MIXING REAL AND VIRTUAL IN WEBAR - AUGMENTED AND MIXED REALITY FOR EVERYONE

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Graduate Student, Rice University
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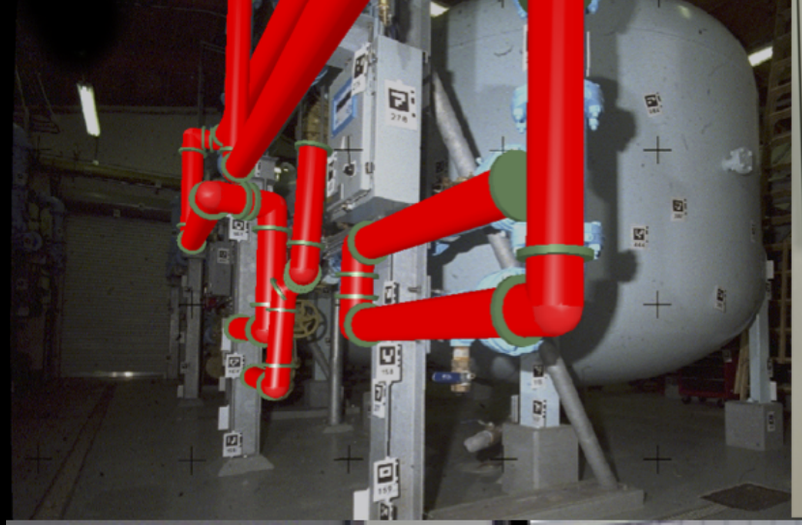
moz://a

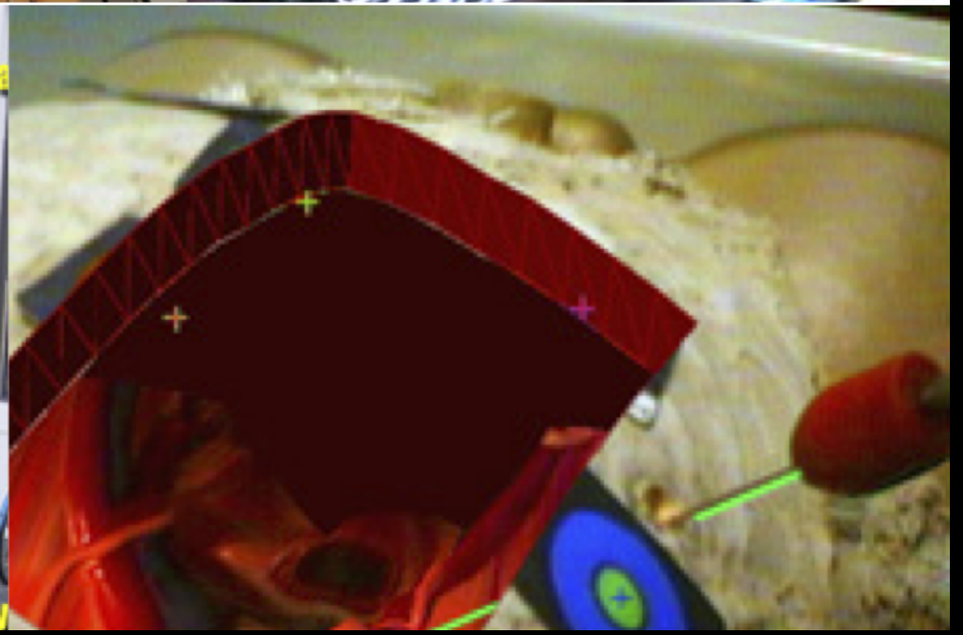

AR? VR? MR?
Mixing media with a
person's perception of the world
registered in 3D, in real-time
Ivan Sutherland, "The Ultimate Display", mid-1960's
moz://a




DIPSTICK

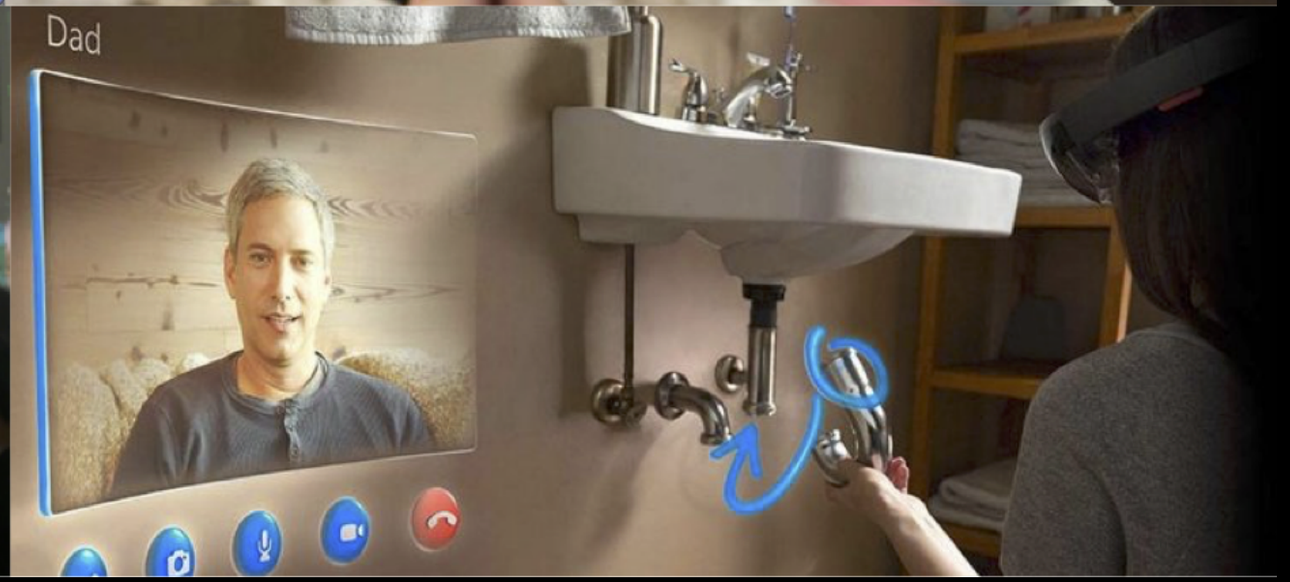

Wireless Input Device
Camera
See-Through Display
Audio Headset
moz://a


Orientation Tracker
GPS Antenna
Wireless Network Antenna
Battery

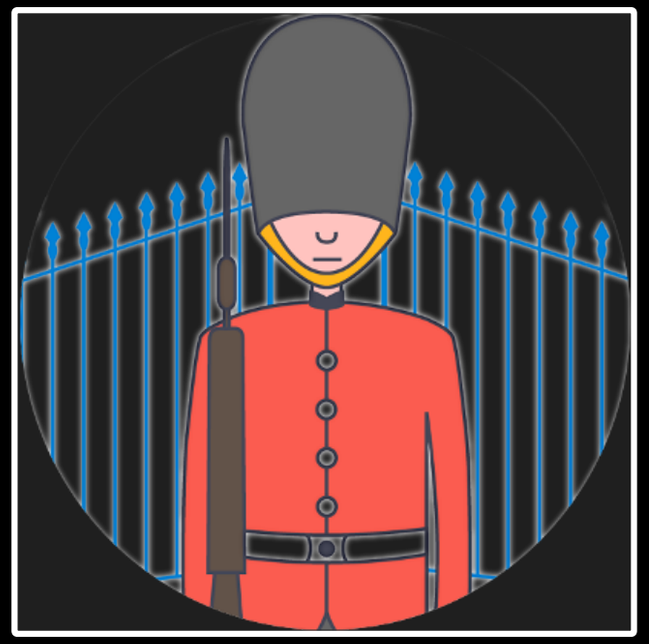



File Edit View World Tools Augmented Reality Help
IM Chat Friends Fly Snapshot Search Build Mini-Map Map Inventory


