

Breaking Down the Barriers to Augmented Reality: Prototyping in the Classroom

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Air Mail: Letters in Three Dimensions

Exercise Prompt

Let's explore how adding the third dimension into our design space can be used to create meaning. In response to the question: *"What does it mean to write messages and put them in the air?"* (Zach Lieberman, *School of Poetic Computation*), we will position and manipulate geometric letterforms in three-dimensional space to communicate the meaning of a word.¹

Objectives

Position letters in three dimensions to communicate the meaning of the word
and/or

Manipulate the depth of the letters to communicate the meaning of the word.

What we'll do

I will assign you a word.

You use the assigned typeface.

You will learn how to change the position, rotation, and scale of your letters.

Questions to consider

1. What new negative spaces can we play with on the z-axis?
2. What types of visual properties make for an engaging composition from all angles?
3. Imagine what happens when our letters live in the real world? In what ways can they respond to the environment and the people in that environment?

Inspiration

- [Word as image](#) (2011), Ji Lee // IG [@wordasimage](#)
- [Weird Type](#) (iOS only, 2018), Zach Lieberman
- [IN PLAIN SIGHT](#) (2020), hosted on 4th Wall App by Nancy Baker Cahill
- [El Barrio is Home](#) (2016), Tamiko Thiel
- [Shades of Absence](#) (2011), Tamiko Thiel
- [Robert Downey Jr. on Esquire's Augmented Reality Cover](#) (2009)

¹ This project is adapted from Ellen Lupton's *Space and Meaning* exercise, and Ji Lee's *Word as Image* project.

AR Terminology

The Basics

Augmented Reality (AR): AR is the overlay of digital information onto the physical environment to enhance what we can see, hear, and/or feel. At the moment, there are four recognized types of AR:

1. *Marker-based*: Marker-based AR uses a device's camera and pattern recognition capabilities to identify specific imagery, or "markers," that trigger the overlay of digital content. Examples include [The Pursuit of Happiness](#) and "[Living Labels](#)" on 19 Crimes wine bottles.
2. *Location-based*: Location-based AR uses the GPS embedded in our devices to trigger the overlay of digital content. Examples include [Pokemon Go](#) and applications like [Star Walk](#).
3. *Superimposition*: This type of AR uses complex object recognition capabilities, or SLAM (Simultaneous Localization and Mapping), to recognize faces, spatial planes, or 3D objects in order to overlay digital content. SLAM allows our cameras to understand and track the physical world and our relationship to the space we are in. Examples include face filters and [Ikea Place](#).
4. *Projection-based*: Because this type of AR uses hardware (projectors) beyond our phones, you might not have heard of it. Projection-based AR uses light to overlay digital images on real-world objects or surfaces. Examples include [laser projection keyboards](#) and the [AccuVein](#) vein visualizer.

Software Development Kit (SDK): SDKs are libraries that allow programmers to access the hardware in smartphones that make AR experiences possible. SDKs like Apple's [ARKit](#) and Google's [ARCore](#) contributed significantly to making AR accessible on a smartphone and the subsequent rise of AR content.

Beyond AR²

Virtual Reality (VR): VR is a completely simulated and immersive digital realm that erases the physical world and is experienced by a person using special electronic equipment (like a headset).

Mixed Reality (MR): This term refers to environments that consist of both virtual and physical elements. Originally coined in Paul Milgram and Fumio Kishino's "A Taxonomy of Mixed Reality Visual Displays" (1994), MR includes AR and excludes entirely real or entirely virtual environments (like VR). For more information, see figure 1 below.

Extended Reality (XR): XR encompasses all real-and-virtual combined environments and human-computer interactions. The 'X' represents a variable for any current or future technologies.

Spatial Computing: Spatial computing is computing that uses the 3D space around us as an interface. It is a broad term that refers to many different types of hardware and software, and is often used synonymously with XR. However, spatial computing specifically highlights content that uses 3D space or physical actions (head and movement movements, gestures, speech) as inputs for interactive digital media systems.

