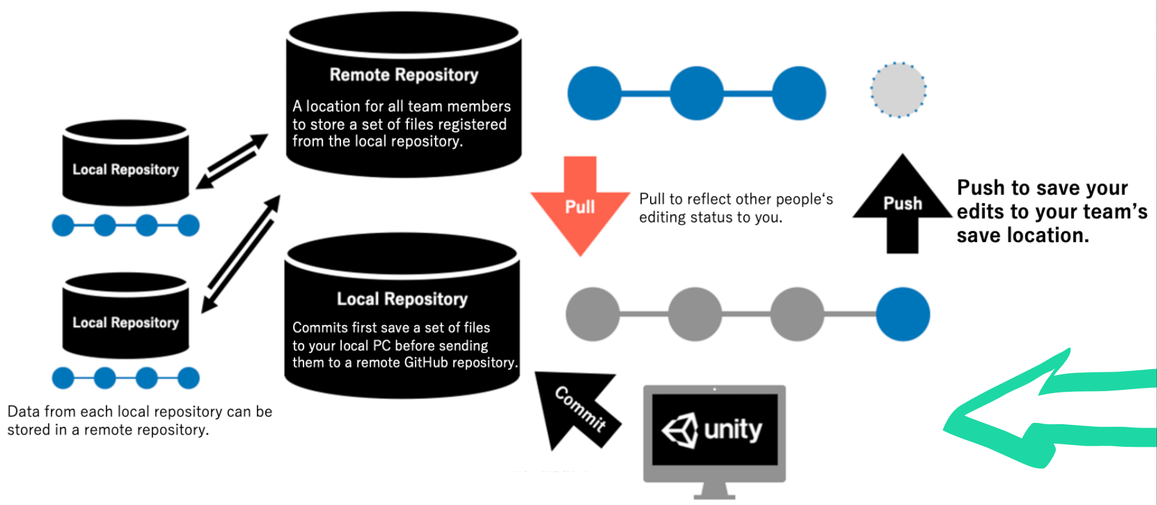
What we need to learn or consider to built it?

Very MOSCOW method: What is essential and what could we do without/fake?

