

# STATE OF WEBVR , A-FRAME AND OUR FORAY INTO WEB MIXED REALITY

**Rabimba Karanjai**

Mozilla Mixed Reality Team | Mozilla Tech Speaker, Mozilla  
Graduate Student, Rice University  
@rabimba / rabimba@mozilla.com

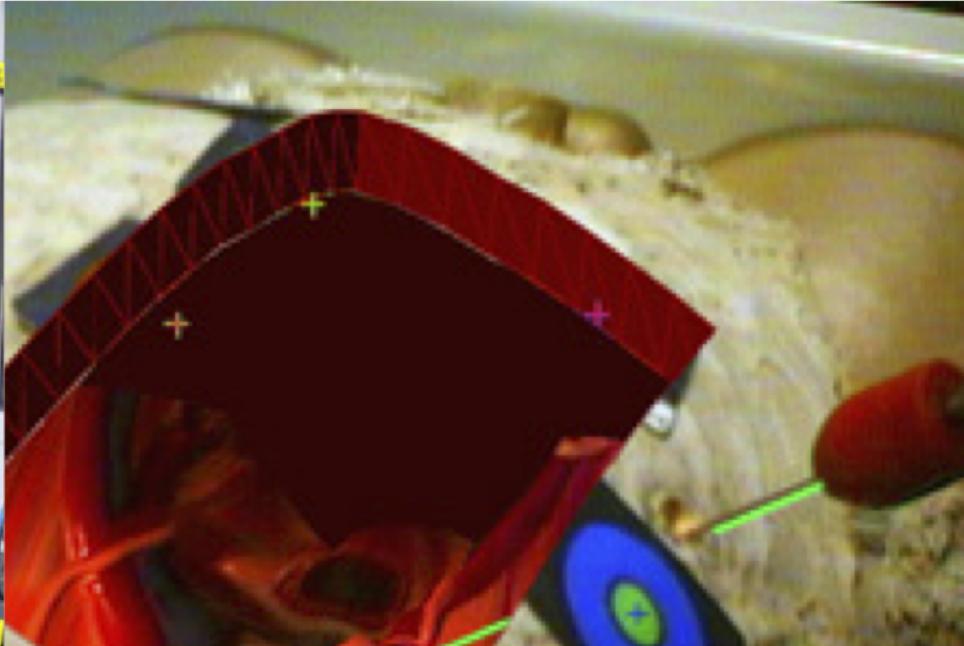


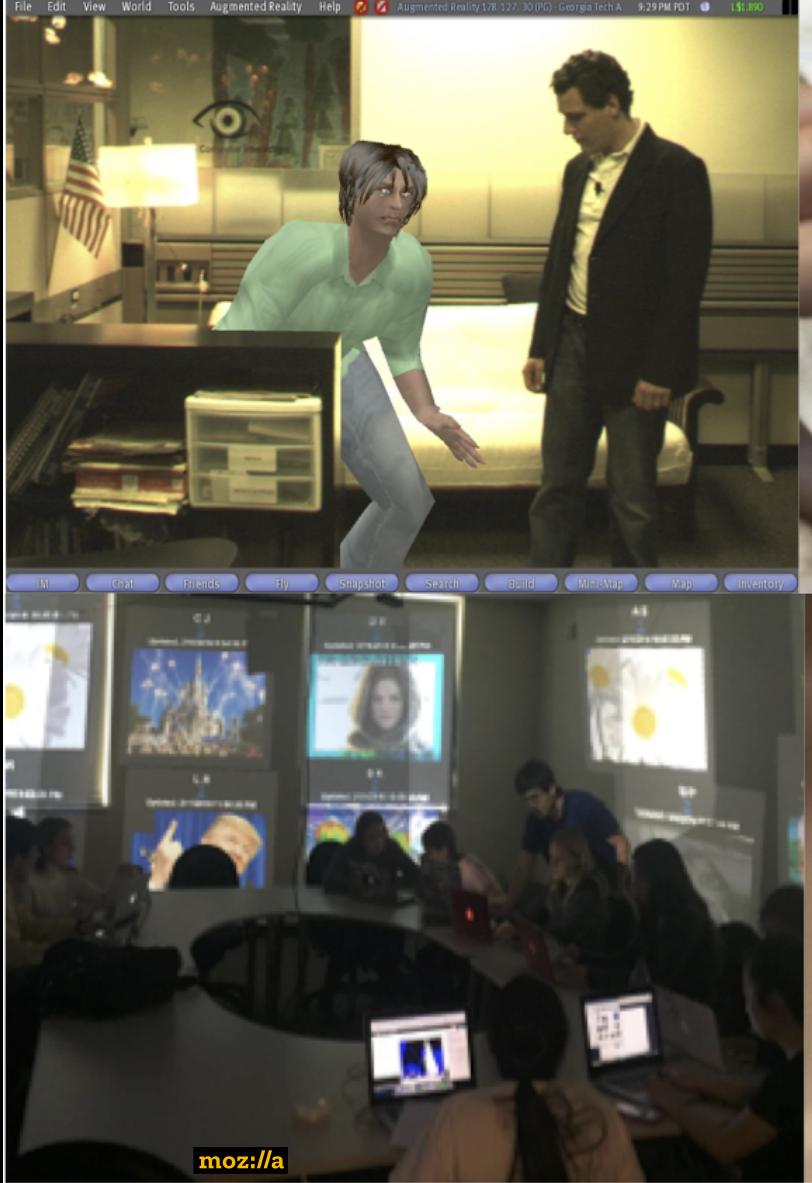
**AR? VR? MR?**

*Mixing media with a  
person's perception of the world  
registered in 3D, in real-time*

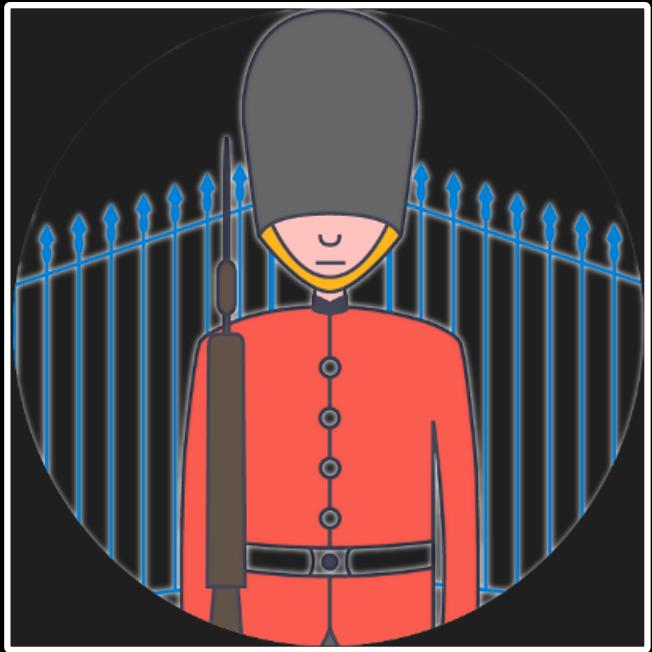
Ivan Sutherland, "The Ultimate Display", mid-1960's

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# FRICTION OF VR ECOSYSTEMS



*Gatekeepers*



*Installs*



*Closed*

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# WHAT ARE THE PROBLEMS WE NEED TO SOLVE?