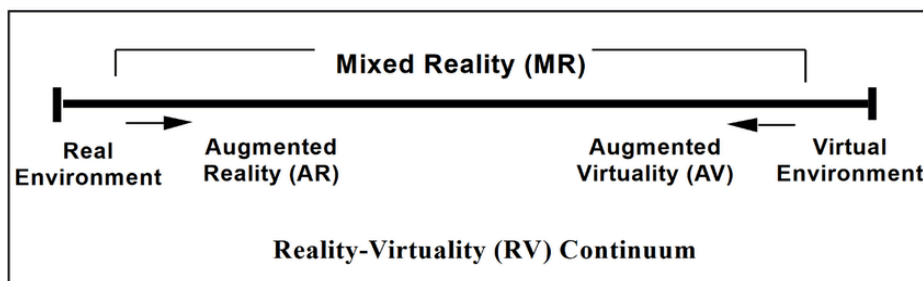


Figure 1. Reality-Virtuality continuum according to Milgram, Takemura, Utsumi and Kishino (1994).

Augmented Typography

Adaptive³ Typography: This term describes type with properties that respond to a variable environment and to the people existing in that environment. Adaptable typographic properties include anything that can enhance legibility: typographic style, weight, width, x-height, counter spaces, color, scale, placement, and more.

Legibility and Readability: Legibility refers to the ability to differentiate one letterform from another in a particular typeface. Factors such as x-height, ascender and descender length, counter and bowl sizes, and variation in stroke thickness all affect legibility. Readability concerns the effectiveness of the whole reading process, and is determined by how text-based content is styled and organized in a composition.

² These definitions are likely to evolve in the future.

³ The term "adaptive" was first used in Andrew Johnson's blog post [Breaking Boxes – Typography and Augmented Reality](#).

AR Learning Resources

Learn More: AR + Typography

[Fonts to fit your augmented and virtual reality designs](#): Monotype's recommended AR typefaces.

[A 3-D Incunabula of Type](#): This is a great overview by arts journalist (and mom) Susan Hodara, for Communication Arts magazine.

[Breaking Boxes – Typography and Augmented Reality](#) & [AR Optical Typography](#): Type designer and AR-pioneer Andrew Johnson documents and reflects on his experiments with AR type

[Approaching Spatially Adaptive Type](#): Andrew Johnson does it again! Beautiful detailed article about what factors to consider when it comes to creating legible typographic experiences in AR.

Play: Download and experience AR on your phones

[Immersive \(AR/VR\) New York Times](#): With its beautiful and timely content, the New York Times has been a pioneer in immersive journalism, beginning with their 360 film The Displaced (2015). To explore, download the New York Times app and in the Sections menu, scroll to the very bottom to find Immersive (AR/VR). iOS + Android.

[Kinfolk](#): This application was released this past March by [Movers and Shakers](#) (2021). It uses augmented reality to tell the stories of six Black historical figures. It is part of a greater effort, The Monuments Project, which aims to create “culturally responsive pedagogy so that students of color can see themselves in their history.”

[Weird Type](#) (iOS only, \$1.99): Zach Leiberma's iPhone application lets you draw with words in space. Read more [here](#).

[Just a Line](#) (iOS + Android): Simple app by Google that lets anyone make drawings in AR by touching their screen to draw. Record and share what you make!

Extras: AR History, Art, Design

[Augmented reality: A class of displays on the reality-virtuality continuum](#) (1994): The seminal paper that depicts the reality-virtuality continuum.

[Manifest.AR](#) (2010): If you'd like a bit of history, here's a manifesto written by an artist collective in honor of the birth of mobile AR as an art form.

[Augmented Reality \(AR\) as an Artist's Tool for Equity and Access](#): AR-artist Nancy Baker Cahill discusses how AR can be used for social change. Check out her [4th Wall App](#), which is a free, augmented reality (AR) public art platform exploring resistance and inclusive creative expression.

[Transforming Placemaking with Augmented Reality](#): Interesting talk by Julia Beabout (CEO, [Novaby](#)) which discusses how AR can build community and culture through Placemaking.

[5G app transforms Vienna's City Hall into an AR wonderland](#) (Feb, 2021): UK media company Azoomee/Da Vinci has created an AR app that utilizes 5G to deliver an enhanced experience for children visiting Vienna's historic Rathaus building.