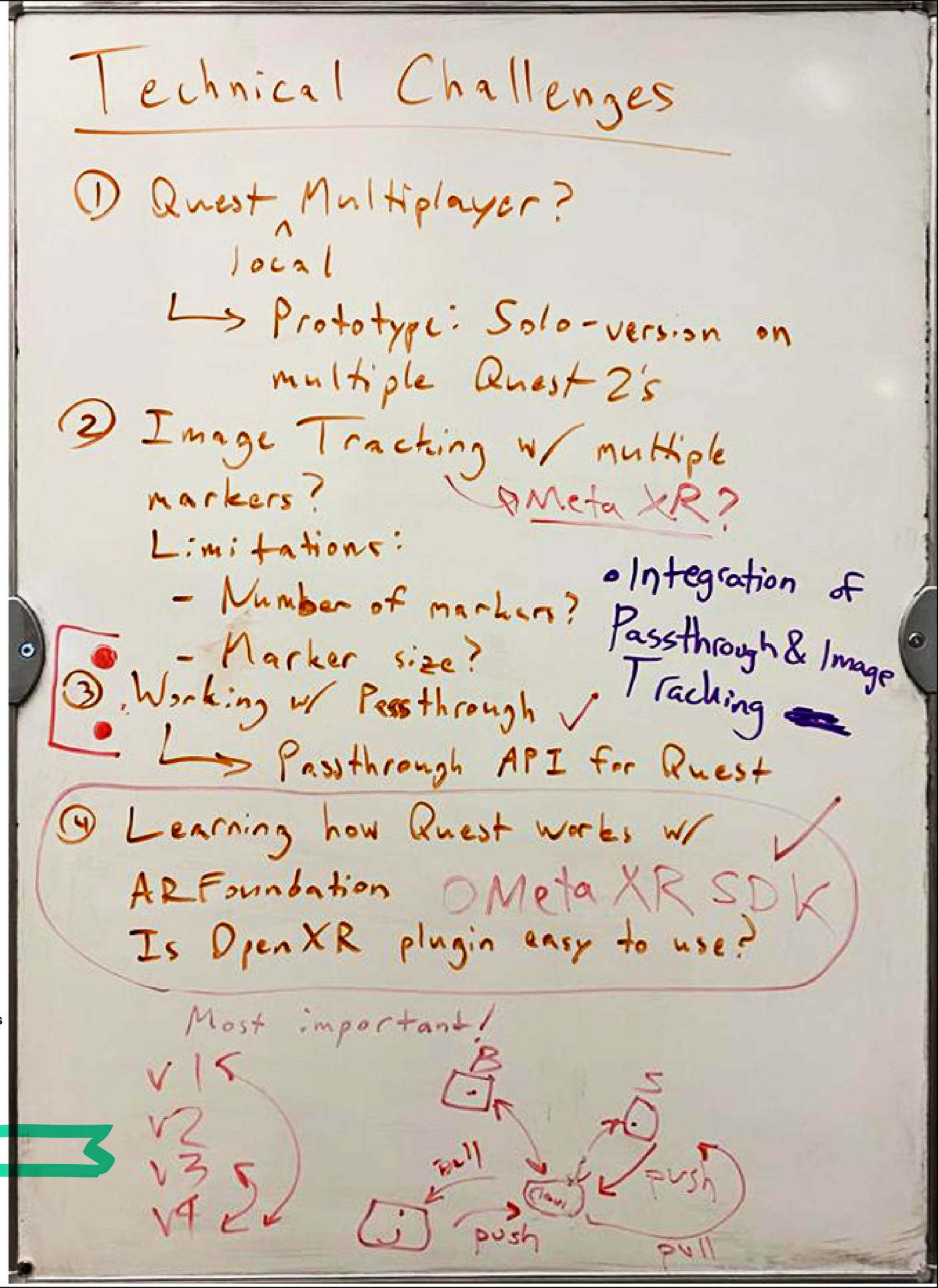
Scheduling the team work

Repository workflow

Using Github to do version control/team development for our Unity project



https://styly.cc/tips/unity/michi_unity_github_2/



Testing providers

Meta Quest 2/3

- We hit a wall once we realized Meta doesn't allow camera feed for development processing. We were unable to track images via passthrough.

Tilt 5

- The technical side was fine, but we would need to install some proprietary software and we didn't think the tech was what we wanted to use/needed for this idea