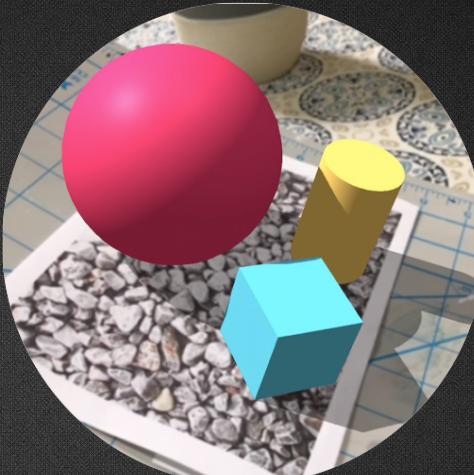
- Browser level technology
- Platform independent AR/VR/MR frameworks
- Lightweight authoring
- Content creation
- Services for world knowledge, persistence
- Social service
- Search and Discovery



*Tech:*  
*WebVR*



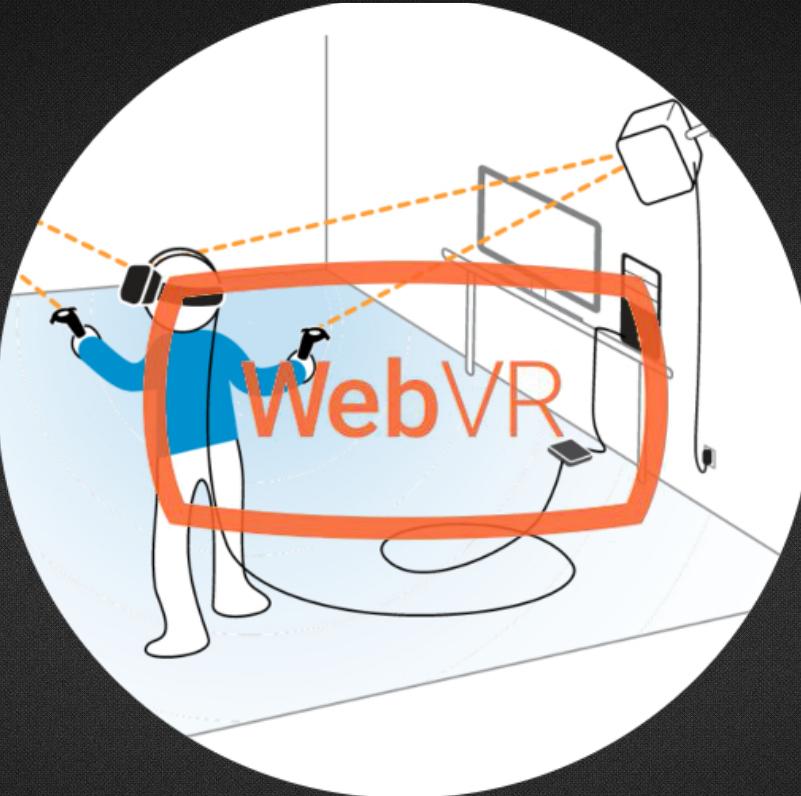
*Frameworks:*  
*AFrame*



*Tech:*  
*WebAR*



*Example*



*Tech:  
WebVR*

# PEOPLE TRIED TO DO WEB+VR BEFORE WEBVR

<https://github.com/mrdoob/three.js/commit/7e19183619439d03ff441b239157f1720eb9a7>  
in 2013

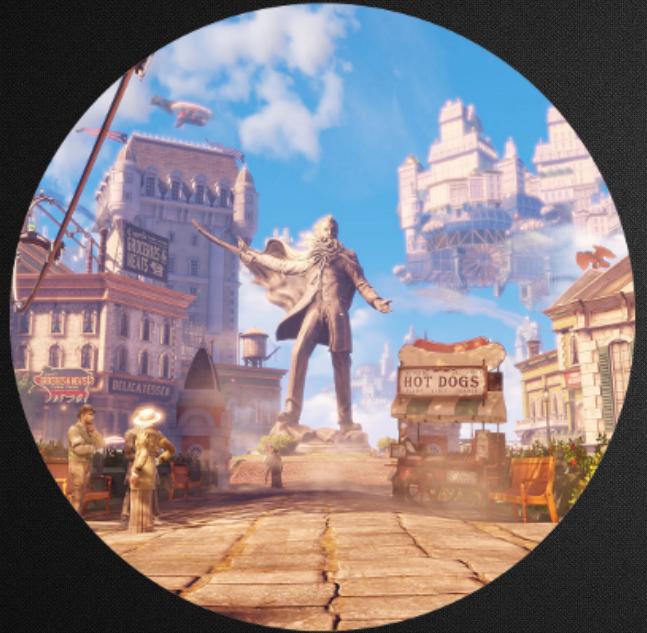
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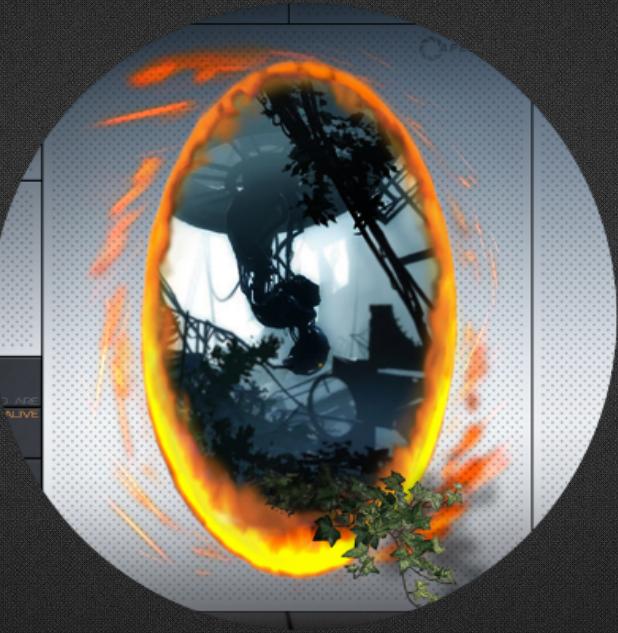
moz://a

# WEBVR

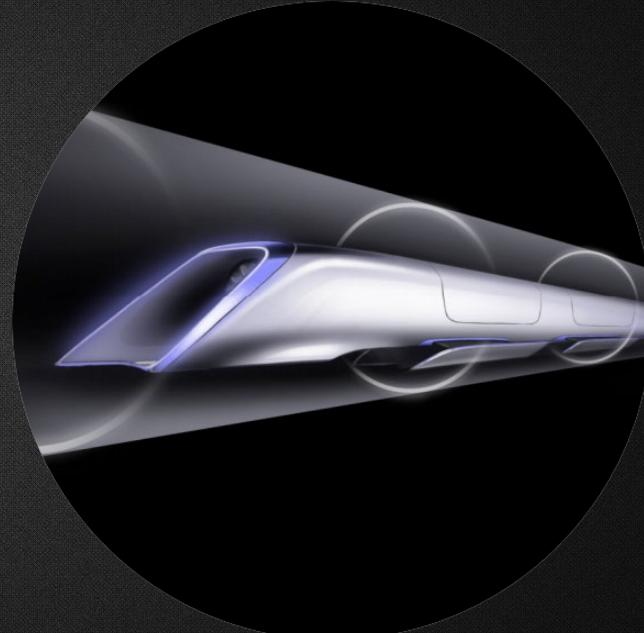
An open virtual reality platform with the advantages of **the Web**