moz://a


Dad

FRICTION OF VR ECOSYSTEMS



Gatekeepers

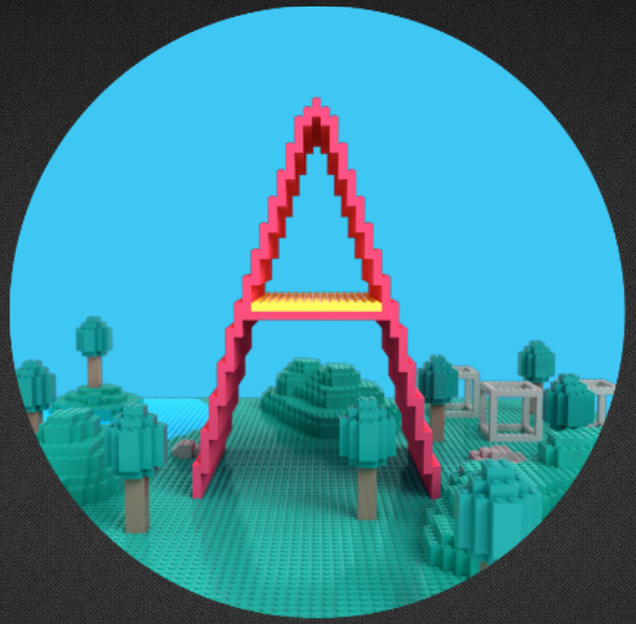
Installs

Closed

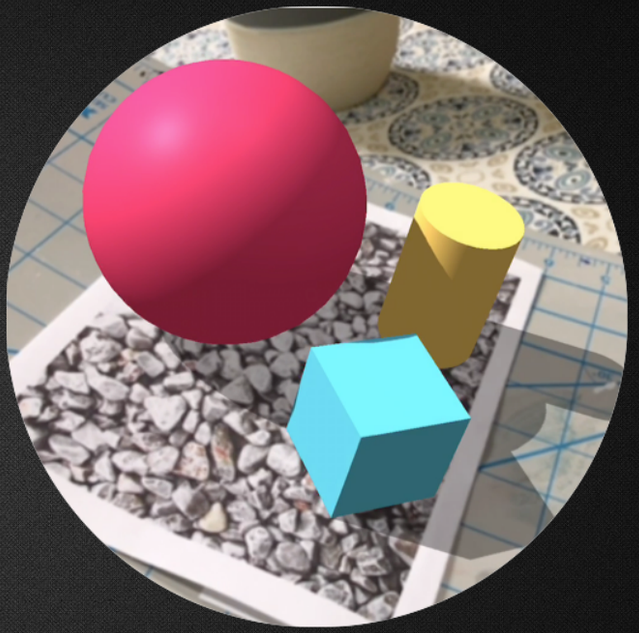
WHAT ARE THE PROBLEMS WE NEED TO SOLVE?