[Play the City](#) (2018): Documentation of an award-winning project in which an augmented uber helped celebrate the Grammys.

[Augmented Reality in the Art Gallery | Martha Rettig & Sofie Hodara | ARIA 2019](#): All you need to know about putting AR in an exhibition space.

[Augmented Reality for the Classroom: A Pedagogy](#): Martha Rettig and Sofie Hodara, 2021

AR Prototyping Tools

Make: Getting Started in AR (no-code)

[Artivive](#): Tool for artists that lets you turn graphics into augmented experiences by uploading an image and video. This is a limited but great place to get started. Examples: [The Borderline Mural Project](#) (MIT, 2017-ongoing), [The Pursuit of Happiness](#) (Martha Rettig & Sofie Hodara, 2018), [Disobedient Design](#) (MassArt, 2019).

[Lens Studio](#): Snapchat's creation tool for desktop, publish content to your Snapchat account.

[SparkAR](#): Facebook's creation tool for desktop, publish content to your Instagram account.

[Adobe Aero](#): Adobe's AR app is still in beta for the desktop, but it's a robust and promising platform for creating complex AR content.

[Reality Composer](#): Reality Composer allows you to create and share XR experiences on either a phone/tablet or Mac desktop.

[Minsar Studio](#): If you have an Oculus Quest, you can use this software to create AR experiences in VR. Minsar's primary target is to build a VR to AR workflow, which allows creators to share in Web XR for anyone to access. This is a new application and a little buggy, but seems interesting!

[CabinAR](#): Open-source tool to make and share marker-based AR.

Make: Creating or finding 3D assets

[Vectary](#): Browser-based 3D creation software

[Sketchfab](#): Publish and find 3D models

[Blender](#): 3D creation software

[Zbrush](#): Digital sculpting software

[Maya](#): 3D modeling software

Looking in the Black Mirror

Assignment By reflecting on Black Mirror's examination of the unintended consequences of humanity's growing dependency on digital technology, tell your own story of technology's impact on society through writing, drawing, or creating in your preferred media.

Objectives By observing trends in society and technology, speculate on the unanticipated consequences of technical advances (can be positive or negative).

Employ basic storytelling structures and tools to demonstrate the repercussions of technology through a **main action**, with a clearly defined **beginning, middle, and end**.

Practice creating deliverables for abstract ideas and concepts.

Deliverables Story proposal

Final Story (written, drawn, or told in your preferred media)

Resources Black Mirror SE1 E3: [The Entire History of You](#) from Netflix

Black Mirror SE3 E1: [Nosedive](#) from Netflix

Black Mirror SE4 E6: [Black Museum](#) from Netflix

[Storytelling Handout](#) + [Design is Storytelling](#), Ellen Lupton (excerpt)

[Things from the Future](#): Deck of playing cards for a game about telling stories about the future. Instructions [here](#).

[Speculative Everything, Ch.1-3.pdf](#): Dunne and Raby

[Design and Futures-StuartCandy.pdf](#): Includes Alex McDowell's "Storytelling Shapes the Future"

Process *Part 1. Reflection*

Review the [Storytelling Handout](#) and assigned [reading](#).

What frightens or inspires you about your relationship with technology?

Consider the themes presented in the assigned Black Mirror episodes.

Are they believable? Do they make you cringe? If so, why? If not, why?

Part 2. Proposal + Storyboard

Write a brief (2-3 paragraph) proposal for your own story. Address the following:

- *In a brief paragraph, describe your future world. What specific pieces of digital technology (software, hardware, etc.) will you consider? Why?*
- *What are some specific effects of this technology on society and/or interpersonal relationships (building empathy between certain groups or individuals, inciting distrust, etc.)?*
- *What is the main theme of your story? What social or political problem does this technology highlight?*
- *What main action and characters do you need to demonstrate the effects of this technology?*
- *What are the beginning, middle, and end of your main action?*
- *How does your action transform your character or situation?*

As visual thinkers, pick one of your scenarios and create a lo-fidelity (stick figures) storyboard or sequential narrative to help develop your ideas.

Part 3. Final Deliverable

Deliverable forms may vary; the story may consist of any combination of text and imagery. It should demonstrate either the positive or negative repercussions of technology by a main action, with a clearly defined beginning, middle, and end.

