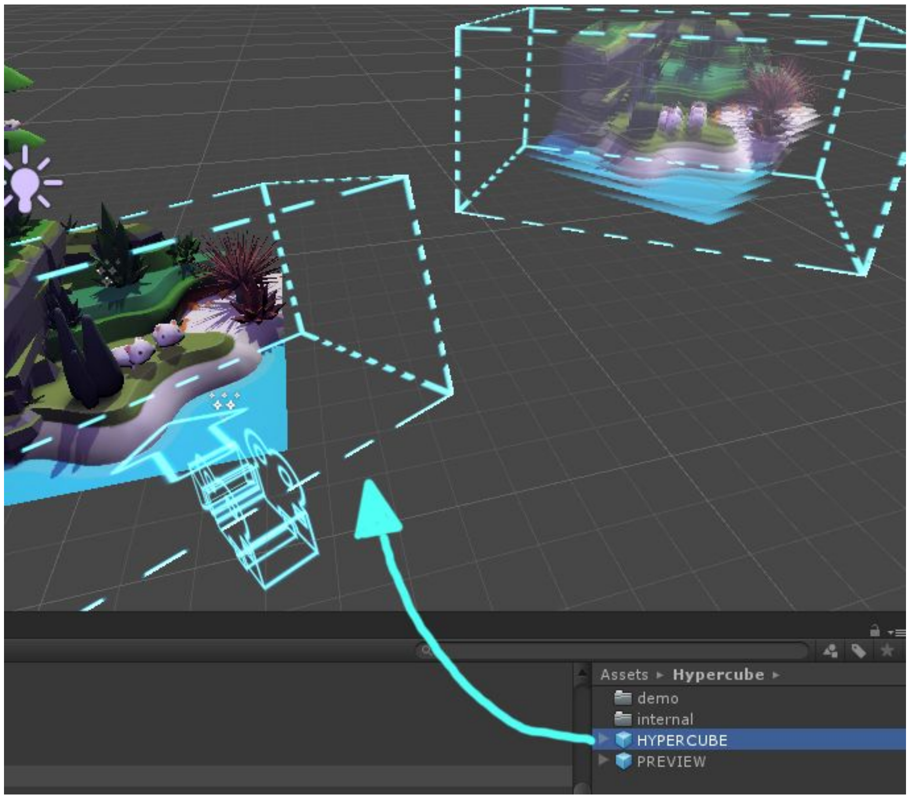
HYPERCUBE

VOLUME PLUGIN

How to use Hypercube:



Drag the Hypercube prefab into your scene.
THATS it!

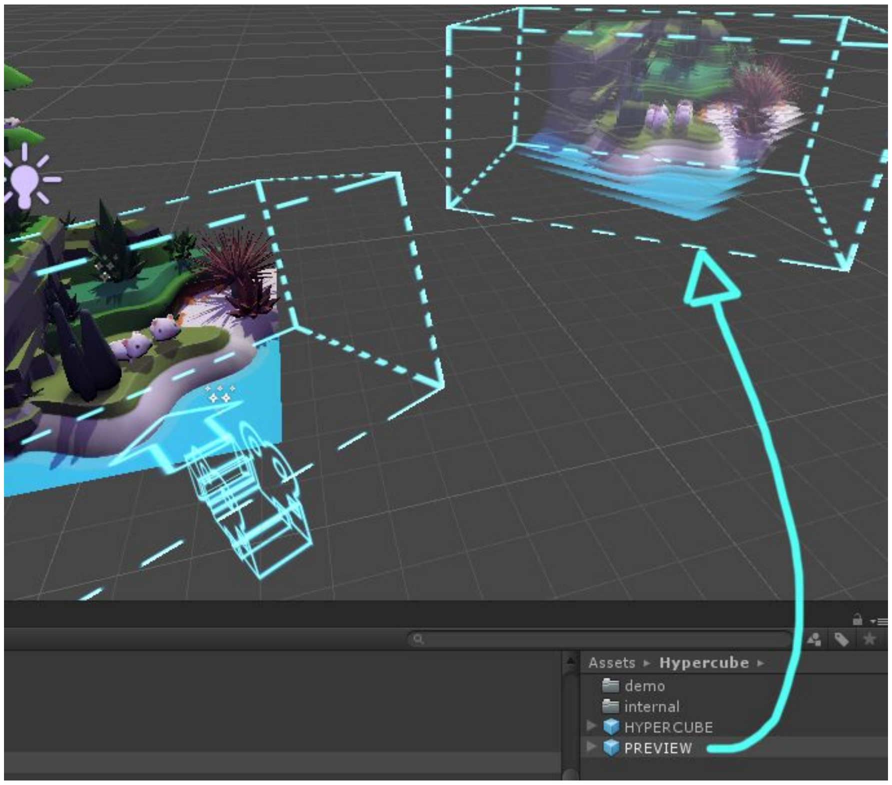
Any geometry inside the Hypercube will be rendered accordingly in Volume!
Is it really that simple? Yes. Just BUILD! :)

For best results, however, you will probably want to use a few more tools to make your life easier yet, so read on!