- 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

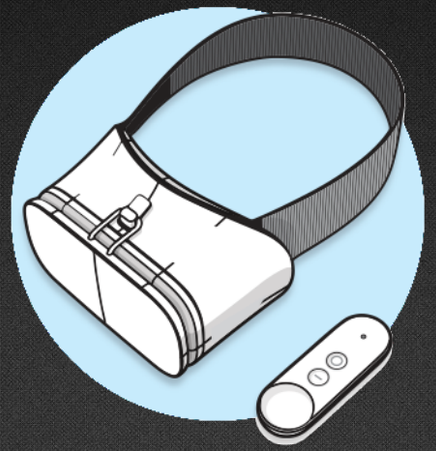


Frameworks:
AFrame



Tech:
WebAR

Tech:
WebVR

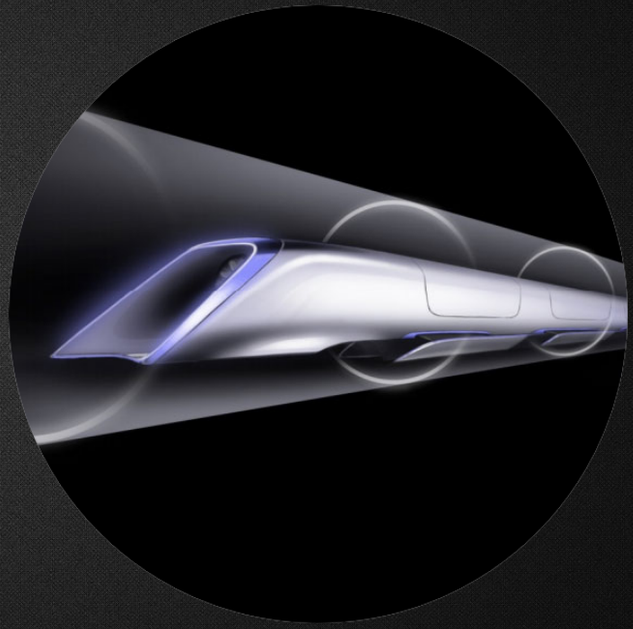


WEBVR

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/

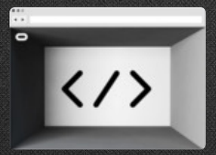
https://webvr.rocks

Firefox

Microsoft Edge

Chromium

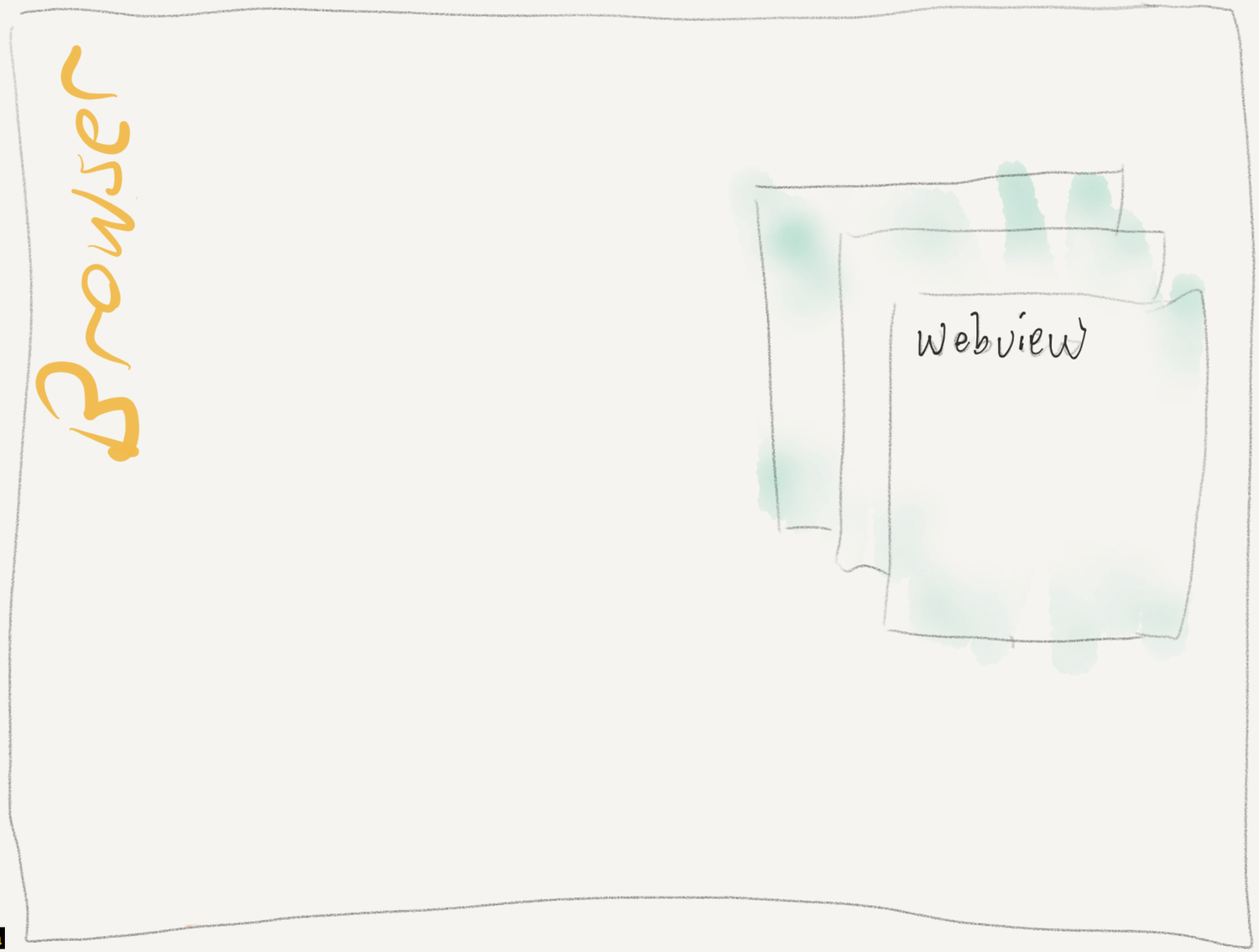
Chrome for Android

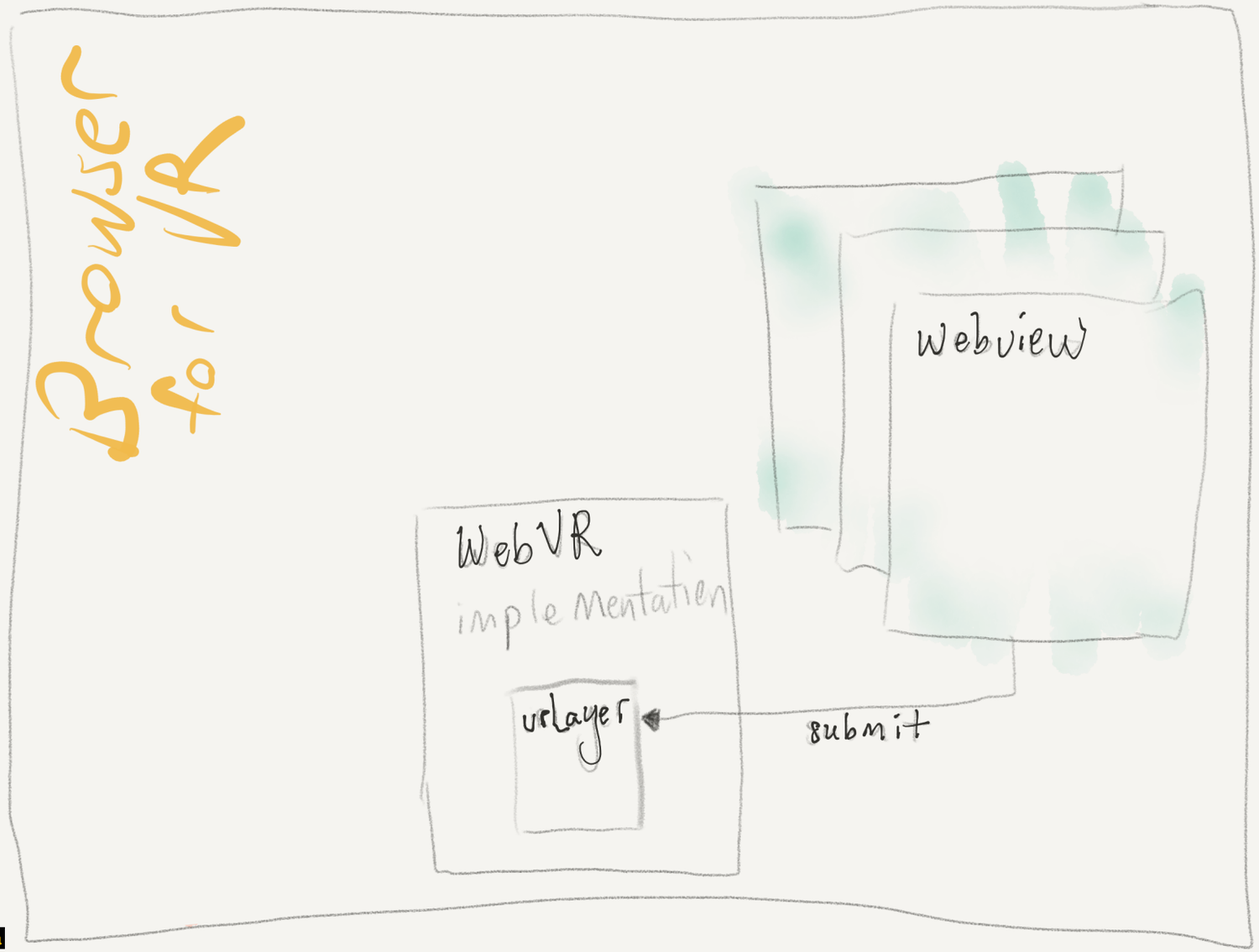


Oculus Carmel

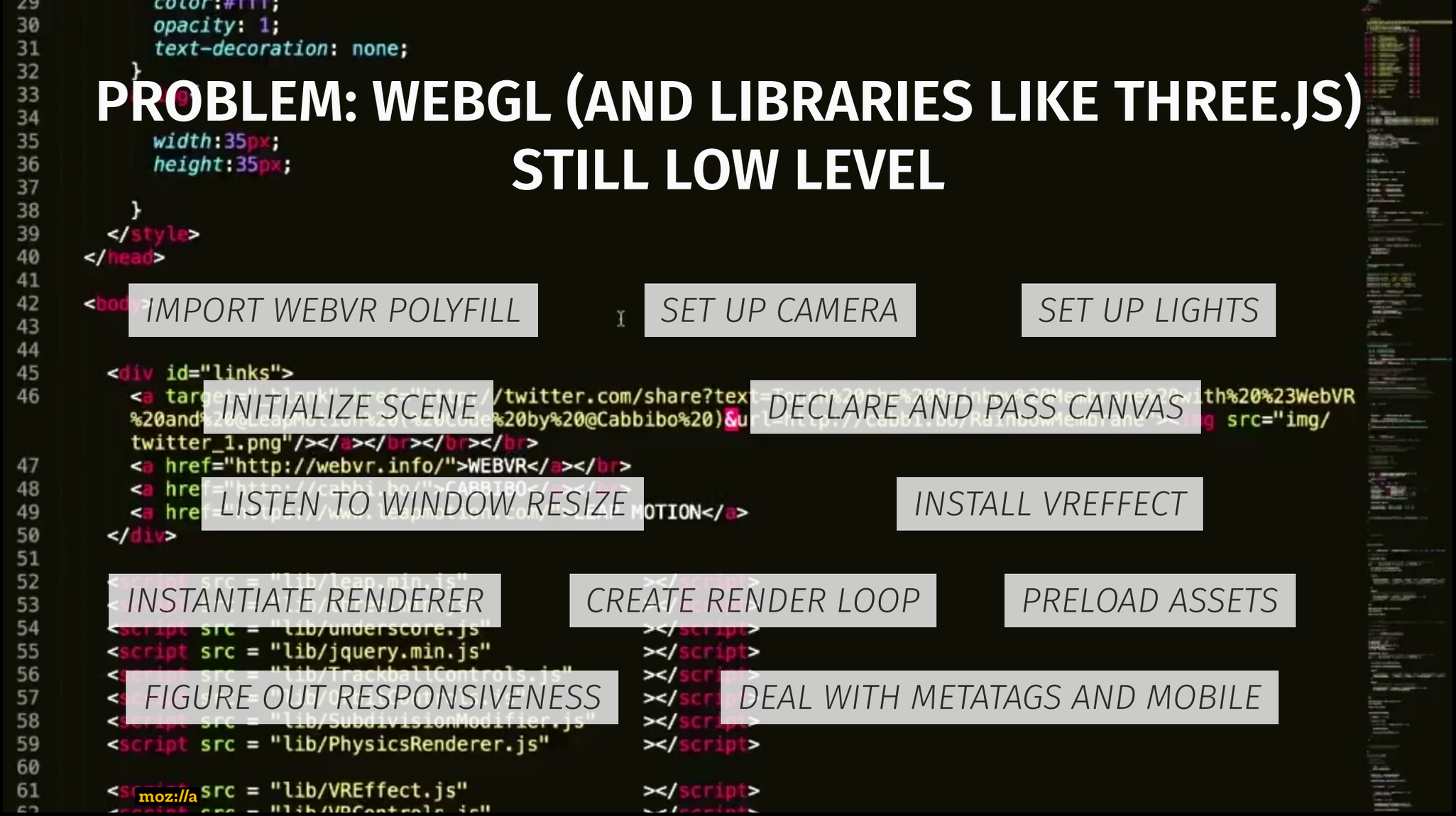
Samsung Internet

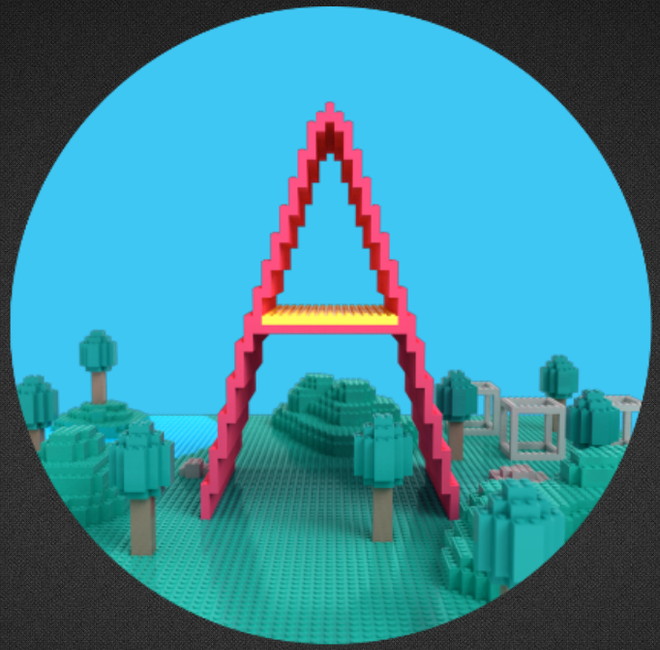
Mobile Polyfill


Browser
Webview


Browser for VR
Webview
WebVR
implementation
vrlayer
submit

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





Frameworks:
AFrame

HELLO WORLD

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




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

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>
```

WORKS WITH EVERYTHING

d3.js

Vue.js

React

Redux

jQuery

Angular


ENTITY-COMPONENT-SYSTEM
TNT
moz://a

COMPOSING AN ENTITY