J o s h

Jumpscare

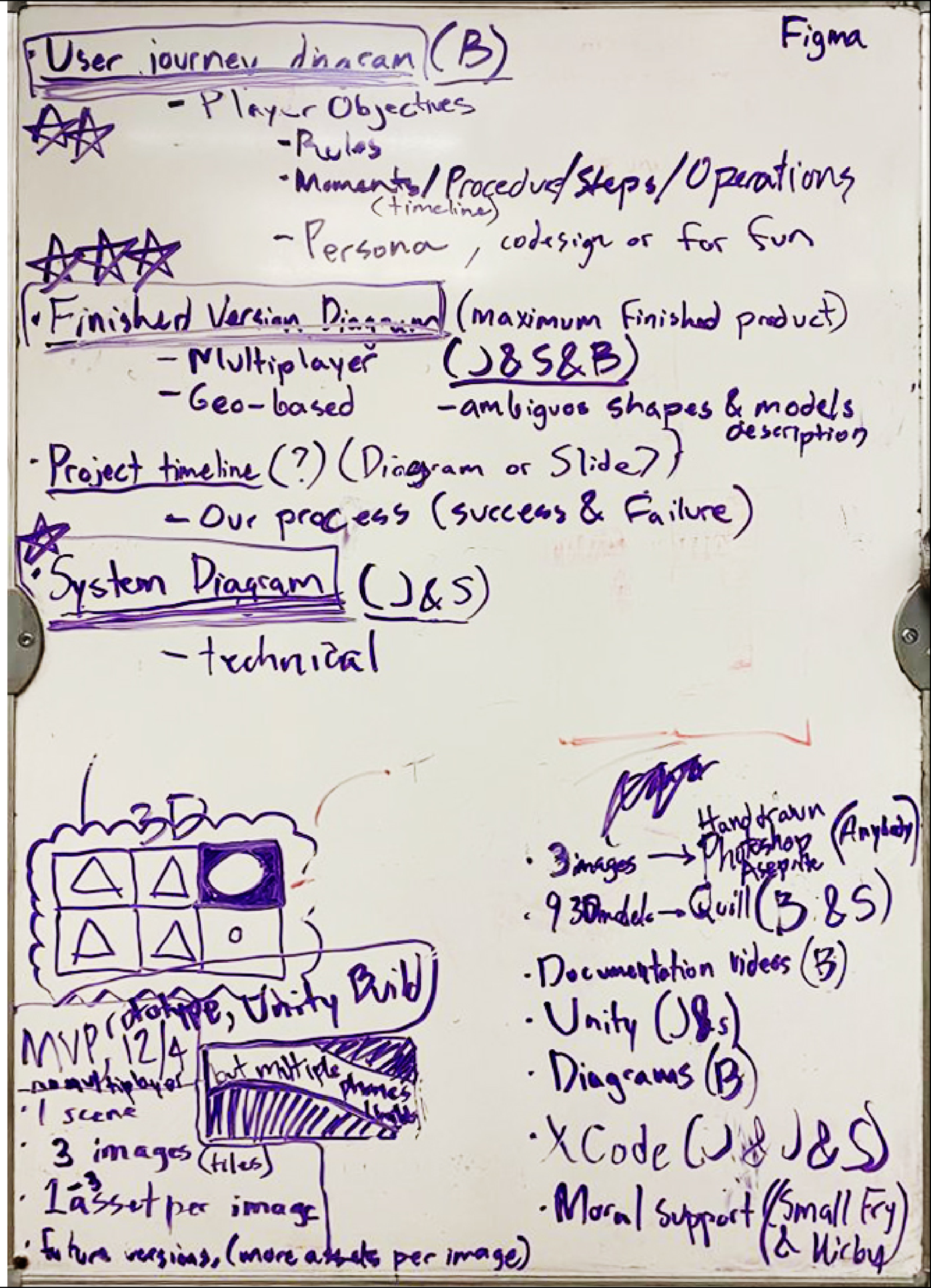
Building in Mobile

We decided to pivot and look into mobile development for our AR experience

We would use **AR Foundation** and make an iOS build

We also ended up making a new schedule with a set of tasks that we wanted to get done, including:

- Figma diagrams
- Hand-drawing tiles
- Hand-drawing 3D assets in Quill
- Debugging Unity.. :(



User´s journey

Tiles

Abstract → Users can decide the meaning

Figurative → Users can make stories

Setting the map

Prompt:
Build a world

USER

Get the Tiles

Place the tiles

Dialogue: Does it make any sense?

Launching AR

Mobile

AR- App

marker → asset asset asset

marker → asset asset asset

marker → asset asset asset

Sharing worlds

Crops!

Water!

Dialogue

Our world!

VersionAlfa

Session 1 | Session 2 | Session 3

Version Beta

Same session

System diagram

Application

Open app, load core components of Unity game engine, AR Foundation

Feature check / device compatibility → app triggers a call to the OS to display permission dialogue

AR Foundation initializes AR Session → Configures sensors for AR tracking and positioning

Initialize camera → Stream video data for processing

Process camera feed for detection of images in library ↔ Run computer vision algorithms particular to each OS

Retrieve 3D model and render using Unity ← Image recognition

Calculates position, scale, orientation → Overlays the 3D model into the camera feed

Capture and process inputs → Update the overlay per inputs

Unity manages memory and resources

Upon exit, shuts down AR Session and other processes

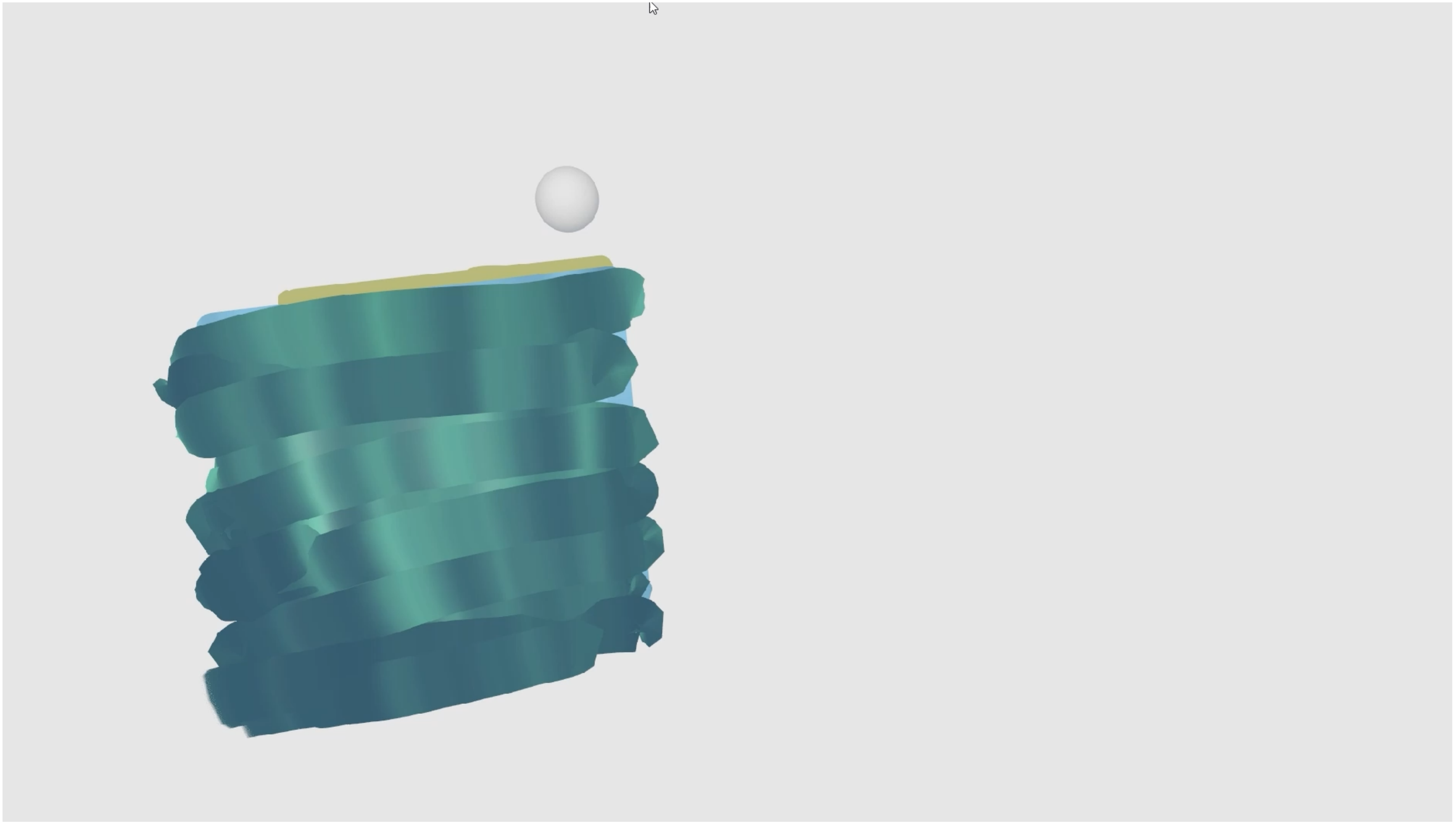
Unity and AR Foundation perform cleanup operations