CabinAR - A Guide

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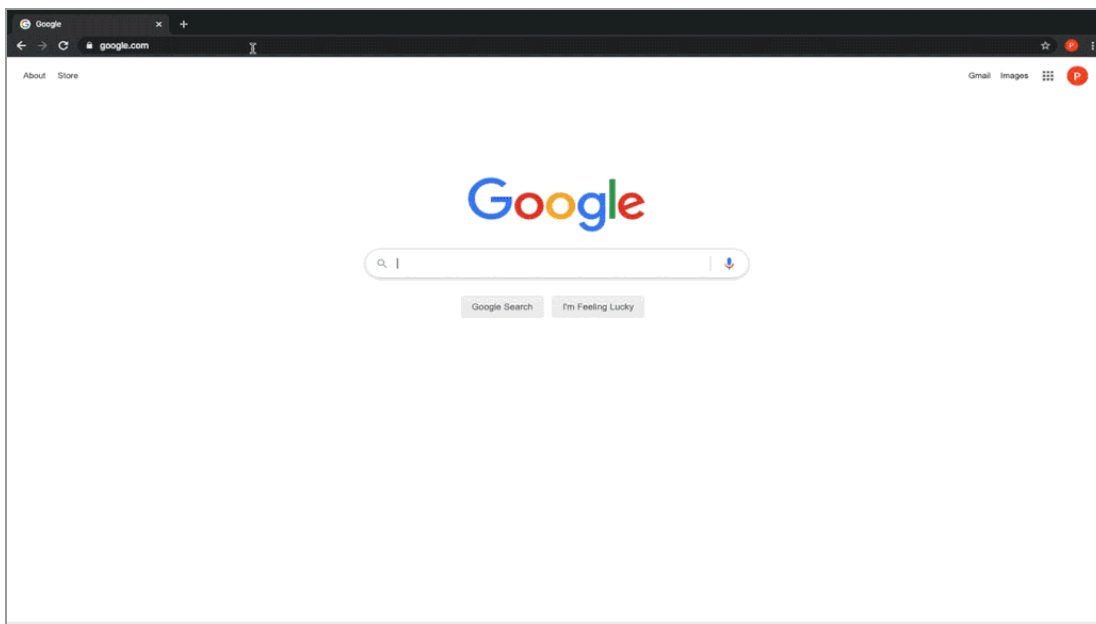
Getting Started

How it works

CabinAR allows you to build marker-based AR⁴ content in your web browser and publish that content to a free smartphone app. The content can then be shared with others through the smartphone application.

Create an Account

Using either [Google Chrome](#) or [Chrome Canary](#) as your browser, please create a CabinAR account at [CabinAR](#). This account brings you to a web software platform where you can build marker-based AR. For more, see [1. Create an Account](#).



Download the smartphone application*

In order to view your AR projects, you will need to download the smartphone app, available for free on [iOS](#) and [Android](#).

**We will not be using this during the demonstration.*

⁴ Marker-based AR uses a device's camera and pattern recognition capabilities to identify specific imagery, or "markers," that trigger the overlay of digital content. Examples include [The Pursuit of Happiness](#) and [Living Labels](#) on 19 Crimes wine bottles.

CabinAR Basics

Spaces – Create a new space

What is a space in CabinAR? For each new project you make in CabinAR, you will create a new space. Think about each space like an exhibition space. In an exhibition space, you can hang a single piece of artwork or many pieces of artwork. In each CabinAR space, you can have as little as one marker-based piece of art or many.

To create a new space:

1. Log into your account at cabin-ar.com
2. Go to your spaces by clicking on the pink button that reads “My Spaces”
3. In your spaces, select the pink text that reads “+ Create a New Space.”

For more: [2. Create a New Space](#)

For more about the interface: [3. Interface Overview](#)

Pieces – Create a new piece

What is a piece in CabinAR? A piece is an augmented experience tied to a marker. The marker, usually a flat image or piece of artwork, will trigger the augmented content when viewed through your phone on the CabinAR app. In your space, you can have multiple pieces of marker-based AR artworks. Each artwork is called a piece. For each piece you create, you will want to upload a unique marker under the Properties panel.