```
<a-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">
```

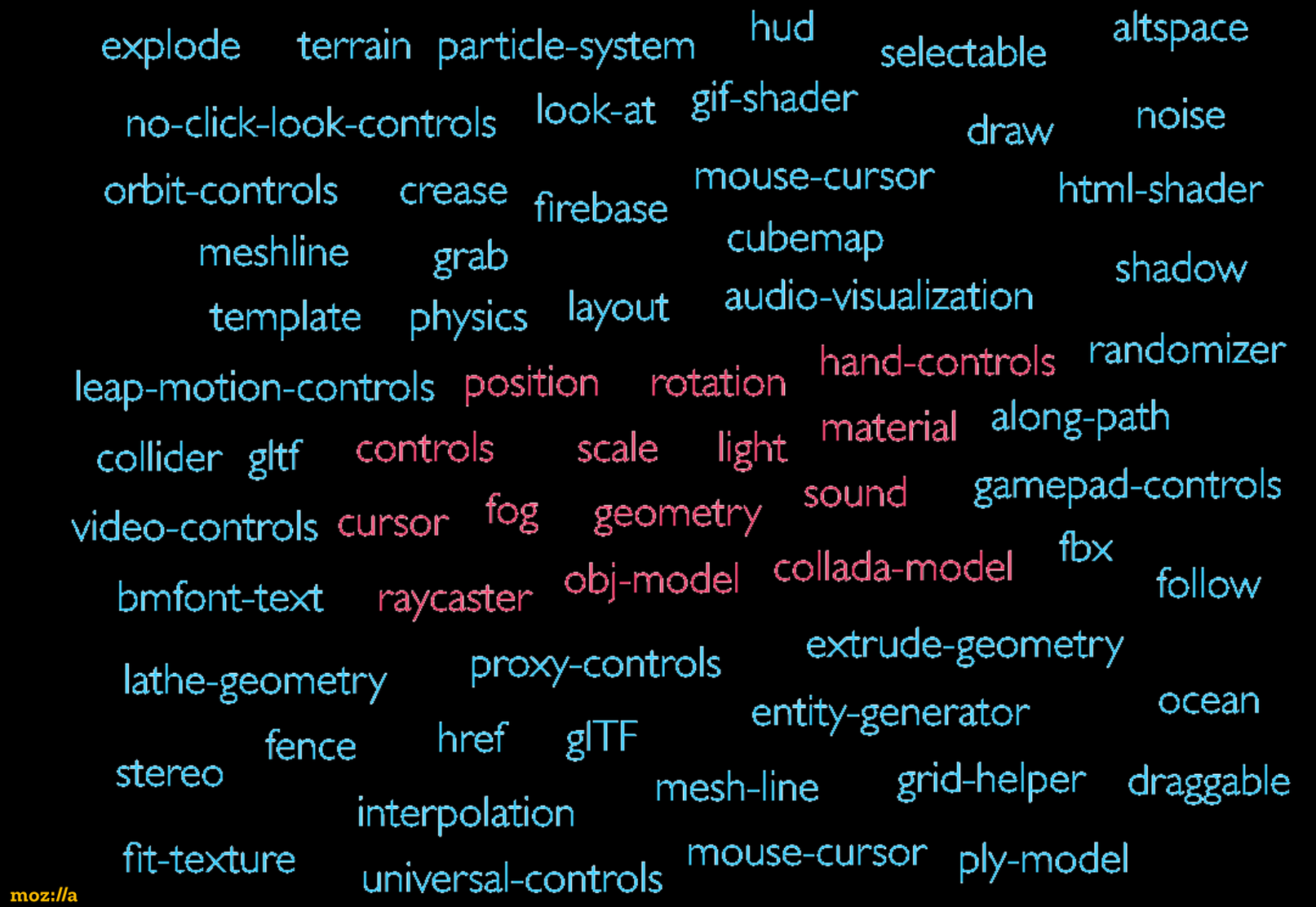
COMPOSING AN ENTITY