*Open*



*Connected*



*Instant*



Browser APIs that enable WebGL rendering to headsets and access to VR sensors

<https://w3c.github.io/webvr/>

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<https://webvr.rocks>



*Firefox*



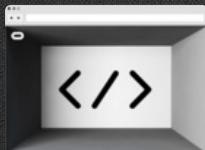
*Microsoft Edge*



*Chromium*



*Chrome for Android*



*Oculus Carmel*



*Samsung Internet*

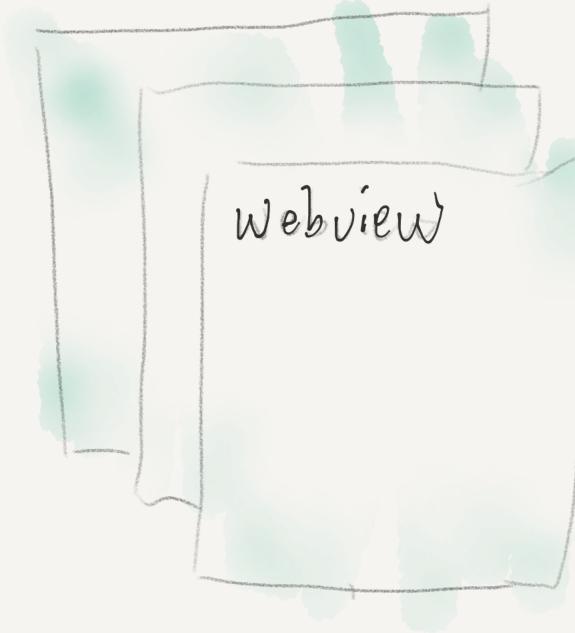


*Mobile Polyfill*

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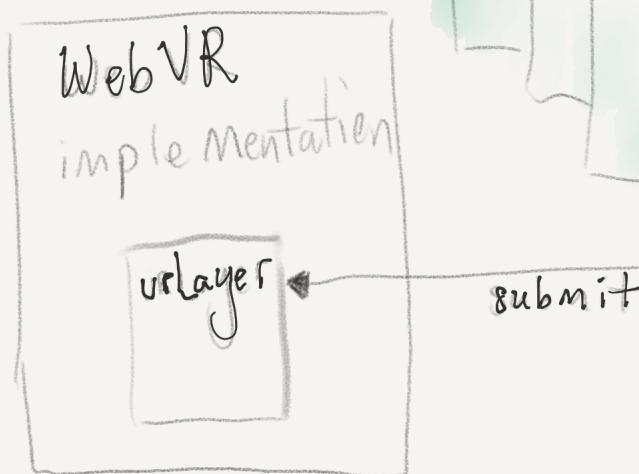
Browser

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# Browser for VR

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# PROBLEM: WEBGL (AND LIBRARIES LIKE THREE.JS) STILL LOW LEVEL

```
42 <bod IMPORT WEBVR POLYFILL      I SET UP CAMERA      SET UP LIGHTS
43 
44 
45 <div id="links">
46   <a target="_blank" href="https://twitter.com/share?text=I%20and%20LeapVR%20by%20@Cabbibo%20&url=http://cabbibo.com">TWITTER</a>
47   <a href="http://webvr.info/">WEBVR</a>
48   <a href="http://cabbibo.com">CABBIBO</a>
49   <a href="http://williamsleap.com">WILLIAMS LEAP</a>
50 </div>
51 
52 <div>
53   <INSTANTIATE RENDERER>
54   <script src = "lib/underscore.js"></script>
55   <script src = "lib/jquery.min.js"></script>
56   <script src = "lib/TrackballControls.js"></script>
57   <FIGURE OUT RESPONSIVENESS>
58   <script src = "lib/SubdivisionModifier.js"></script>
59   <script src = "lib/PhysicsRenderer.js"></script>
60 
61   <script moz://a src = "lib/VREffect.js"></script>
62   <script moz://a src = "lib/VRControls.js"></script>
63 
64   <INITIALIZE SCENE>
65   <script>
66     <DECLARE AND PASS CANVAS>
67     <LISTEN TO WINDOW RESIZE MOTION>
68   </script>
69 
70   <CREATE RENDER LOOP>
71   <script>
72     <PRELOAD ASSETS>
73     <DEAL WITH METATAGS AND MOBILE>
74   </script>
75 
76   <INSTALL VREFFECT>
77   <script>
```



*Frameworks:*  
*AFrame*

# HELLO WORLD

```
<html>
  <script src="https://aframe.io/releases/0.5.0/aframe.min.js"></script>
  <a-scene>

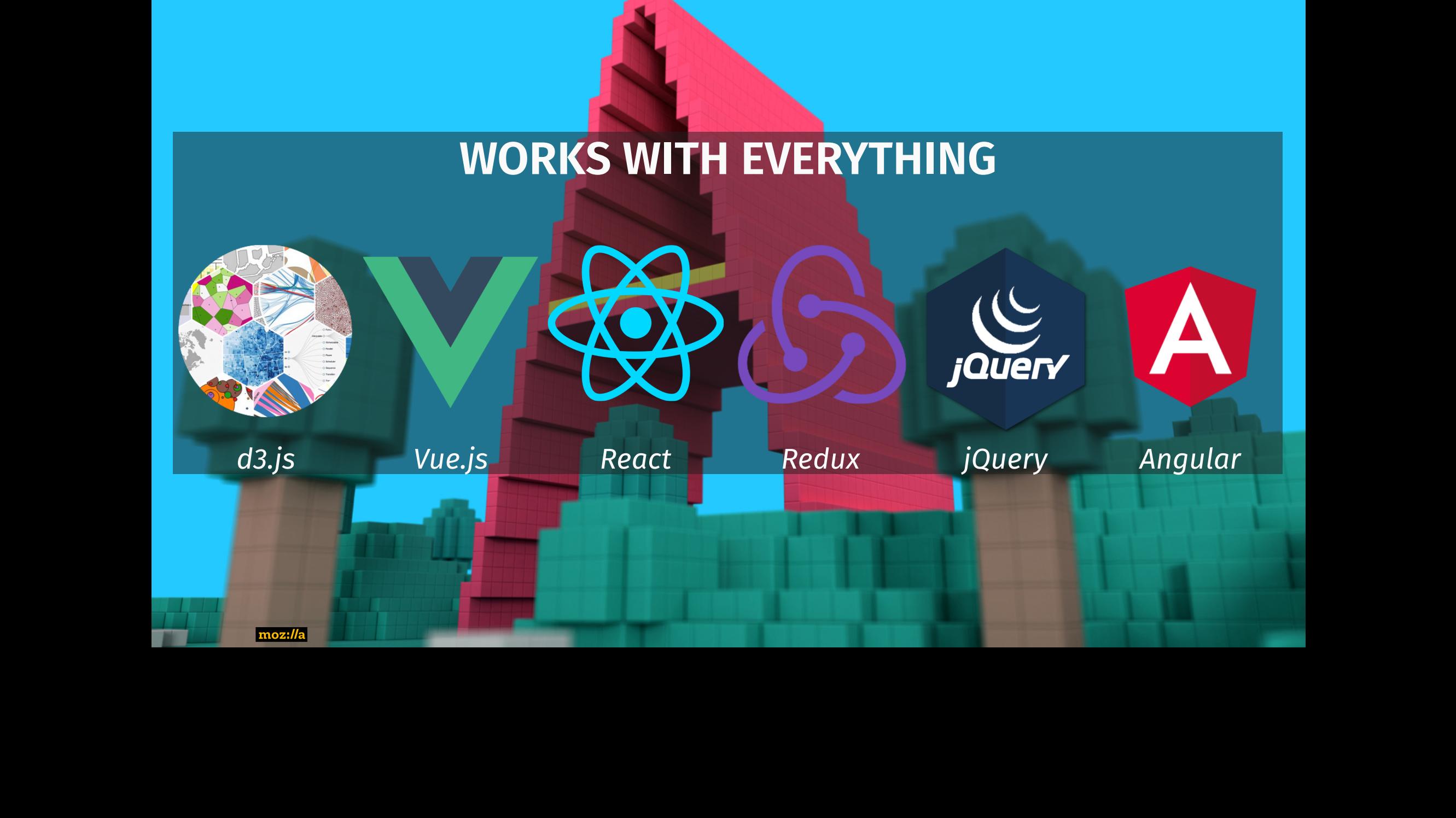
    </a-scene>
</html>
```