Unity and AR Foundation perform cleanup operations

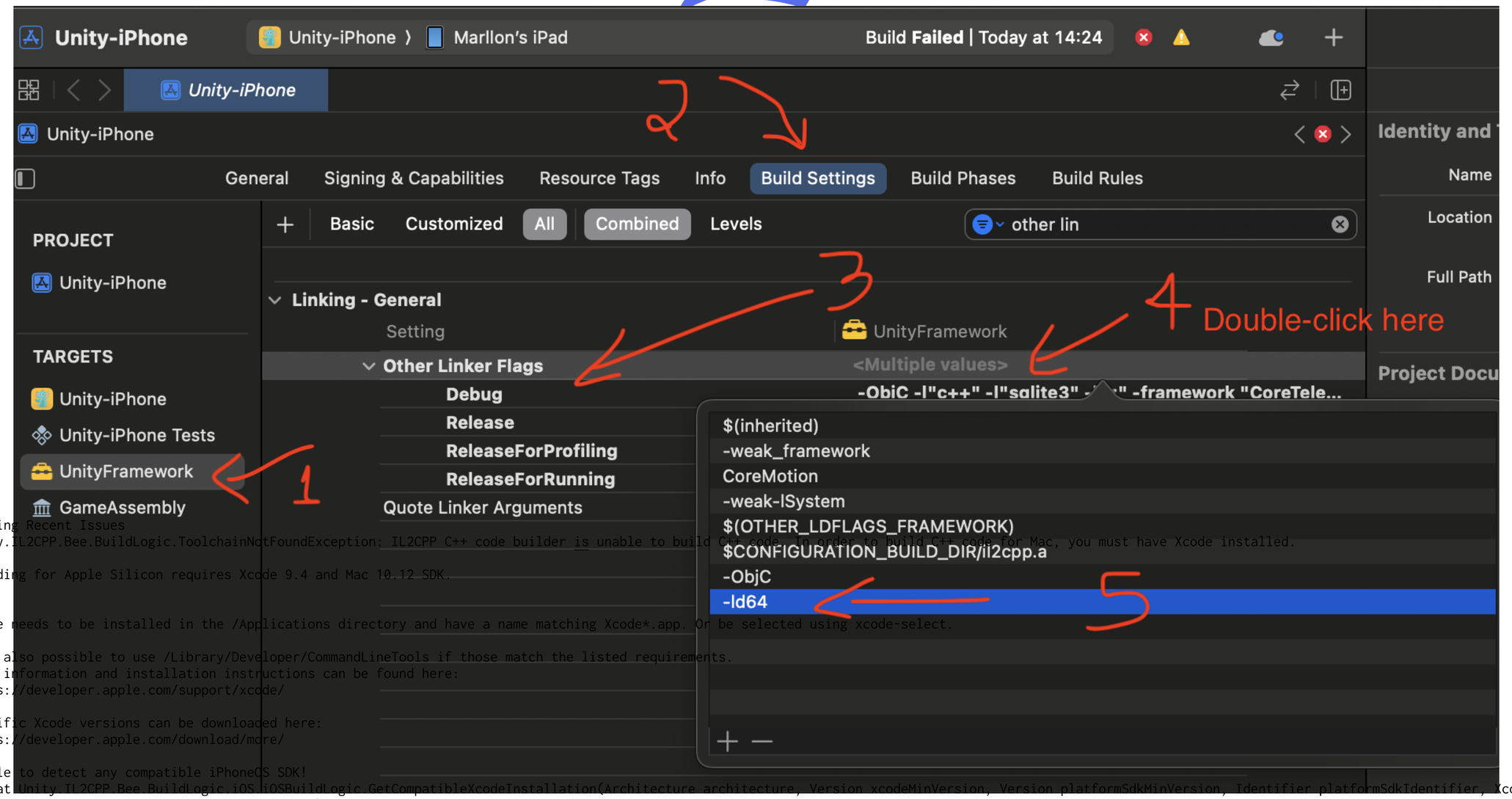
App closes and Unity ensures all processes have terminated

iPhone

Quill props



Testing Mobile Development

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Showing Recent Issues
Unity.IL2CPP.Bee.BuildLogic.ToolchainNotFoundException: IL2CPP C++ code builder is unable to build C++ code. In order to build C++ code for Mac, you must have Xcode installed.