```
<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">
```

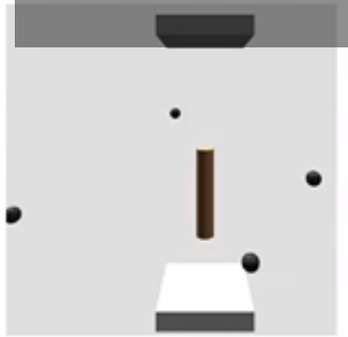
position rotation hand-controls
controls scale light material
cursor fog geometry sound
raycaster obj-model collada-model


explode
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
randomizer
leap-motion-controls
position
rotation
hand-controls
material
along-path
collider
gltf
controls
scale
light
sound
gamepad-controls
video-controls
cursor
fog
geometry
fbx
bmfont-text
raycaster
obj-model
collada-model
follow
lathe-geometry
proxy-controls
extrude-geometry
entity-generator
ocean
fence
href
glTF
stereo
mesh-line
grid-helper
draggable
interpolation
fit-texture
mouse-cursor
ply-model
universal-controls

aframe-alongpath-component.min.js on GitHub

REGISTRY

Curated collection of A-Frame components.



aframe-animation-component

Kevin Ngo June 1st 2016 © MIT ★ 193

Animations in A-Frame using anime.js

aframe-animation-component.min.js on GitHub

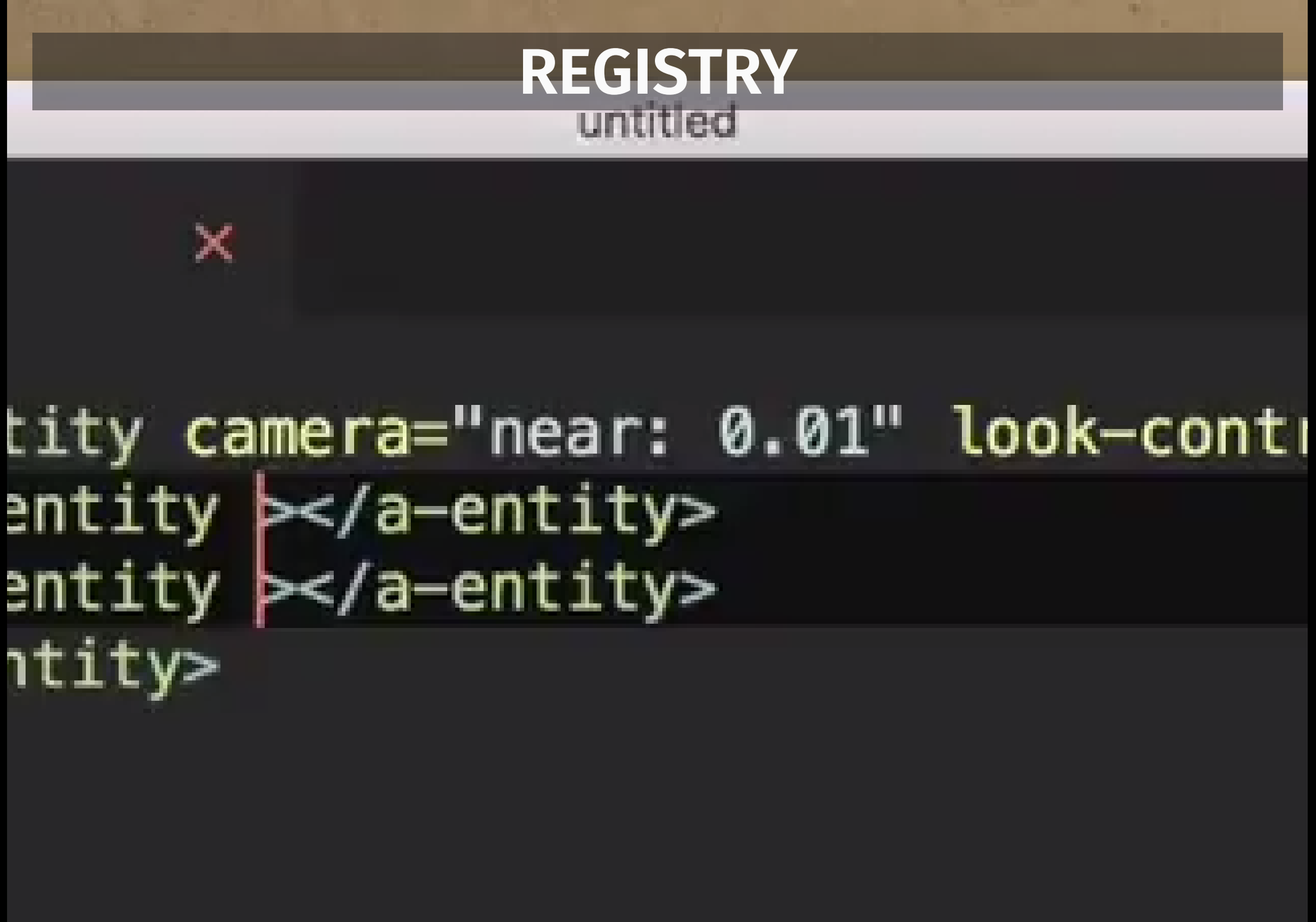