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# HELLO WORLD

```
<html>
  <script src="https://aframe.io/releases/0.5.0/aframe.min.js"></script>
  <a-scene>
    <a-box color="#4CC3D9" position="-1 0.5 -3" rotation="0 45 0"></a-box>
    <a-cylinder color="#FFC65D" position="1 0.75 -3" radius="0.5" height="1.5"></a-cylinder>
    <a-sphere color="#EF2D5E" position="0 1.25 -5" radius="1.25"></a-sphere>
    <a-plane color="#7BC8A4" position="0 0 -4" rotation="-90 0 0" width="4" height="4"></a-plane>
    <a-sky color="#ECECEC"></a-sky>
  </a-scene>
</html>
```

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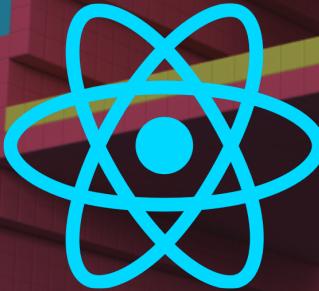
# WORKS WITH EVERYTHING



*d3.js*



*Vue.js*



*React*



*Redux*



*jQuery*



*Angular*

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# ENTITY-COMPONENT-SYSTEM

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# COMPOSING AN ENTITY



# COMPOSING AN ENTITY

```
<a-entity  
    geometry="primitive: sphere; radius: 1.5"  
    material="color: #343434; roughness: 0.4; sphericalEnvMap: #texture">
```

# COMPOSING AN ENTITY

```
<a-entity  
    geometry="primitive: sphere; radius: 1.5"  
    material="color: #343434; roughness: 0.4; sphericalEnvMap: #texture"  
    position="-1 2 4" rotation="45 0 90" scale="2 2 2">
```

# COMPOSING AN ENTITY

```
<a-entity  
    geometry="primitive: sphere; radius: 1.5"  
    material="color: #343434; roughness: 0.4; sphericalEnvMap: #texture"  
    position="-1 2 4" rotation="45 0 90" scale="2 2 2"  
    animation="property: rotation; loop: true; to: 0 360 0"  
    movement-pattern="type: spline; speed: 4">
```

# COMPOSING AN ENTITY

```
<a-entity  
  json-model="src: #robot"  
  position="-1 2 4" rotation="45 0 90" scale="2 2 2"  
  animation="property: rotation; loop: true; to: 0 360 0"  
  movement-pattern="type: spline; speed: 4">
```

# COMPOSING AN ENTITY

```
<a-entity  
  json-model="src: #robot"  
  position="-1 2 4" rotation="45 0 90" scale="2 2 2"  
  animation="property: rotation; loop: true; to: 0 360 0"  
  movement-pattern="type: attack; target: #player"  
  explode="on: hit">
```

position rotation hand-controls  
controls scale light material  
cursor fog geometry sound  
raycaster obj-model collada-model

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explore terrain particle-system hud selectable altspace  
no-click-look-controls look-at gif-shader draw noise  
orbit-controls crease firebase mouse-cursor html-shader  
meshline grab cubemap shadow  
template physics layout audio-visualization  
leap-motion-controls position rotation hand-controls randomizer  
collider gltf controls scale light material along-path  
video-controls cursor fog geometry sound gamepad-controls  
bmfont-text raycaster obj-model collada-model fbx follow  
lathe-geometry proxy-controls extrude-geometry  
stereo fence href glTF entity-generator ocean  
fit-texture interpolation mesh-line grid-helper draggable  
universal-controls mouse-cursor ply-model

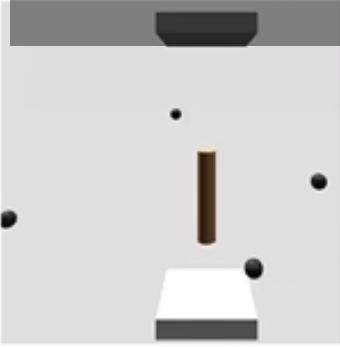
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[⬇ aframe-alongpath-component.min.js](#)

 on GitHub

# REGISTRY

aframe-animation-component Curated collection of A-Frame components.



Kevin Ngo

June 1st 2016 © MIT  193

Animations in A-Frame using anime.js

[⬇ aframe-animation-component.min.js](#)

 on GitHub



aframe-auto-detect-controllers-component

Michael Chen

December 27th 2016 © MIT  5

Auto-Detect Controllers component for A-Frame.

[⬇ aframe-auto-detect-controllers-component.min.js](#)

 on GitHub

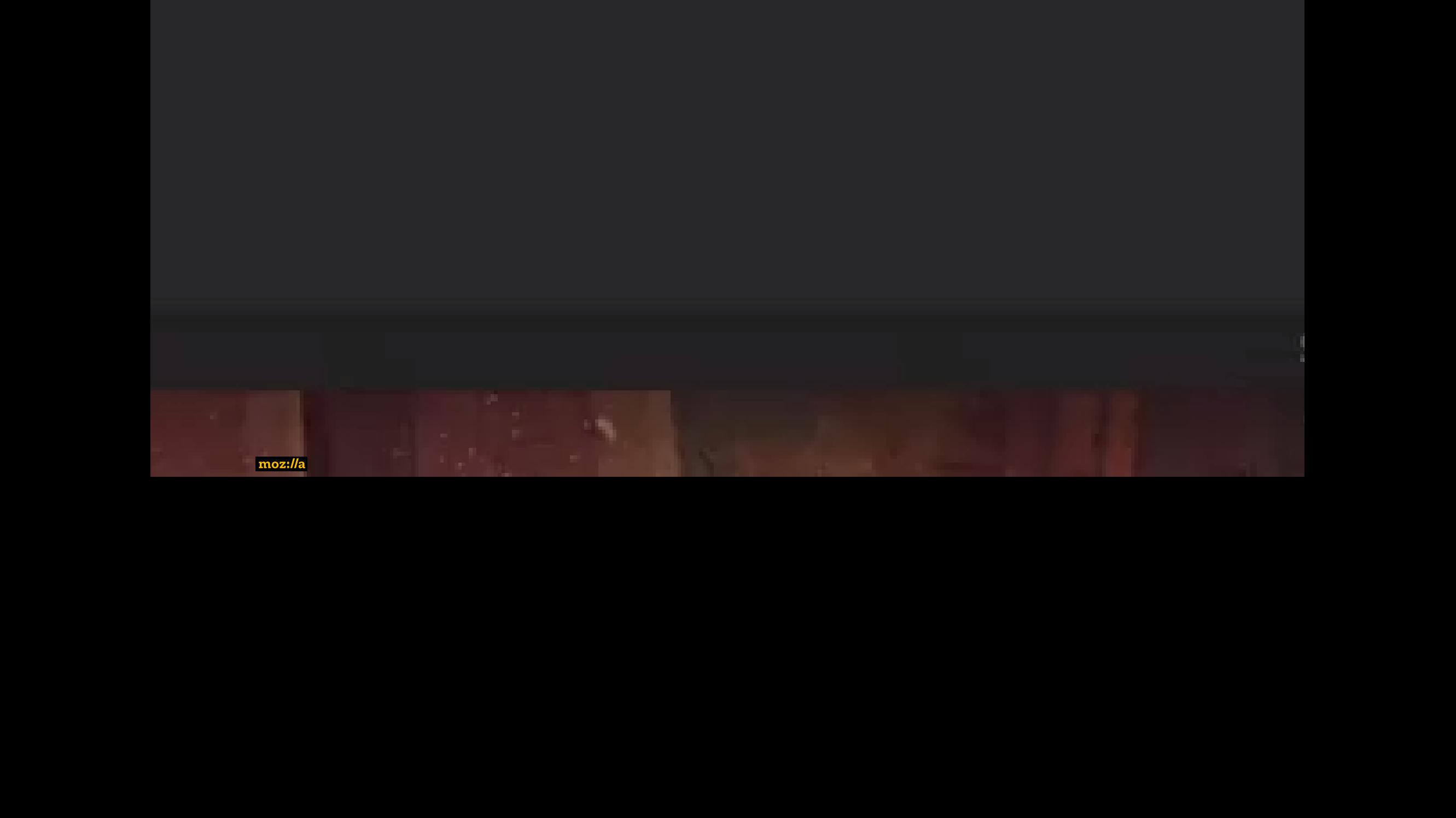
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# REGISTRY

untitled

```
x

entity camera="near: 0.01" look-controls>
entity ></a-entity>
entity ></a-entity>
entity>
```



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Search...