Previewing content for Volume in the Unity Editor:

Use the PREVIEW prefab.

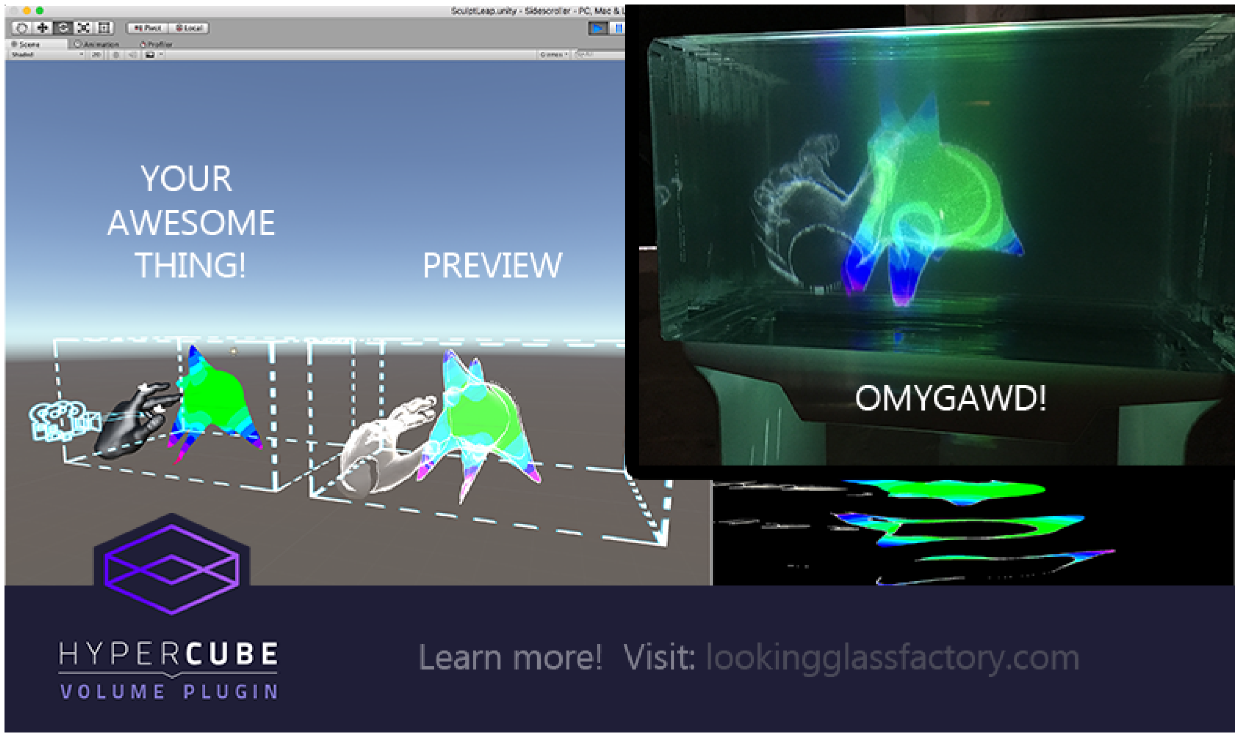
This is not a way to view your content in the Volume itself, but you can preview an idealized visualization of how it will look inside Volume by dragging PREVIEW.prefab into your scene. It will connect automatically to the Hypercube Camera.



The PREVIEW also adds a feature to your player: if a Volume is not detected at runtime, the preview will display itself instead of slices, hence your application will display a coherent image on a monitor when a Volume isn’t accessible.

Previewing Unity Editor content inside Volume:

Use the Hypercube Caster Window.



Editor content being shown directly in volume, in real-time, using the Caster Window.