aframe-auto-detect-controllers-component

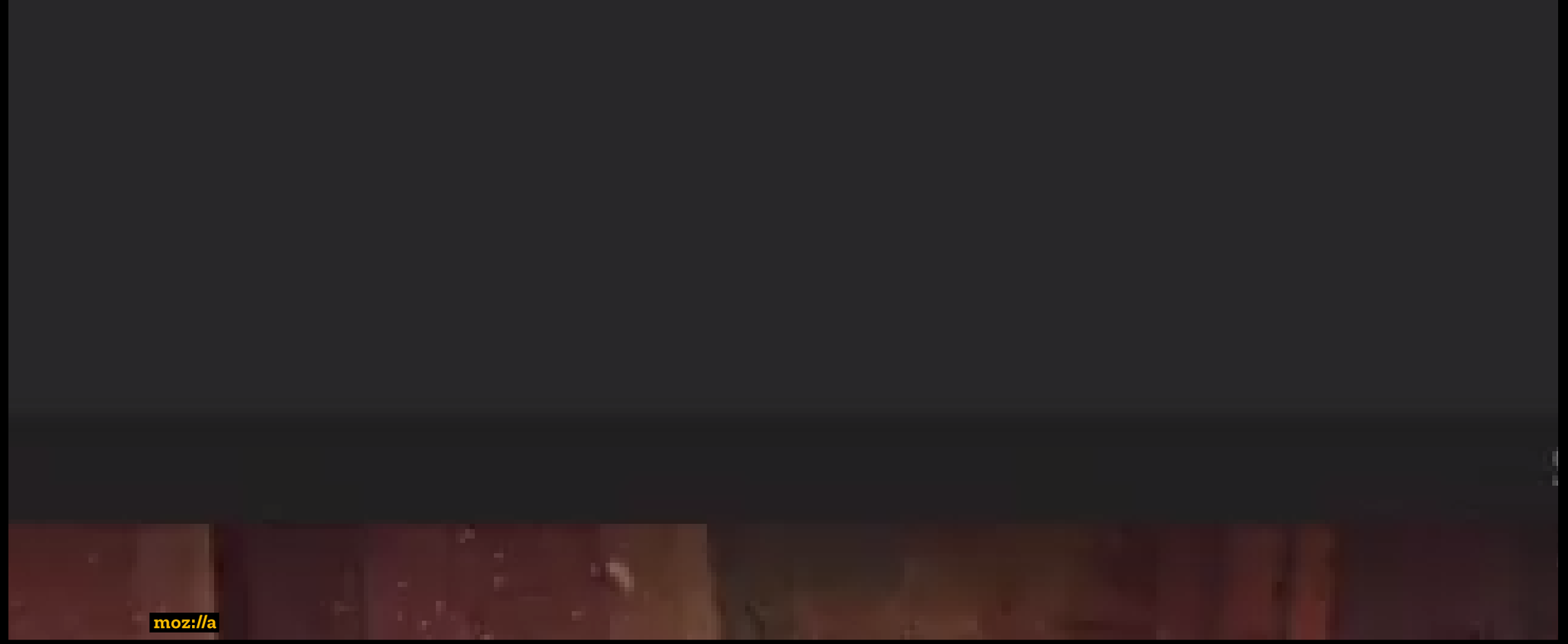
Michael Chen December 27th 2016 © MIT ★ 5

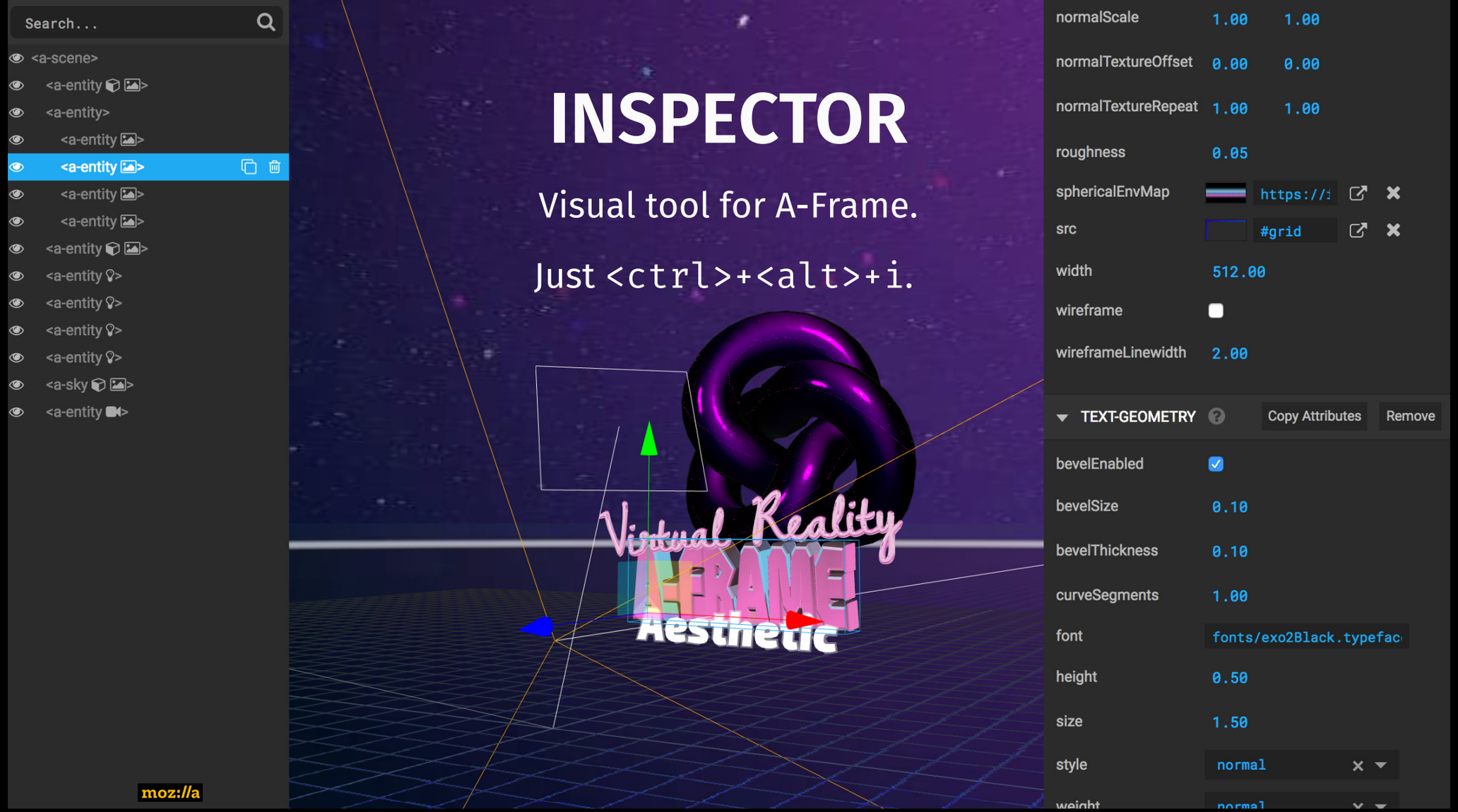
Auto-Detect Controllers component for A-Frame.

aframe-auto-detect-controllers-component.min.js on GitHub

REGISTRY


untitled
tity camera="near: 0.01" look-contr
entity ></a-entity>
entity ></a-entity>
ntity>


moz://a


Search...
<a-scene>
<a-entity>
<a-entity>
<a-entity>
<a-entity>
<a-entity>
<a-entity>
<a-entity>
<a-entity>
<a-entity>
<a-entity>
<a-sky>
<a-entity>
INSPECTOR
Visual tool for A-Frame.
Just <ctrl>+<alt>+i.
Virtual Reality
A-FRAME
Aesthetic
moz://a
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
wireframeLinewidth 2.00
TEXT-GEOMETRY
Copy Attributes
Remove
bevelEnabled
bevelSize 0.10
bevelThickness 0.10
curveSegments 1.00
font fonts/exo2Black.typefac
height 0.50
size 1.50
style normal

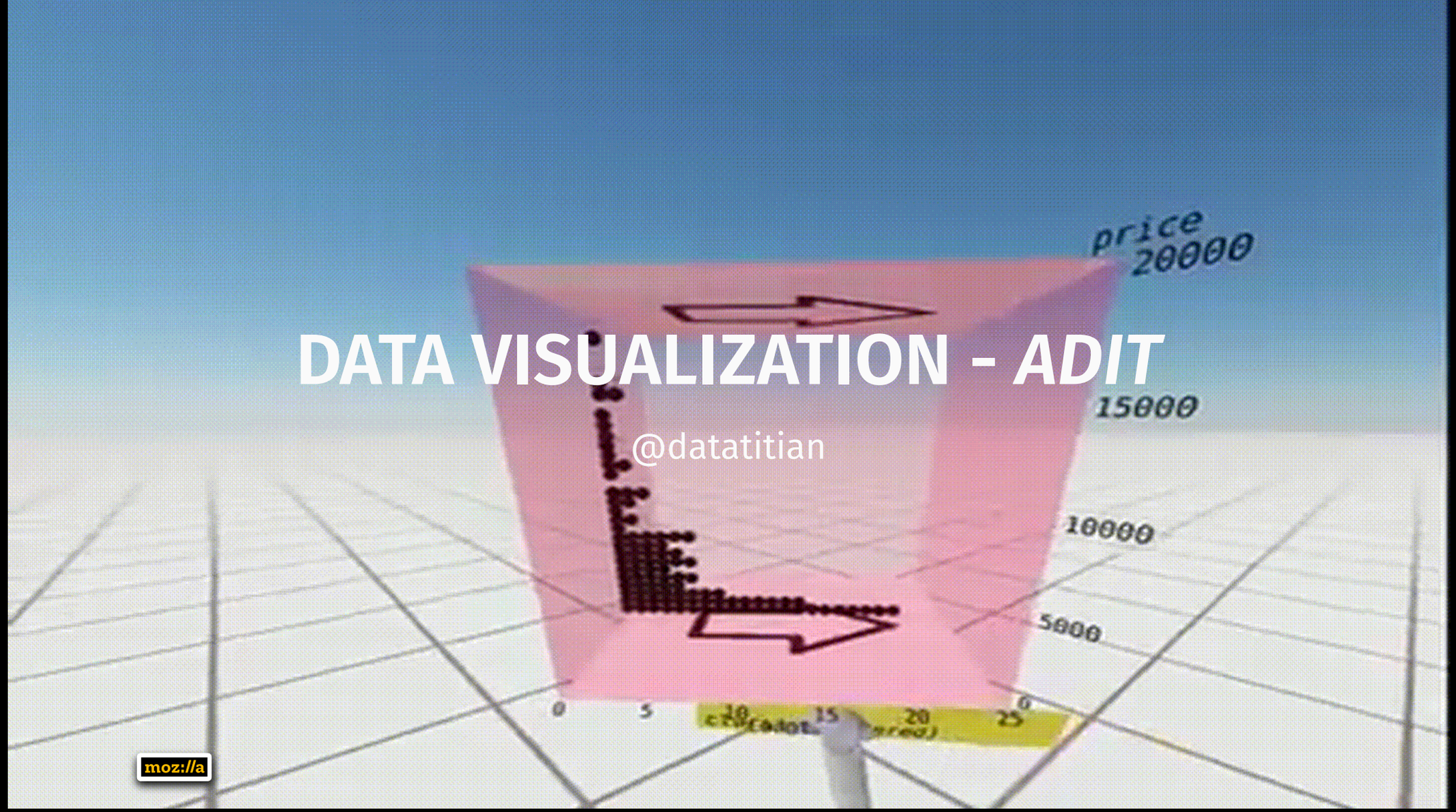

COMMUNITY
https://aframe.io/blog/
moz://a


ART - A-PAINTER
@mozillavr
moz://a