Building for Apple Silicon requires Xcode 9.4 and Mac 10.12 SDK.


Xcode needs to be installed in the /Applications directory and have a name matching Xcode*.app. Or be selected using xcode-select.

It's also possible to use /Library/Developer/CommandLineTools if those match the listed requirements.
More information and installation instructions can be found here:
https://developer.apple.com/support/xcode/

Specific Xcode versions can be downloaded here:
https://developer.apple.com/download/more/

Unable to detect any compatible iPhoneOS SDK!
    at Unity.IL2CPP.Bee.BuildLogic.iOS.iOSBuildLogic.GetCompatibleXcodeInstallation(Architecture architecture, Version xcodeMinVersion, Version platformSdkMinVersion, Identifier platformSdkIdentifier, XcodePlatformSdk& compatiblePlatformSdk,
XcodeInstallation& compatibleXcodeInstallation)
    at Unity.IL2CPP.Bee.BuildLogic.iOS.iOSBuildLogic.UserAvailableToolchainFor(Architecture architecture, NPath toolChainPath, NPath sysRootPath, Boolean targetIsSimulator)
    at Unity.IL2CPP.Bee.IL2CPPExeCompileCppBuildProgram.BuildProgram.Main(String[] args, String currentDirectory)
    at Unity.IL2CPP.Building.InProcessBuildProgram.StartImpl(String workingDirectory, String[] arguments) in /Users/bokken/build/output/unity/il2cpp/Unity.IL2CPP.Building/InProcessBuildProgram.cs:line 51