NOTE: For best results, set "Edit > preferences > Colors > playmode tint" to white so that the window will not be greyed during play (occurs only on some versions of Unity)

How to use the Hypercube Caster:

OSX:

1. Go to *System Preferences > Mission Control > Displays have separate spaces* set to **OFF** (this will remove the OSX menu bar from the Volume's display). This will require a logout if it was previously ON.
2. Use *Volume > Caster Window Prefs* to set the **resolution to: 1920x1080, other values should be 0**.
3. **Move your mouse over to Volume's screen** and press ⌘E to toggle the window.
4. If you want to close the caster window, also press ⌘E

Windows:

1. If open, close Unity.
2. Connect Volume's HDMI to your computer.
3. *RMB on the Desktop > Display Settings*
4. Configure Volume so that it's display is to the **left of your main display**. Align the top of it to the top of your main monitor. If that is not possible, align the bottoms.
5. Start Unity.
6. Open *Hypercube > Caster Window Prefs*
7. Set the resolution of your Volume to **1920 x 1080**, and the "**X Position**": to **-1920**.
8. If the Volume display is aligned with the top of your main display set **"Y Position" to 0**, otherwise if the bottoms are aligned set it to (**Main Display Height - 1080**).
9. Press Ctrl + E to toggle the window.

Note: *If the caster window is misconfigured, it is possible for it to block important Unity GUI elements. Close it with Ctrl+E.*

Note: These settings will be saved, and from then on be able to open/close the window with the Toggle menu or hotkey.

Getting touch input:

Volume is equipped with touchscreen input. How can we read these events? Super easy:

1. **Hypercube > Load Volume friendly Unity prefs.**
   Among other things, what this does is add a preprocessor define needed for Volume input called HYPERCUBE_INPUT, and also sets our build to use .Net 2.0, as opposed to .Net 2.0 subset. This is needed because .Net 2.0 subset doesn't include the IO.Ports library which we need to talk to the touch screen via serial port.

2. **We're ready to grab input now :D**
   Open: ***Assets/Hypercube/demo/DEMO_touchInput.scene***
   to see working example code using the hypercube.input class.

USING VOLUME INPUT:
Once the above is done, there are 2 ways to get touch events from a Volume:

1) **hypercube.input.touchPanel.touches**
   Is an array that will contain any touches during that frame. From there you can get positions, movement difference from the last frame, etc.
   NOTE: touchPanel will be null until Hypercube can connect to the hardware.

2) Inherit from **hypercube.touchScreenTarget**, and then override the methods
   public override void onTouchDown(hypercube.touch touch)
   public override void onTouchMoved(hypercube.touch touch)
   public override void onTouchUp(hypercube.touch touch)
   To get events each frame.