JOURNALISM – *FEAR OF THE SKY*

Amnesty International UK


JOURNALISM - JOURNEY TO MARS
The Washington Post
moz://a



DATA VISUALIZATION - *ADIT*

@datatitian

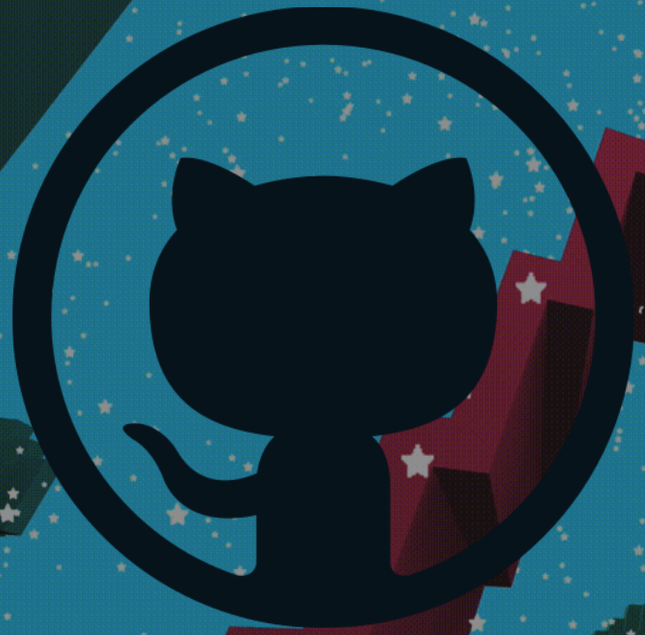
moz://a

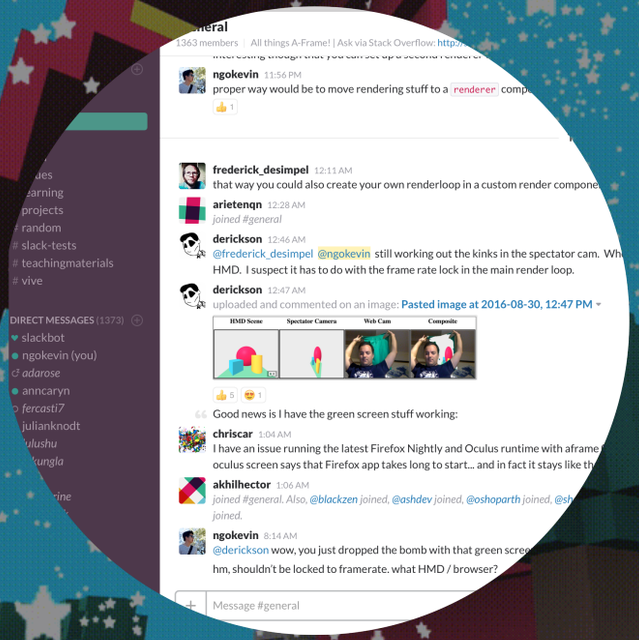
GAMING - *A-BLAST*

@mozillavr

AFRAME.IO

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



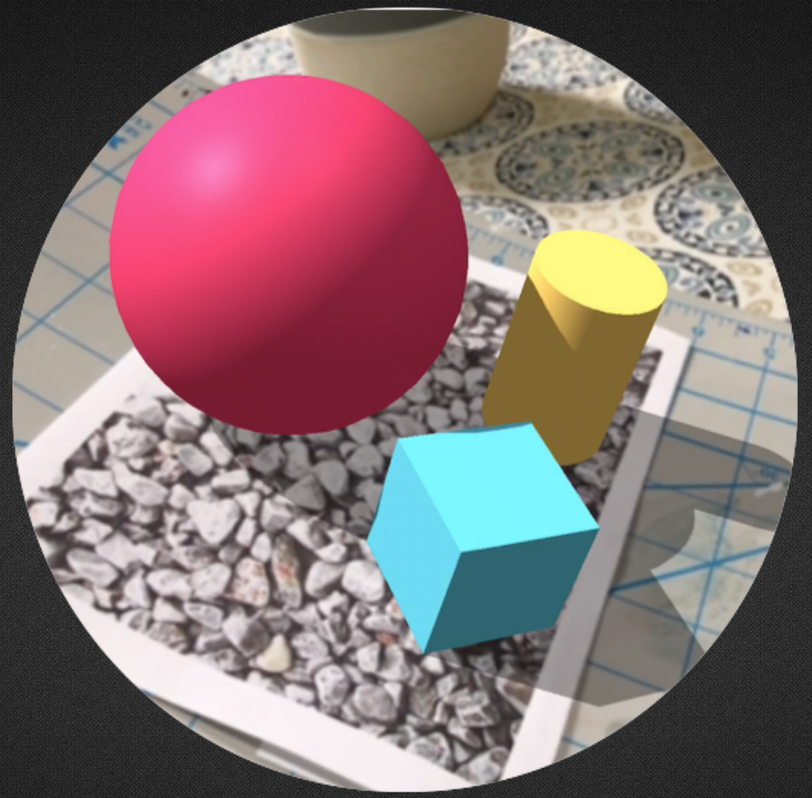


135 contributors 5000 Stargazers

3200 members on Slack

100s of featured projects

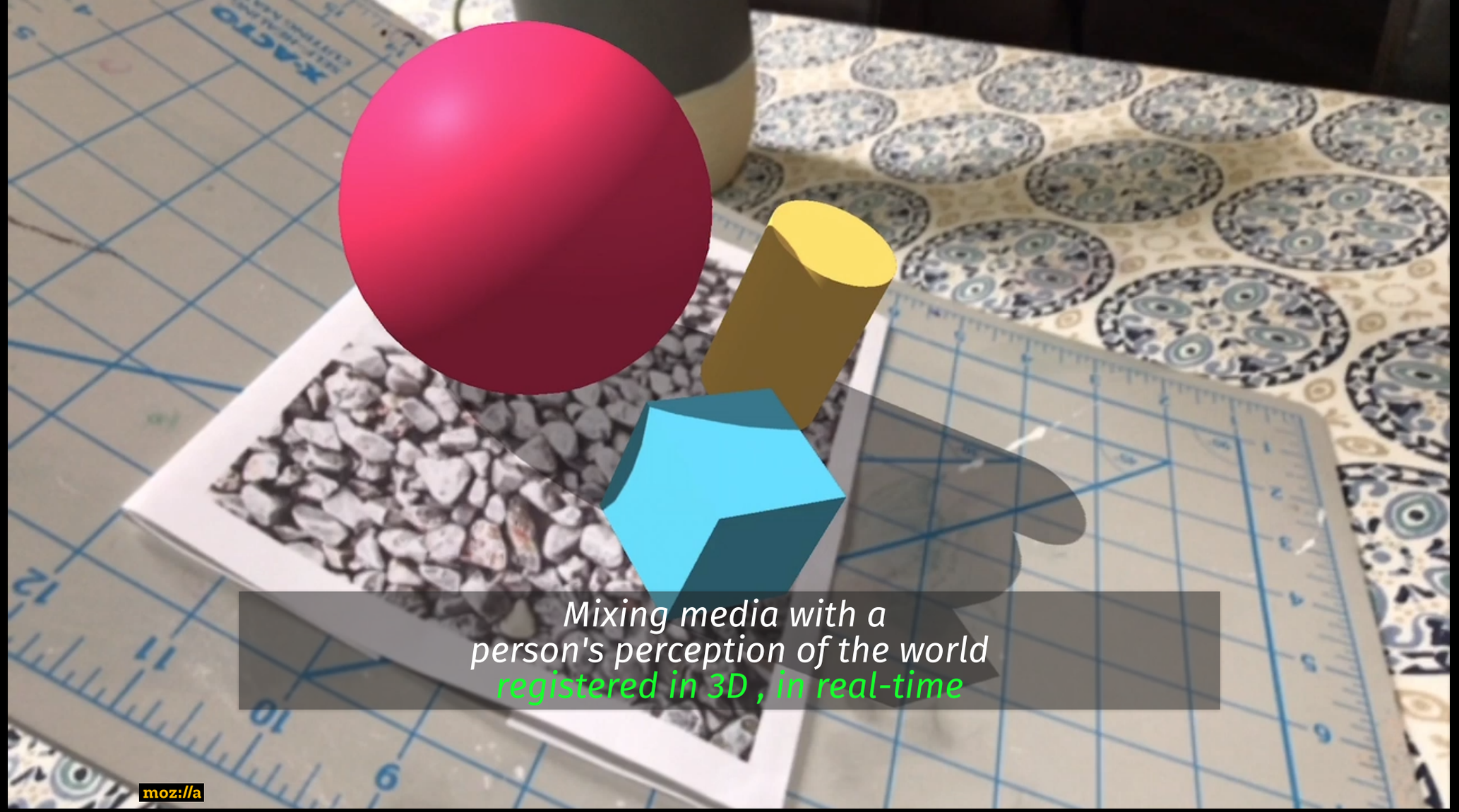
moz://a



Tech:
WebAR

WEBAR DOESN'T EXIST YET

But how close are we?


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


VUZIX

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

WebRTC getUserMedia + JS tracking

https://github.com/jeromeetienne/AR.js
https://twitter.com/jerome_etienne/status/836754117964017664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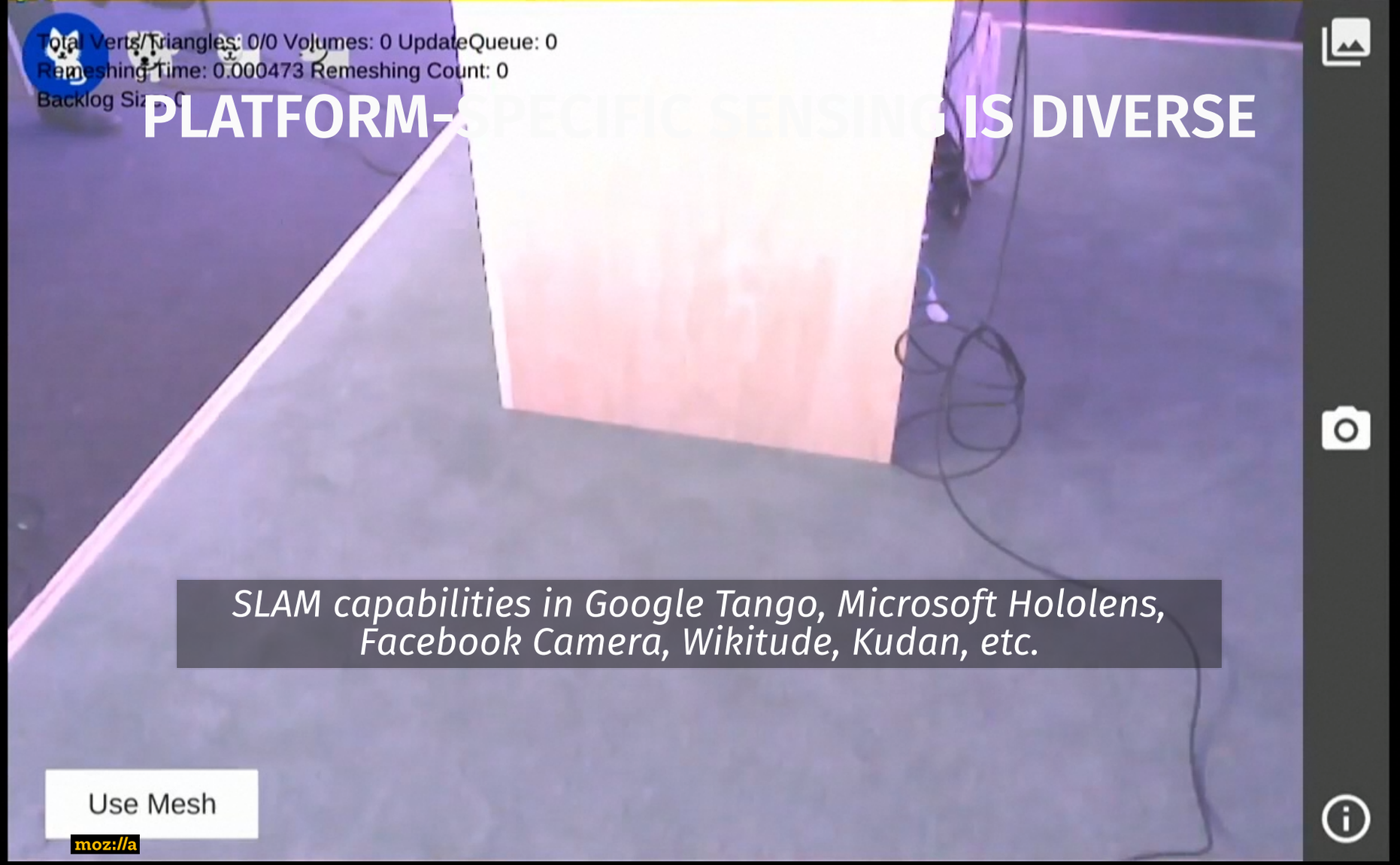
IN THE LONG RUN, THIS SIMPLE APPROACH WILL NOT BE ENOUGH