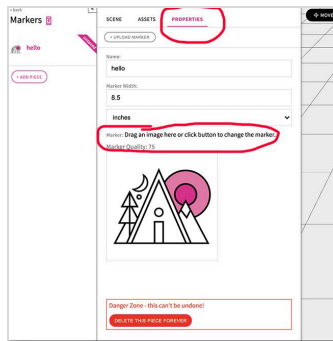
For more: [4. Add a New Piece](#)

Once you create a piece you can add your own marker, and then you can begin to design your own augmented content.

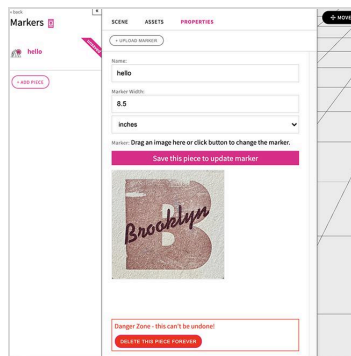
Markers – Adding or updating a marker

For each new piece you add, you can upload a unique marker. To upload a new marker or change an existing one, find the upload marker button under properties.

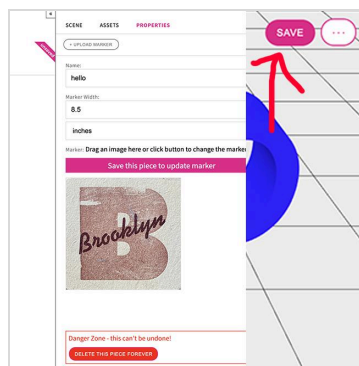
To add or update your marker. Go to the properties tab:



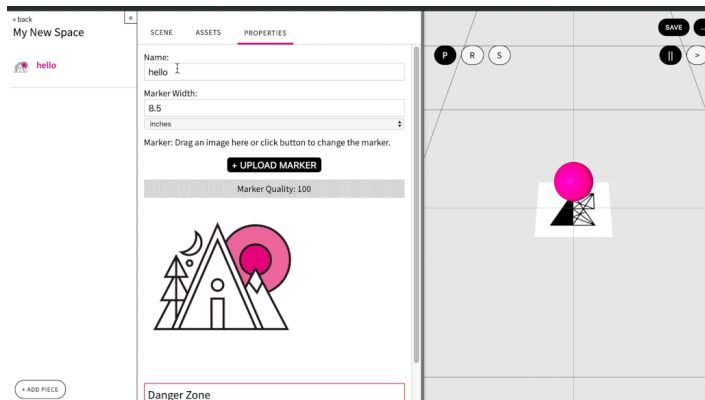
Drag your new marker into the panel (drop it beneath the measurements for your marker).



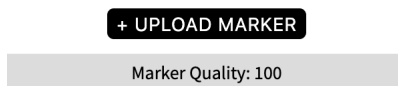
And then hit save to update your marker. A thumbnail should appear next to the name of your piece in your list of pieces. You may need to refresh your browser after you hit save.



Before you go back to your scene, be sure to name your piece, define the marker width that corresponds to your printed marker, and save your piece, using “cmd+s” or the save button in the upper right.



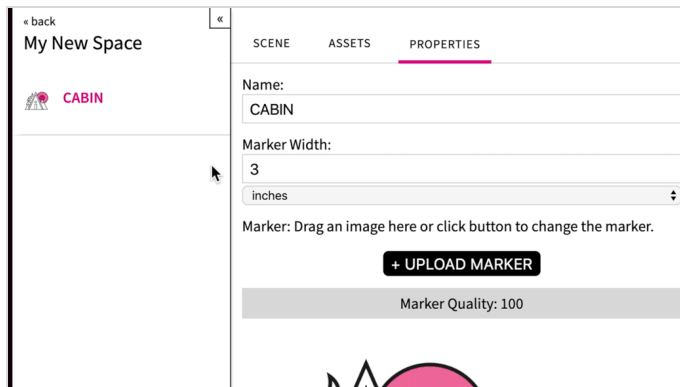
Also, note the *marker quality*. This scale rates the recognizability of your image marker; a higher score indicates stronger recognition. Aim for 80 or above.