Error: Unity.IL2CPP.Building.BuilderFailedException: Build failed with 0 successful nodes and 0 failed ones
Error: Internal build system error. BuildProgram exited with code 1.
Unity.IL2CPP.Bee.BuildLogic.ToolchainNotFoundException: IL2CPP C++ code builder is unable to build C++ code. In order to build C++ code for Mac, you must have Xcode installed.
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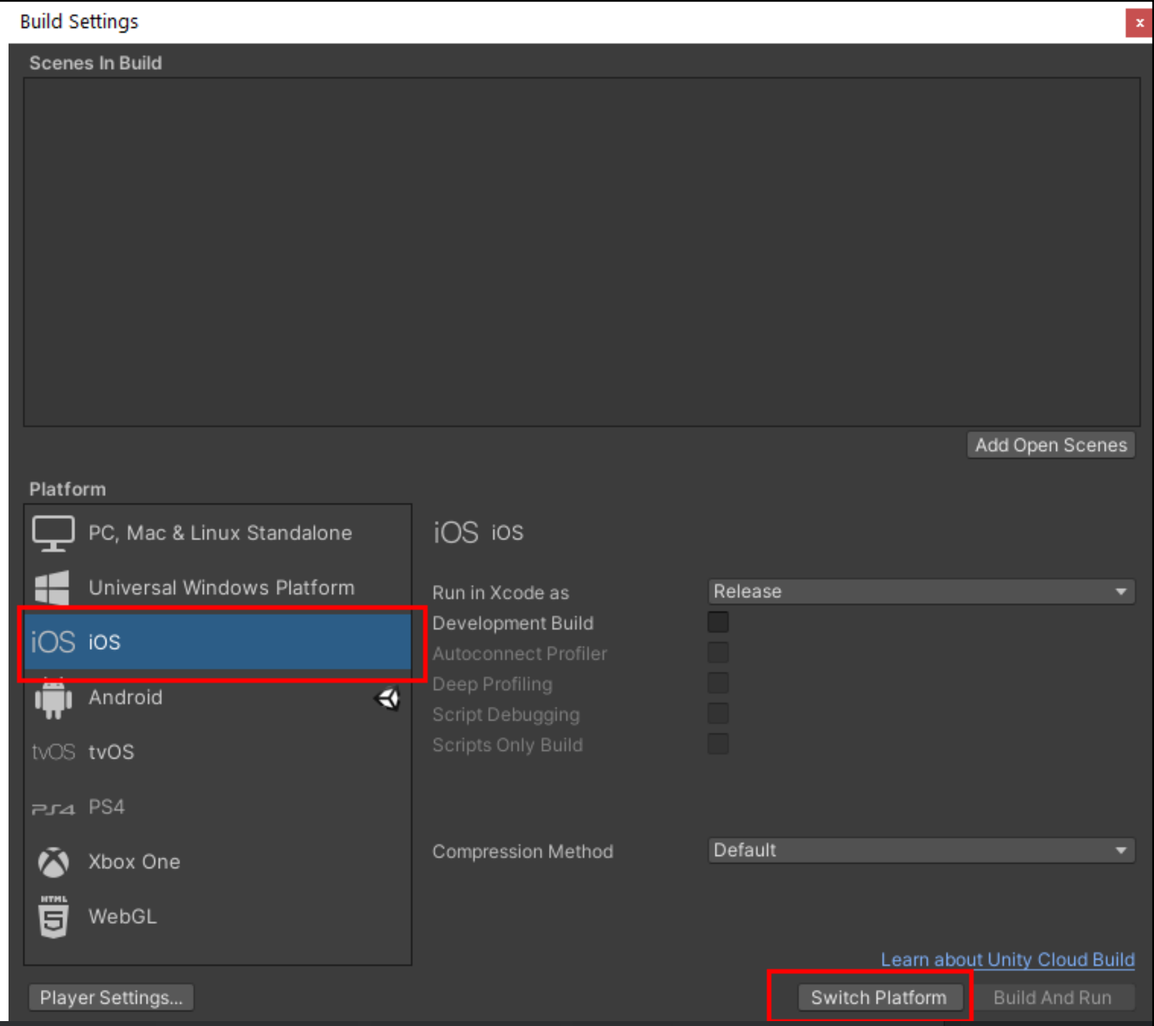
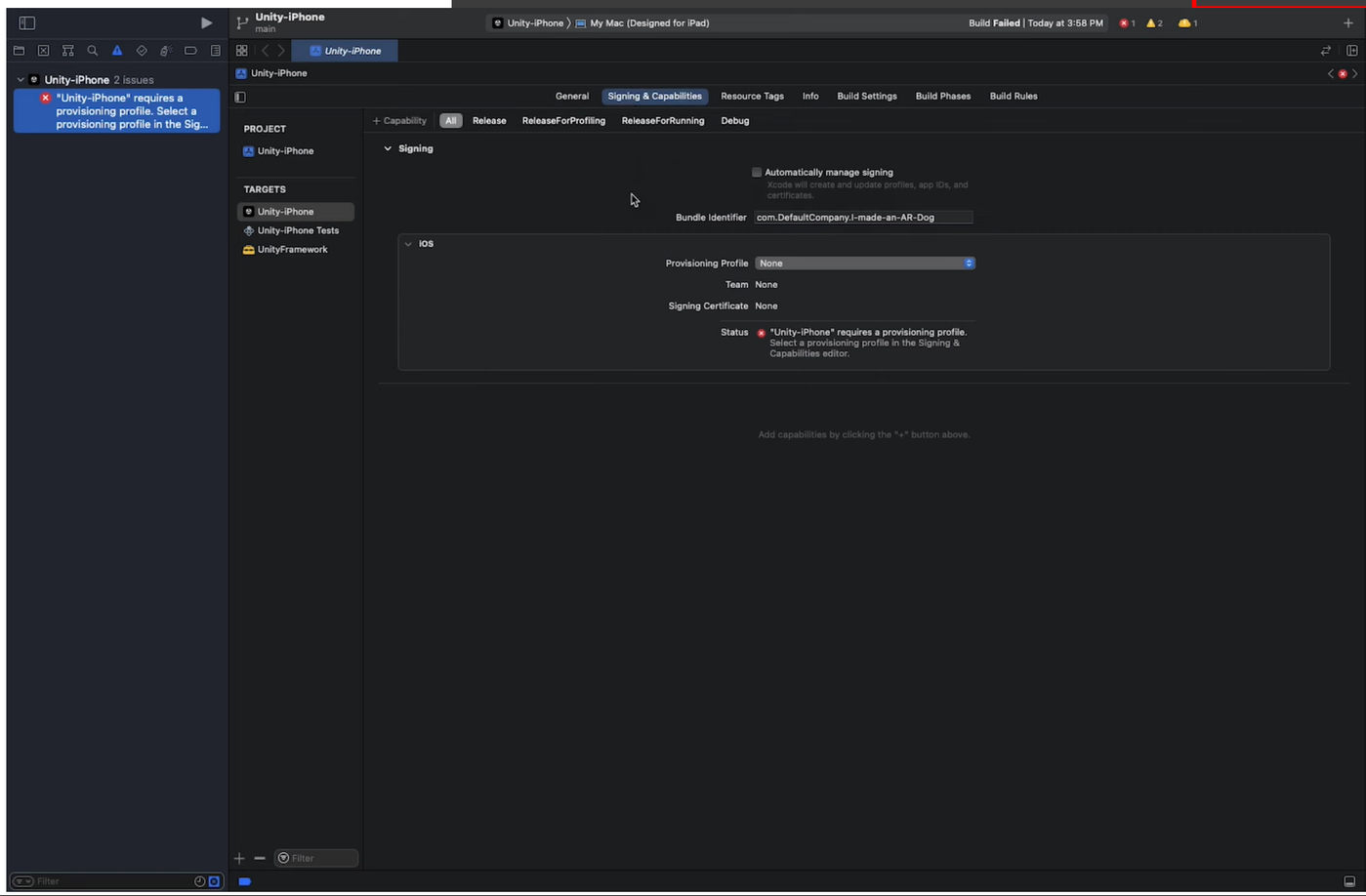
Unable to detect any compatible iPhoneOS SDK!
    at Unity.IL2CPP.Bee.BuildLogic.iOS.iOSBuildLogic.GetCompatibleXcodeInstallation(Architecture architecture, Version xcodeMinVersion, Version platformSdkMinVersion, Identifier platformSdkIdentifier, XcodePlatformSdk& compatiblePlatformSdk,
XcodeInstallation& compatibleXcodeInstallation)
    at Unity.IL2CPP.Bee.BuildLogic.iOS.iOSBuildLogic.UserAvailableToolchainFor(Architecture architecture, NPath toolChainPath, NPath sysRootPath, Boolean targetIsSimulator)
    at Unity.IL2CPP.Bee.IL2CPPExeCompileCppBuildProgram.BuildProgram.Main(String[] args, String currentDirectory)