- <a-scene>
- <a-entity >
- <a-entity>
- <a-entity >
- <a-sky >
- <a-entity >

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normalScale	1.00	1.00
normalTextureOffset	0.00	0.00
normalTextureRepeat	1.00	1.00
roughness	0.05	
sphericalEnvMap	https://	
src	#grid	
width	512.00	
wireframe	<input type="checkbox"/>	
wireframeLinewidth	2.00	
▼ TEXT-GEOMETRY		
bevelEnabled	<input checked="" type="checkbox"/>	
bevelSize	0.10	
bevelThickness	0.10	
curveSegments	1.00	
font	fonts/exo2Black.typeface	
height	0.50	
size	1.50	
style	normal	
weight	normal	



# COMMUNITY

<https://aframe.io/blog/>

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# ART - A-PAINTER

@mozillavr

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# JOURNALISM – FEAR OF THE SKY

Amnesty International UK



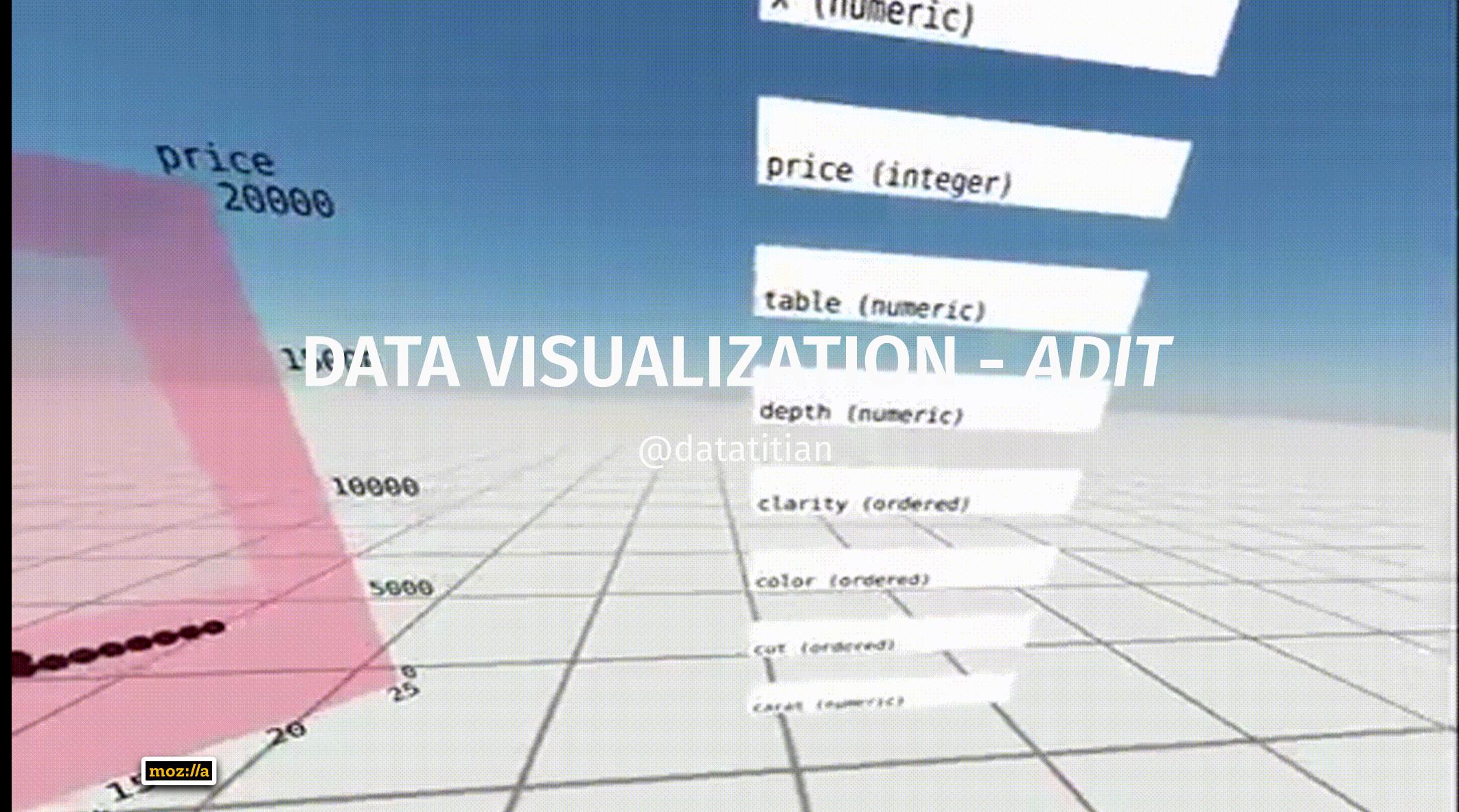
moz:l/a



# JOURNALISM - JOURNEY TO MARS

The Washington Post

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# GAMING - A-BLAST

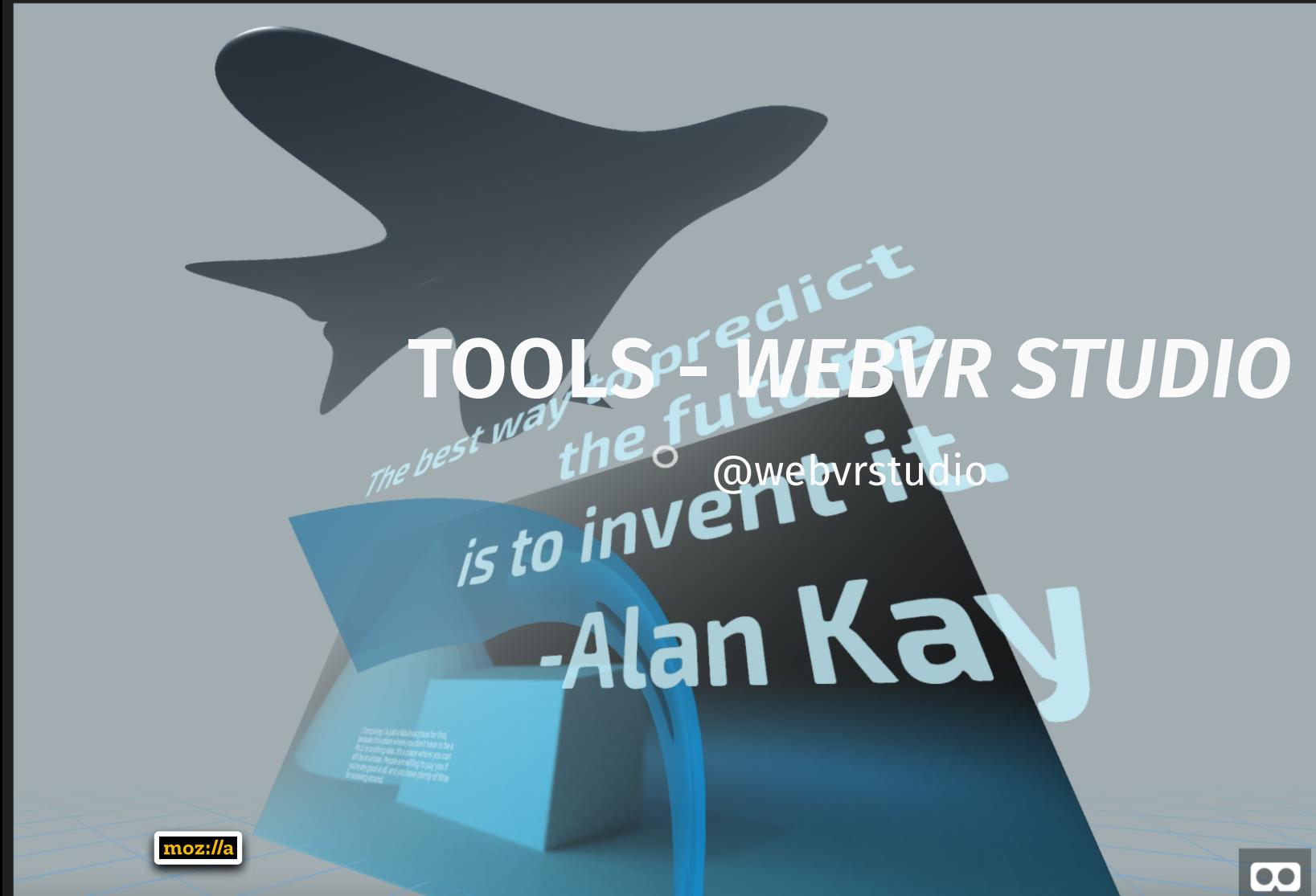
@mozillavr

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# MATHEMATICS - MATHWORLDR

@sleighdogs

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ITEMS

Add

	ITEMS	X
①	BG	X
①	Headline	
①	Blurb	
①	curved_image 11	
①	curved_image 12	