Primitives – Add augmented content

To begin creating your own augmented reality content, let's add a primitive. Primitives are the building blocks of 3D — basic geometric forms that you can use as is or modify.

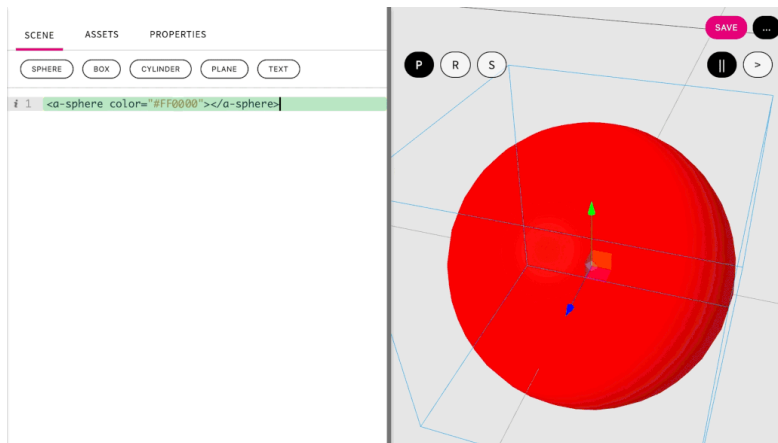
To add a primitive, go to the scene panel.



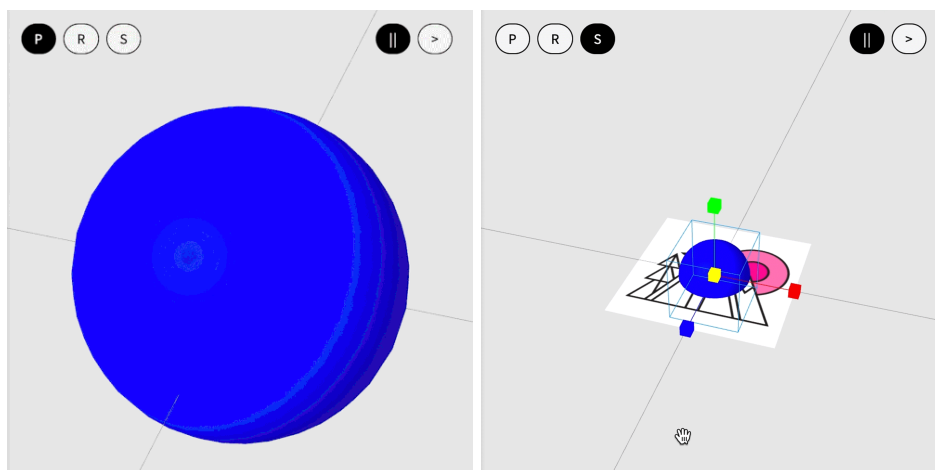
Select the button labeled *sphere* from the menu. A large red sphere should appear in the 3D editor, and a single line of html should appear in the html editor.



You have now added your first primitive!! You can change the color (and other attributes) of your primitive directly in the code editor.



Now you can use the P, R, and S buttons in your 3D editor to change the position, rotation, and scale.



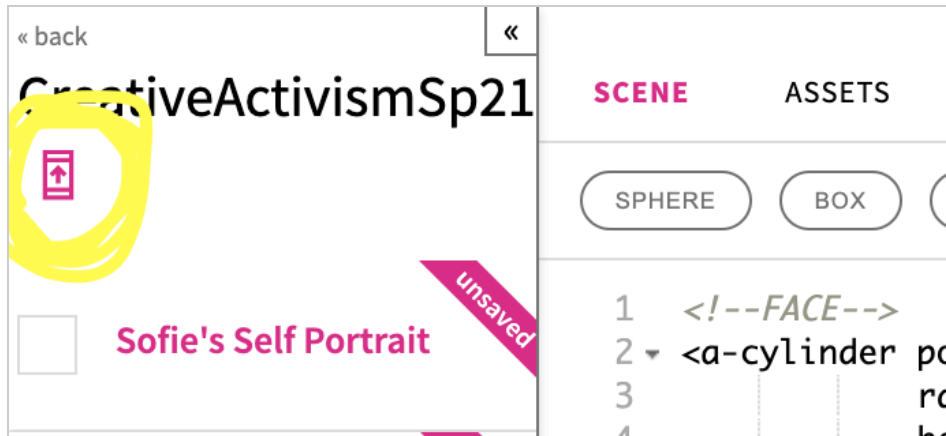
Adding a Primitive: [5. Add a Primitive](#)