    at Unity.IL2CPP.Building.InProcessBuildProgram.StartImpl(String workingDirectory, String[] arguments) in /Users/bokken/build/output/unity/il2cpp/Unity.IL2CPP.Building/InProcessBuildProgram.cs:line 51
    at il2cpp.Program.DoRun(TinyProfiler2 tinyProfiler, String[] args, RuntimePlatform platform, Il2CppCommandLineArguments il2CppCommandLineArguments, BuildingOptions buildingOptions, Boolean throwExceptions) in /Users/bokken/build/output/
unity/il2cpp/il2cpp/Program.cs:line 319
```

Building iOS- XCode

In order to build to an iPhone, we needed to:

- Switch platforms in our Unity project build settings and **make a build on a Mac**
- **Open** the generated project in Xcode
- Put an **iPhone into developer mode**
- Register our **apple account** as a developer account (the free version)
- Build the project **to the connected phone** via Xcode





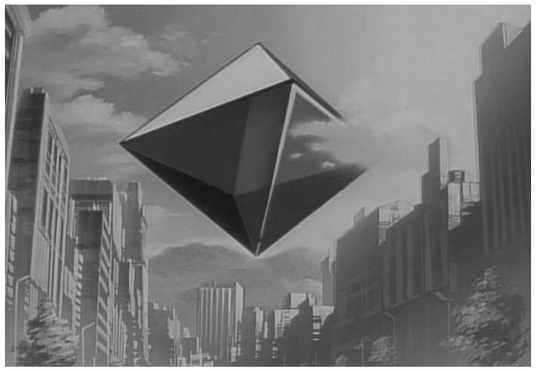
Iterative Unity Development

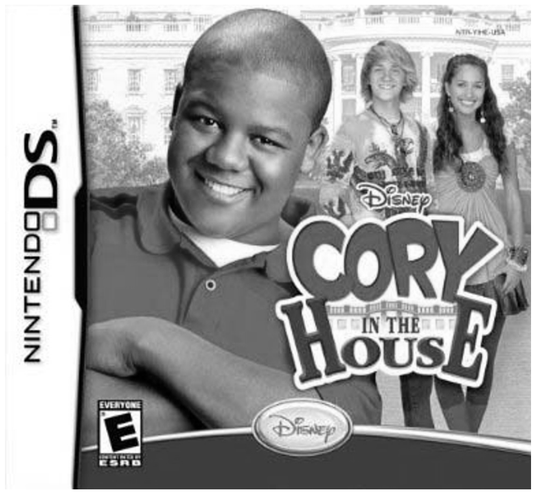
Things we did **in order of testing in Unity** for functionality:

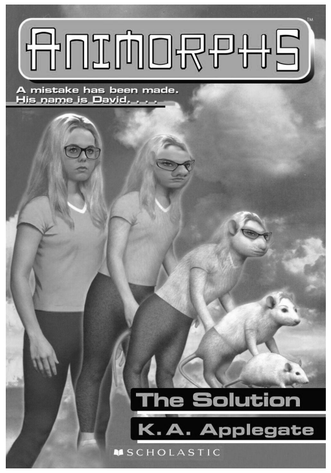
1. Could we get an AR project onto the phone that **could access the camera**?
2. Could we get an AR project onto the phone **with camera access and something in the space?**