①	text 13	
①	curved_image 14	
①	text 15	
①	obj_model 16	

Properties Interaction

Position  X  Y  Z

Rotation  X  Y  Z

Scale  X  Y  Z

Image  ...

Color

Opacity



aging  
AGING CORP  
36 2993 1333

Affinity , Australia

(684173)

2876 43 17

# REAL ESTATE - LIVE TOUR

iStaging

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Living room



Bedroom



Dining room



Kitchen



Bedroom



Remove the wall of the heart

Pin the pulmonary valve

Done

Once in resize mode, make the heart  
as big as you can, then let go with  
both hands.

# EDUCATION - CADAVR

@drryanjames

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# AFRAME.IO

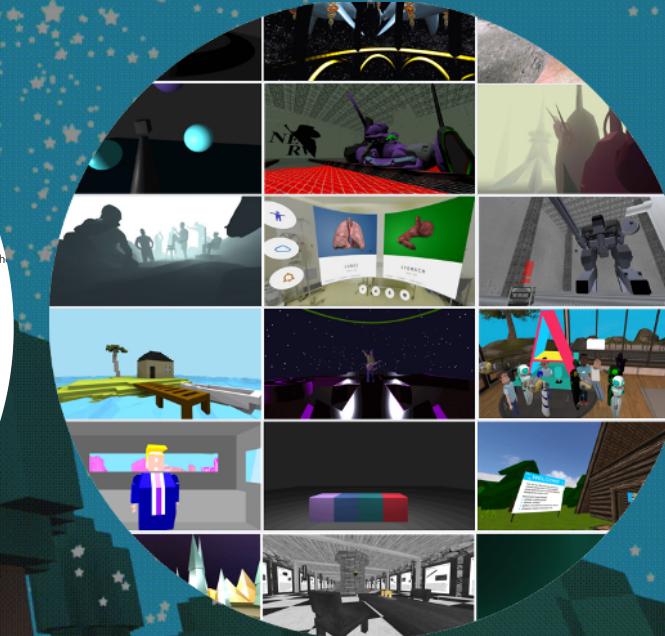
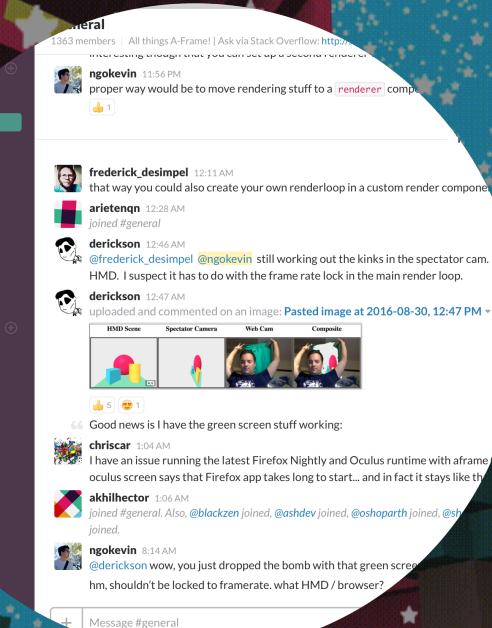
aframe-5000.glitch.me / glitch.com/~aframe-5000

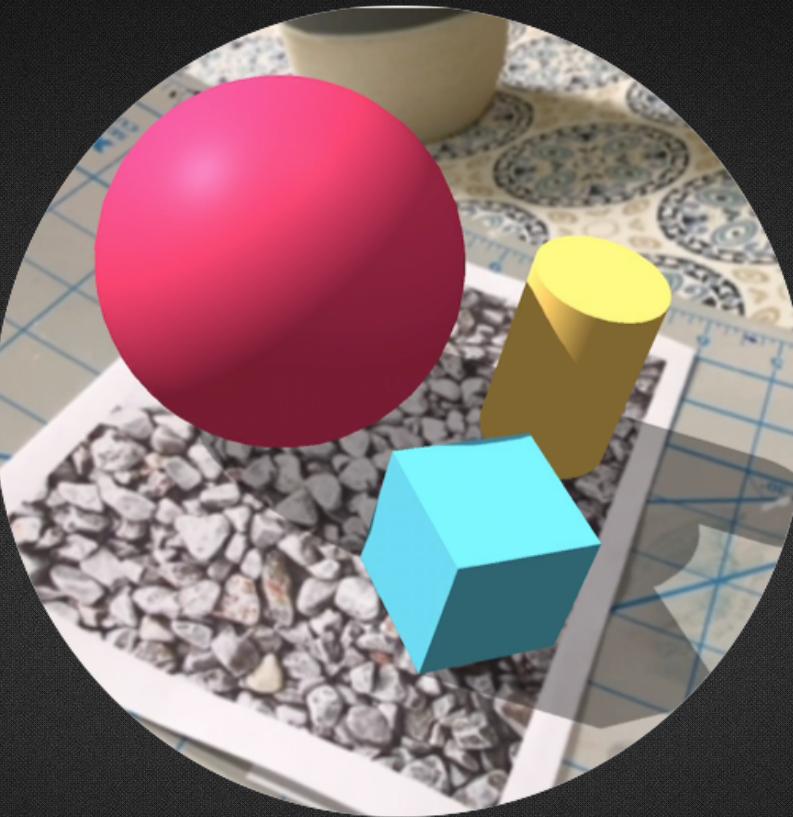
135 contributors  
5000 Stargazers

3200 members on Slack

100s of featured projects

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*Tech:  
WebAR*

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# Augmented Reality - Native Acceleration



Tracking and Positioning



Download 3D  
augmentation object  
and scene data

## WEBAR DOESN'T EXIST YET

But how close are we?  
Sensor fusion  
understanding  
(Neural Networks)