Using the resources space

Once you create Primitives, it's easy to position, rotate, and scale them. But what if you want to do more? In the resources space, there are a variety of pieces with different settings and animations. Please get in the habit of copying and pasting code from this resource and using it in your own Space. I keep it open in a different tab while I work.

Viewing Your Work

When you want to see what you have created, click on the phone icon underneath the name of your space. This will bring up a QR code. Scan the code with your phone and it will open up the CabinAR app. Frame your marker in your phone camera to trigger your AR content.



Save often. Save often. Save often.

The browser and the internet are tricky. Save often. Sometimes, if I'm working on something extensive, I'll take my code and paste it into a text edit file just to be sure I don't lose it.

Sharing your work

There are two ways to share your work.

If you'd like to have share access to your space and pieces in the browser through their CabinAR account, you can invite specific users as collaborators.

If you'd like the augmented content to be viewable to anyone with your specific markers and the CabinAR app on their smartphone, you will want to publish the space.

Adding Collaborators

The best way to ensure your work is shared with the class is to invite us as collaborators.

You can add collaborators to any project space you create. Collaborators can create new pieces, edit your code, or help you troubleshoot a project.

1. Go to "My Spaces" and select the ellipsis to the right of the project name.
2. On the next page, you will be prompted to add a collaborator with the email address that is associated with their account.



COLLABORATORS	DETAILS
sofie.hodara@gmail.com	Admin
user email	ADD

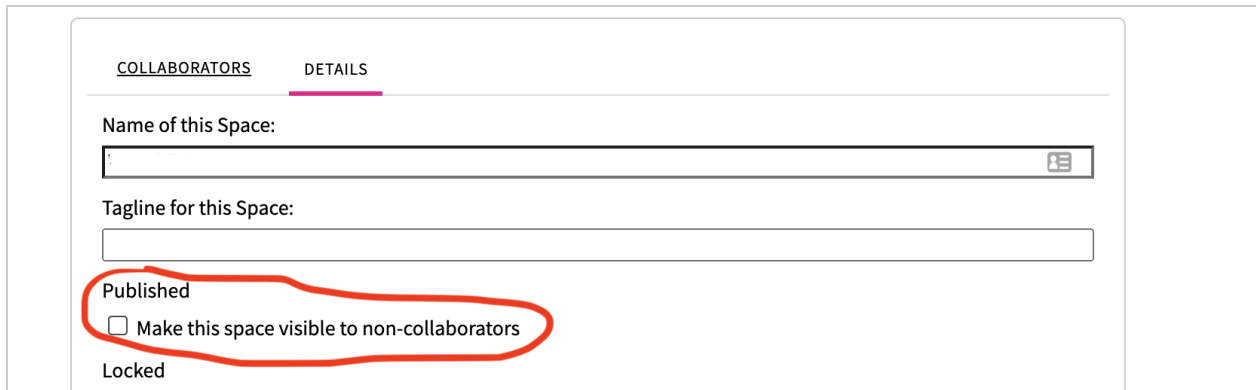
3. Once you hit add, you've added the collaborator and can go back to making!

Read more: [Add Collaborators](#)

Publishing Your Space

You can also publish your work to a specific location:

1. Go to “My Spaces” and select the ellipsis to the right of the project name.
2. Select Details.
3. Here you have two options:
 - a. You can publish this space so everyone who has the CabinAR application can see it:



The screenshot shows the 'DETAILS' tab of a space configuration interface. It includes fields for 'Name of this Space:' and 'Tagline for this Space:'. Below these, the 'Published' section is highlighted with a red circle, containing an unchecked checkbox labeled 'Make this space visible to non-collaborators' and a 'Locked' label.

- b. Or you can publish the space to a specific location by putting an address in the search bar. Adjust the slider to set the size of your location.