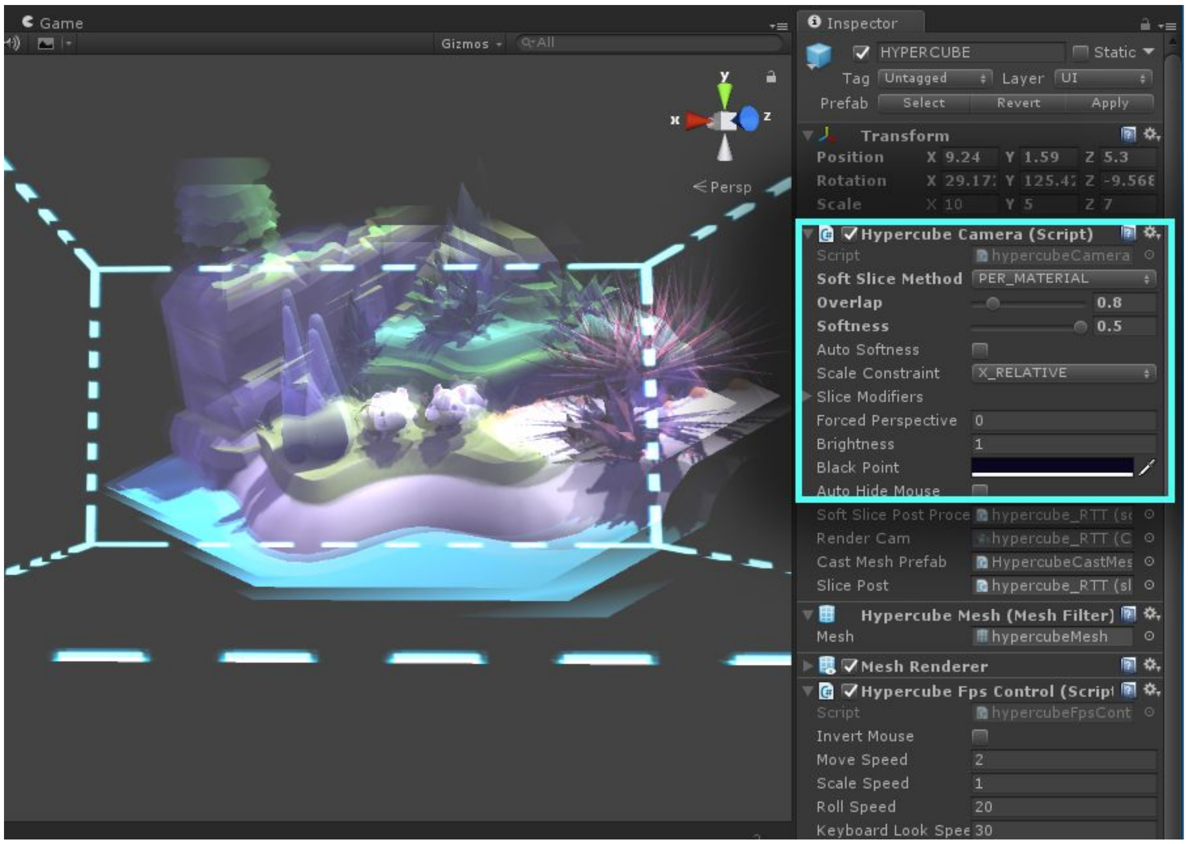
Here are some snippets that use hypercube.input:
If placed inside Update(), these lines of code will cause **Transform t** to be manipulated by touch input:

```
//uses the average of all touches to move t
t.Translate(hypercube.input.touchPanel.averageDiff.x, hypercube.input.frontScreen.averageDiff.y, 0f, Space.World);

t.Rotate(0f, hypercube.input.touchPanel.twist, 0f);  //ROTATE t

t.localScale *= hypercube.input.touchPanel.pinch;  //SCALE t
```

Getting best results:

To get the best output you can into Volume, you may find that you have to rethink some common assumptions about 3D art. For example, geometries can't simply be clipped into each other because those faces would now still be clearly visible in Volume. Another example is eyeballs, which would be visible inside of a character's head if they are modelled as spheres. Further, because Volume uses separate slices to generate the 3D effect, how the slices blend is an important part of generating convincing art in Volume. The slice blending should be tweaked to best meet your project's needs.

Full control of slice blendingis available on the HYPERCUBE asset:



```
HYPERCUBE                          Static
Tag  Untagged        Layer  UI
Prefab   Select   Revert   Apply
Transform
Position   X 9.24    Y 1.59    Z 5.3
Rotation   X 29.17   Y 125.4   Z -9.568
Scale      X 10      Y 5       Z 7
Hypercube Camera (Script)
Script                  hypercubeCamera
Soft Slice Method       PER_MATERIAL
Overlap                 0.8
Softness                0.5
Auto Softness
Scale Constraint        X_RELATIVE
Slice Modifiers
Forced Perspective      0
Brightness              1
Black Point
Auto Hide Mouse
Soft Slice Post Proce   hypercube_RTT (s
Render Cam              hypercube_RTT (C
Cast Mesh Prefab        HypercubeCastMes
Slice Post              hypercube_RTT (sl
Hypercube Mesh (Mesh Filter)
Mesh                    hypercubeMesh
Mesh Renderer
Hypercube Fps Control (Script
Script                  hypercubeFpsCont
Invert Mouse
Move Speed              2
Scale Speed             1
Roll Speed              20
Keyboard Look Spee      30
```

Play with the Hypercube visual settings to optimize slice blending for your project.

***Hypercube: Volume Plugin** includes code by Daniel Wilches: http://www.cs.uwyo.edu/~dwilches/

LEARN TO KICK ASS IN VOLUME:

Soft Slice Method:

Hypercube comes with different rendering methods that you can use to draw a scene inside Hypercube. Each has its own advantages and disadvantages:

Rule of thumb for what to use:
If you want it to look old-school: **HARD**
If you want to show fancy effects: **PER_MATERIAL**
If you can't use Hypercube shaders: **POST_PROCESS**
If you mostly have 1 only large object to display: **OCCLUDING**

What they do:

- **HARD** - No slice blending. Blending will be OFF.
- **PER_MATERIAL** - All objects will draw, but only meshes using Hypercube/ shaders will be soft sliced. Use this method and use the provided Hypercube shaders if you want to have effects show well in Volume.
- **POST_PROCESS** - Uses the depth buffer in a post process to calculate soft slicing. This means shaders that do not ZWrite will be treated as empty space and draw black (effects, or transparent things). However, ANY opaque shader will be soft sliced. Use this if you want soft slicing, but don't want to use Hypercube shaders.
- **OCCLUDING** - Draws the scene one time, and then uses a post process to determine what slices a pixel draws to. The result is that pixels drawn to 'front' slices occlude pixels drawn behind them. Effects and transparent shaders will most likely draw to wrong slices with this method (because they typically use ZWrite OFF). Framing whole models (like a human head or whole opaque object) tend to show well with this method.
  NOTE: OCCLUDING mode does not allow for the use of slice modifiers (covered below).

Scale Constraint:

Which should you use? **Choose the axis that would have the most effect on your application.**

> EXAMPLE 1: I am making a game that shows a character in the screen, it may not matter if I can see more behind him, or to his sides, hence I should choose **Y_RELATIVE** to make sure his head doesn't get cut off. With Y_RELATIVE, my Y will be deemed holy and untouched by Hypercube. X and Z scales will be adjusted to suit the Y I set.
>
> EXAMPLE 2: I am making a game where I am flying into a space. It is very dependent on being able to see into the space and judge distance. I should choose **Z_RELATIVE** because the depth in this game is critical to its play. Hypercube will then adjust X and Y scales to match the display.

Just like monitors, some Volume types are wider, deeper, or taller than others. To make things in Volume display at 1:1 to match your 3D scene Hypercube constrains its aspect ratio to match the physical projection of the connected Volume (not doing so would cause things to appear squashed or stretched in the display). To still allow you to control its size, Hypercube allows you to choose a scale axis to leave free, and it will constrain the other 2 to keep the physical aspect ratio. EXAMPLE: If I have Hypercube *Scale Constraint* set to X_RELATIVE, I can set the X scale of my Hypercube to whatever I want, but the Z and Y scale will be controlled by Hypercube to keep a consistent aspect ratio based on the X I set.
If I set my *Scale Constraint* to NONE, Hypercube will not try to control its aspect ratio and simply allows things to appear squashed or stretched in Volume.

CHEAT SHEET:

Overlap:
Controls how far into sister slices should each slice draw. This helps reduce the ‘banding’ between slices.

Softness:
Controls the blending amount of the content inside slices. Valid values are 0 to .5. A 0 value means no blending (hard slicing), and a .5 value means that geometry will be completely blended from totally transparent when it is near the clipping planes of the slice, to completely opaque only when the geometry is perfectly centered in the slice. EXAMPLE: A value of .2 will make any geometry placed between .2-.8 of the slice be fully opaque while geometry in 0-.2 would be blended and .8 to 1 would also be blended.

Auto Softness:
Mathematically calculates the softness based on the overlap. This gives a correct value to have a true total opacity of 1 across slices, preserving the integrity of the geometry. In practice, however, other values often give better visual results.

Slice Modifiers:
Slice modifiers are a way to add things like GUI or background to slices. They work with a 'depth slider' to choose the slice. Because different Volume types have different slice counts, the 'depth' value you set on a particular slice mod is how the tools will decide which slice to best apply it to.
A slice modifier consists of:

- A depth setting (used to calculate which slice it should be applied to)
- A blend method (OVER, UNDER, ADD, MULTIPLY)
- A texture (it can be a render texture or other)

NOTE: If the depth is required to change in runtime, use the setDepth(d) method on the slice modifier you want to change in order for it to update correctly. Slice modifiers do not interpolate between slices. They round to the most appropriate slice based on the depth value you set. Hence, if you want interpolation, place your GUI in the scene itself and don’t use the slice modifier feature.
NOTE: If you want to match the slice modifier texture resolution to the slice’s output resolution, use hypercube.castMesh.rttResX/Y to get it, note that it may change up to several seconds after initial startup.

Forced Perspective:
If the Hypercube’s camera (hypercube_rtt) is set to perspective mode instead of orthographic, this modifies each successive slice’s field of vision. Use it to make forced perspective effects in Hypercube.

Brightness:
This is a brightness modifier on the final output of the castMesh.

Black Point:
This color is added to the output color of all geometry in Hypercube. Because Volume is an additive display, there is no difference between “void” in Volume, and “black”. Hence, this feature can be used to differentiate between a black surface and a space with nothing in it.

Auto Hide Mouse:
Hides the mouse for you in the player.