GPU Low Latency  
3D Accelerations for  
display by optical system



AR Application

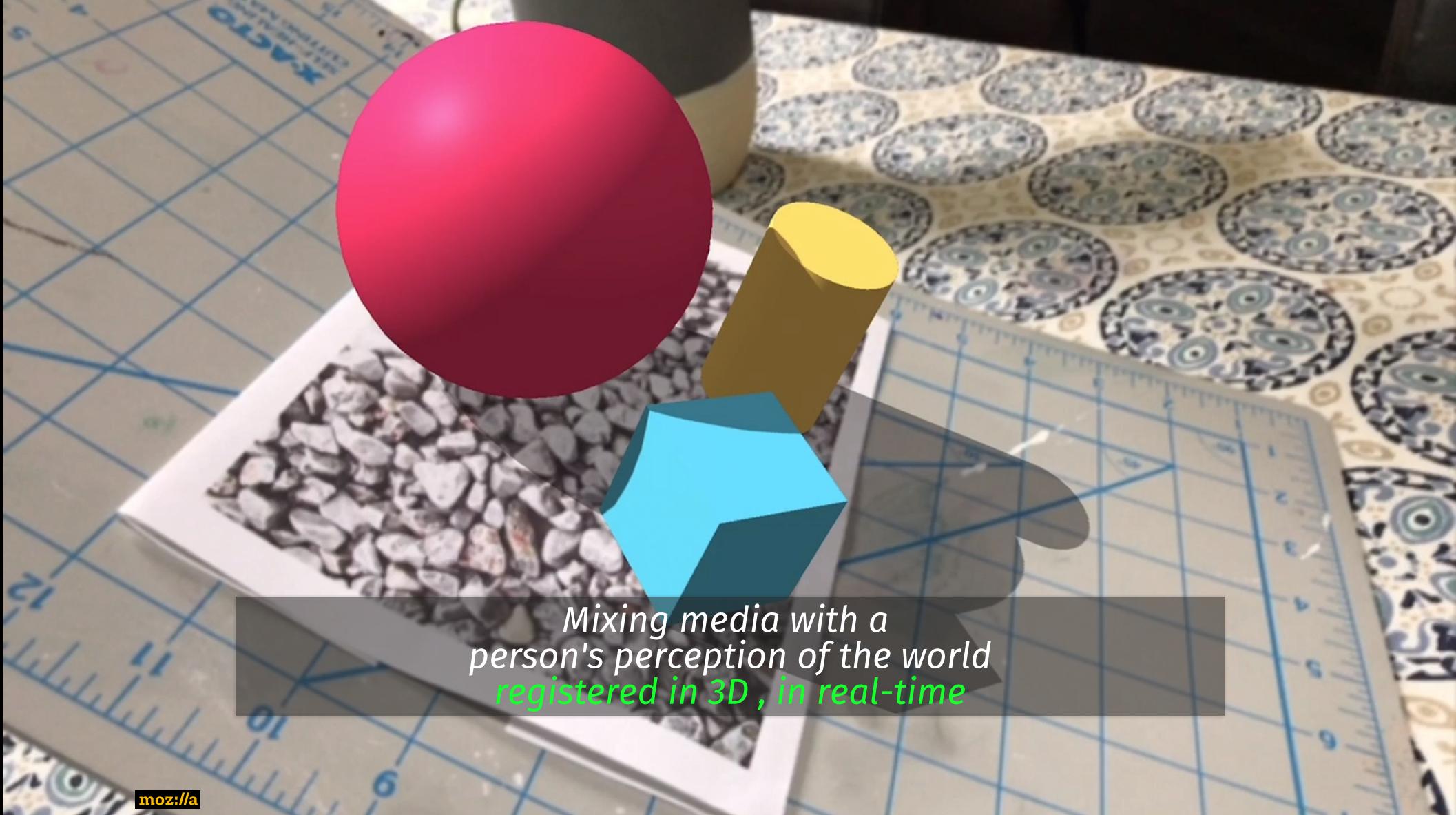
Interact with sensor, haptic  
and display devices



KHRONOS™  
GROUP

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Tap anywhere to start

## THE CHALLENGE OF AR

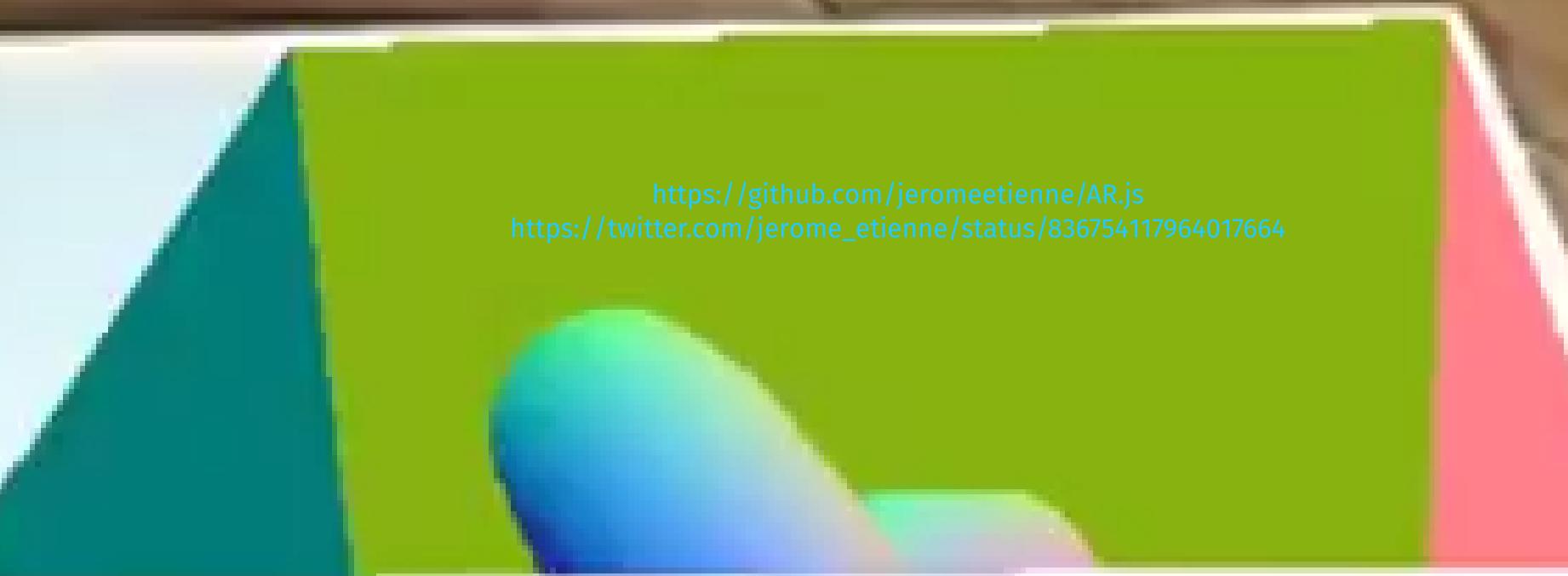
*Must display in **real time** (akin to VR)*

*Can only **display** based on what we  
already **know** or can **sense** about the world  
**relative to** the display*



# SIMPLE AR HAS BEEN POSSIBLE FOR A WHILE

"hole in the wall" effect - Invention by [@Saqoci](#)  
extended by [Frederik Blomqvist](#) and [Jerome etienne](#)  
WebRTC `getUserMedia` + JS tracking



<https://github.com/jeromeetienne/AR.js>

[https://twitter.com/jerome\\_etienne/status/836754117964017664](https://twitter.com/jerome_etienne/status/836754117964017664)



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IN THE LONG RUN, THIS SIMPLE APPROACH  
WILL NOT BE ENOUGH

*VERY LITTLE WORLD KNOWLEDGE,  
TIGHTLY COUPLED TO SPECIFIC TECHNOLOGY,  
DOESN'T LEVERAGE PLATFORM CAPABILITIES*

Julian Oliver "Levelhead" 2008

A dark, low-angle shot of a wooden floor and a doorway. The floor is made of light-colored wood planks. A dark doorway is visible in the background, leading to a room with a white wall. The overall atmosphere is dim and moody.

You are walking west..