3. Could we get **image tracking to work with a single image**?
    a. **How big do the images** have to be? **How much of the screen** do they have to take up before an object gets placed?
    b. What happens **if we have multiple of the same image,** will there be **multiple objects placed**? (No, it just picks the first one it sees)
4. Could we get image tracking to work with multiple images, **but just one model?**
    a. What images does the app **have trouble with** and which ones **does it easily recognize**?
5. Could we place **different items on different images**?
    a. Could we get **the items to stay in the space if the image isn't being tracked**? (Yes, surprisingly easily too)
6. Could we **map lists of objects to images,** and could we get the current object to change by **tapping on** it?
    a. We ended up switching to the new input system for this

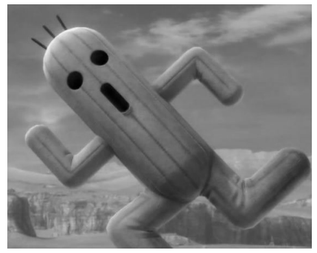
Prototype Alpha Version !!

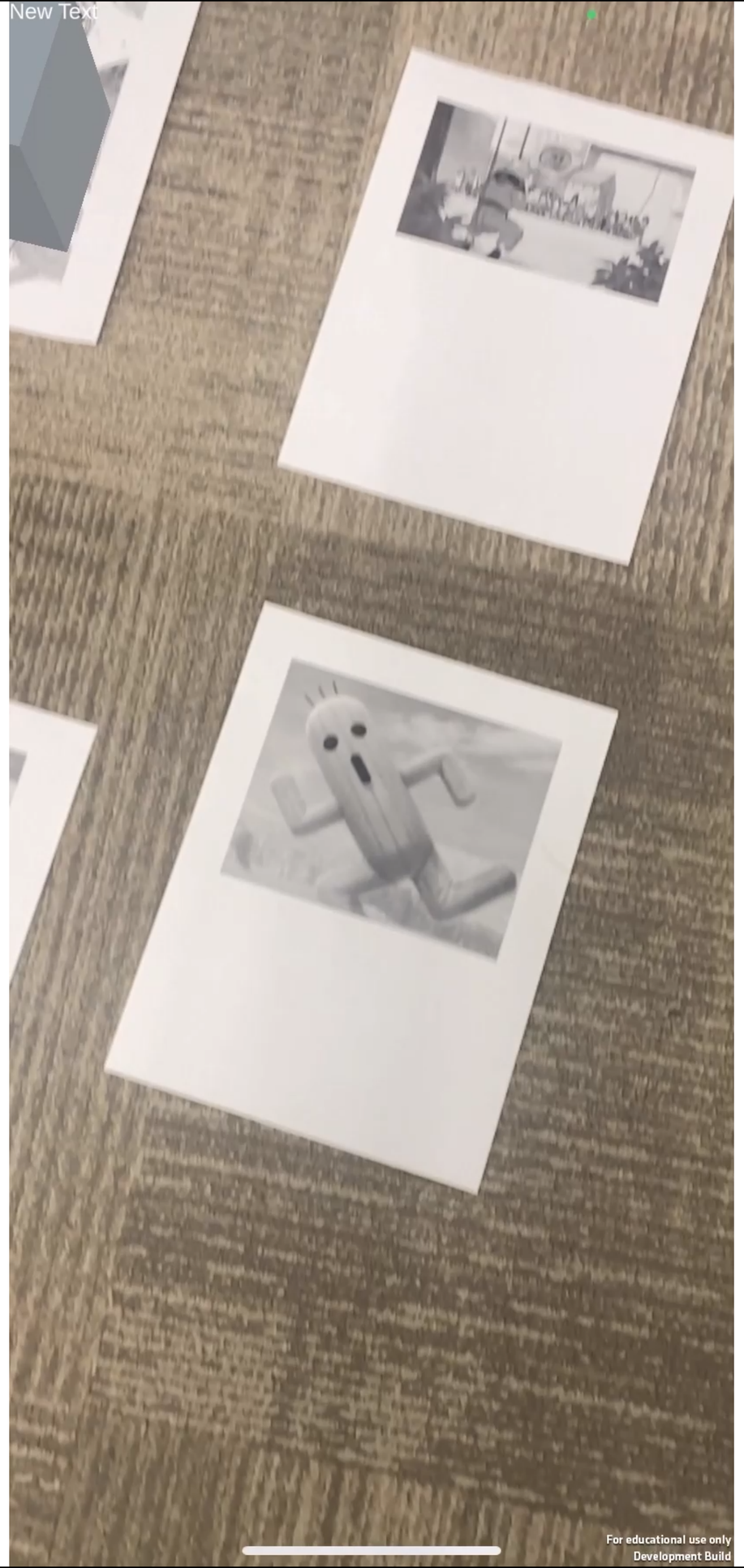
Our initial test helped us realize what type of imagery the image processing algorithms could detect. Certain features and high contrast helped the process detect the image faster.











Prototype Gold Version

LIVE DEMO