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Total Verts/Triangles: 0/0 Volumes: 0 UpdateQueue: 0  
Remeshing Time: 0.000473 Remeshing Count: 0  
Backlog Size: 0

# PLATFORM-SPECIFIC PRESENTATION IS DIVERSE

*SLAM capabilities in Google Tango, Microsoft Hololens,  
Facebook Camera, Wikitude, Kudan, etc.*

Use Mesh

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# KOBI SHIBA PLATFORM-SPECIFIC SENSING IS DIVERSE

*Visual-Intertial Odometry plus plane detection  
(ARKit, ARCore)*

<https://www.youtube.com/watch?v=Rq2NChZ3c4E>

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# DISPLAY TECH ALSO DIVERSE: SEE THROUGH VS VIDEO-MIXED V



# MIMIC / EXTEND WEBVR?

Browser  
for VR

Native  
Sensors  
Hololens or  
Tango  
RGB video  
RGBD cams

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WebVR  
implementation

vrlayer

submit

Webview

# PROBLEM:

**AR IS MORE THAN "VR + VIDEO + SPATIAL TRACKING"**

*and more importantly*

**MR >= AR + VR**

# DECOPPLE APPS FROM "REALITY"

A "webby" approach to MR must

- Support platform independent AR/VR web apps
- Leverage platform capabilities efficiently
- Enable user privacy

<http://blairmacintyre.me/2017/05/20/its-not-webar-yet/>

(Gheric Speigner's PhD work on argon.js and Argon4)

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# WEBXR: EXPANDING WEBVR TO SUPPORT MR

Web Platform: WebVR, Browsers (Custom, Servo, FF, ...), WebAssembly

Native AR Platforms: ARKit, ARCore, Vision SDKs, ...

MR Requirements: Augmented and Virtual Realities, Anchors,  
Geospatial References, Custom Computer Vision.

<https://github.com/mozilla/webxr-api>

<https://github.com/mozilla/webxr-polyfill>

*(and more soon)*

# WEBXR: EXPANDING WEBVR TO SUPPORT MR

Web Platform: WebVR, [Browsers \(Custom, Servo, FF, ...\)](#), WebAssembly

Native AR Platforms: ARKit, ARCore, Vision SDKs, ...

MR Requirements: Augmented and Virtual Realities, Anchors,  
[Geospatial References](#), [Custom Computer Vision](#).

[Services for Persistence, Search, Social Sharing, Cloud CV/ML,...](#)

<https://github.com/mozilla/webxr-api>

<https://github.com/mozilla/webxr-polyfill>

*(and more soon)*

# WEBXR.JS AND THREE.JS ARE JUST LIBRARIES

Used webxr.js and three.js to add AR to this reveal.js presentation

Add argon and aframe scripts up top

```
<script src="resources/js/webxr.js"> </script>
<script src="resources/js/three.js"> </script>
<script src="resources/js/reveal.js"> </script>
```

Add a some code to create a three.js scene down below

```
let box = new THREE.Mesh(
  new THREE.BoxBufferGeometry(0.1, 0.1, 0.1),
  new THREE.MeshPhongMaterial({ color: '#DDFFDD' })
)
```

Adjust the CSS a bit, add some more Javascript and we're off...

# WEB ECOSYSTEM IS RICH AND DIVERSE

Many tools, from the simple to the elaborate

Mashups may suggest new ways of creating 3D!



argon-example Show Live GLITCH.COM

Share Logs + New File

assets .env package.json public/client.js public/style.css README.md server.js views/index.html

```
49 <a-box position="-1 0.5 1" cursor-listener rotation="0 45 0" width="1" height="1" depth="1" color="#4CC3D9" ></a-b
50 <a-entity billboard position="0 3 0">
51   <a-entity rotation="0 45 0">
52     <a-entity css-object="div: #mydiv" scale="0.01 0.01 0.01" rotation="0 0 0" position="0 0 0.5"></a-entity>
53     <a-entity css-object="div: #mydiv2" scale="0.01 0.01 0.01" rotation="0 -90 0" position="-0.5 0 0"></a-ent
54   </a-entity>
55 </a-entity>
56 <a-cylinder position="1 0.75 1" cursor-listener radius="0.5" height="1.5" color="#FFC65D"></a-cylinder>
57 <a-plane rotation="-90 0 0" cursor-listener width="4" height="4" color="#7BC8A4"></a-plane>
58 </a-entity>
59 <ar-camera>
60   <a-entity id="myCursor" cursor="fuse:true; fuse-timeout: 1000"
61     position="0 0 -0.1"
62     geometry="primitive:ring; radiusInner: 0.001; radiusOuter: 0.0015"
63     material="color: #2E3A87; opacity:0.3;">
64   </a-entity>
65 </ar-camera>
66 </ar-scene>
67 <script>
68
69   var arScene = document.querySelector('ar-scene');
70   var content = document.querySelector('#helloworld');
71
72   // the ar-camera has an argon reference frame attached, so when it gets its first value,
73   // we'll get this event
74   arScene.addEventListener("referenceframe-statuschanged", function () {
75     var camera = document.querySelector('ar-camera');
76     var vec = camera.object3D.getWorldDirection();
77     vec.multiplyScalar(-10);
78     vec.y -= 1;
79     content.setAttribute("position", {x: vec.x, y: vec.y, z: vec.z});
80   })
81 </script> https://argon-example.glitch.me
82 </body>
83 </html>
```

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New!

# TWINE

StoryInit

```
/* we want to use  
vuforia for this story  
*/ <<initVuforia  
"http://argonjs.io/argon/  
afram...
```

Start

```
<center><h2>GVU  
Research  
Brochure</h2>  
<h3>AR Companion  
App</h3></c...
```

Page\_01

```
<<set $onPages =  
["Page_01-  
cover"]>>Inside,  
you'll find  
information abou...
```

Page\_02

```
<<set $onPages =  
["Page_02-  
1","Page_02-2"]>>Dr.  
Keith Edwards, GVU  
...
```

Page\_03

```
<<set $onPages =  
["Page_03-  
1","Page_03-2"]>>A  
Diverse Funding and  
R...
```

Page\_04

```
<<set $onPages =  
["Page_04-  
1","Page_04-  
2"]>>Community and  
Civic Par...
```

Page\_05

```
<<set $onPages =  
["Page_05-  
1","Page_05-  
2"]>>Interactive  
Games and A...
```

Page\_06

```
<<set $onPages =  
["Page_06-  
1","Page_06-  
2"]>>Computer  
Graphics and M...
```

Page\_07

```
<<set $onPages =  
["Page_07-  
1","Page_07-  
2"]>>Health and  
Wellness
```

Page\_09

```
<<set $onPages =  
["Page_09-  
1","Page_09-  
2"]>>Creativity and  
Learning
```

Page\_10

```
<<set $onPages =  
["Page_10-  
1","Page_10-  
2"]>>Social  
Computing
```

Page\_11

```
<<set $onPages =  
["Page_11-  
1","Page_11-  
2"]>>Visualizing Large  
Data ...
```

Page\_12

```
<<set $onPages =  
["Page_12-  
1","Page_12-  
2"]>>Interacting with  
Wearab...
```

Page\_13

```
<<set $onPages =  
["Page_13-  
1","Page_13-  
2"]>>Faculty
```

Page\_14

```
<<<set $onPages =  
["Page_14-  
back"]>>Created with  
Argon, AFrame,  
Oldfashioned a...
```

twinery.org

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[HOME](#)[GUIDE](#)[LOGIN](#)

*Describe your VR experience and  
the editor will do the rest.*

```
1 Show me the cool chart exported as
https://s3.amazonaws.com/gurivr/my-data.json from
https://quartz.github.io/Chartbuilder/ on a beige
background
```

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*gurivr.org*



WEB IS THE IDEAL PLAFORM FOR MAKING AR/VR OPEN  
AND ACCESSIBLE TO ALL...

*... IF WE DEVELOP THE TOOLS AND  
TECH TO LET EVERYONE USE IT!*

moz://a

# THANKS!

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To try some of this yourself

- WebXR spec at <http://github.com/mozilla/webxr-api>
- webxr.js + samples at <http://github.com/mozilla/webxr-polyfill>

This talk available at <https://rabimba.github.io/ITCExo2017>

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