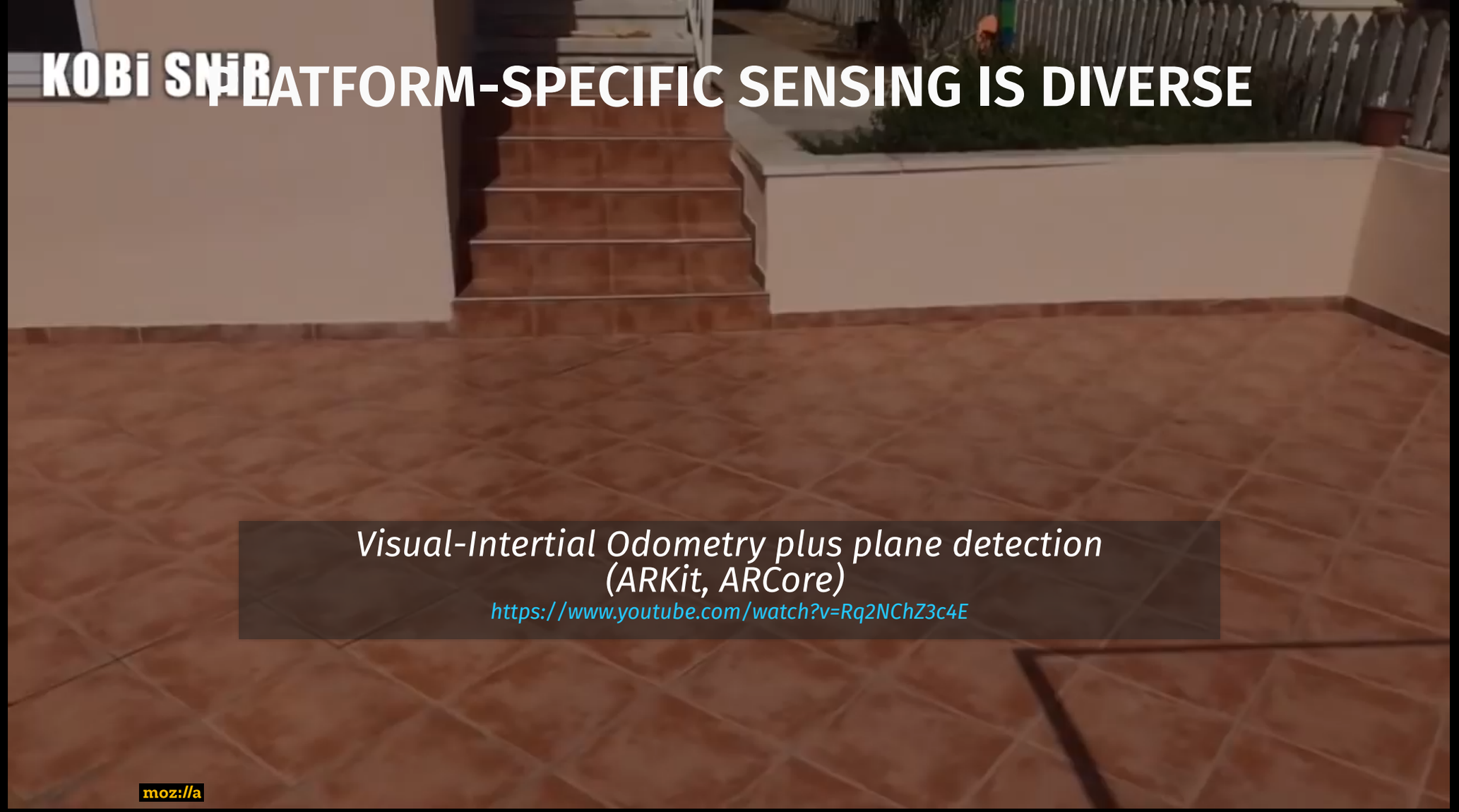
VERY LITTLE WORLD KNOWLEDGE,
TIGHTLY COUPLED TO SPECIFIC TECHNOLOGY,
DOESN'T LEVERAGE PLATFORM CAPABILTIES

Julian Oliver "Levelhead" 2008


You are walking west..
moz://a


Total Verts/Triangles: 0/0 Volumes: 0 UpdateQueue: 0
Remeshing Time: 0.000473 Remeshing Count: 0
Backlog Size: 0
PLATFORM-SPECIFIC SENSING IS DIVERSE
SLAM capabilities in Google Tango, Microsoft Hololens,
Facebook Camera, Wikitude, Kudan, etc.
Use Mesh
moz://a

PLATFORM-SPECIFIC SENSING IS DIVERSE

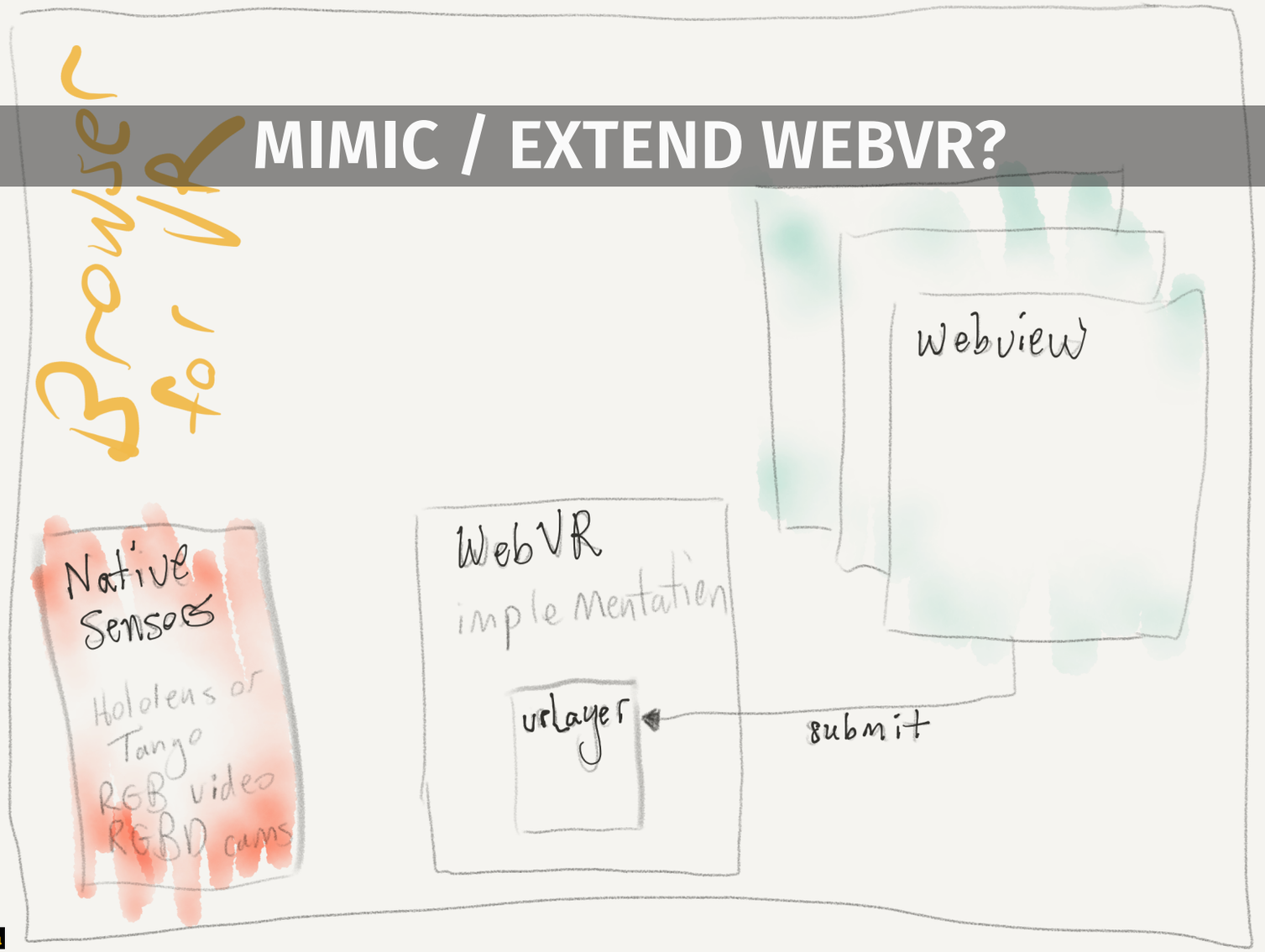


Visual-Intertial Odometry plus plane detection (ARKit, ARCore)

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

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

MIMIC / EXTEND WEBVR?



PROBLEM:

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

and more importantly

MR >= AR + VR

DECOUPLE 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 Speiginer's PhD work on argon.js and Argon4)

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

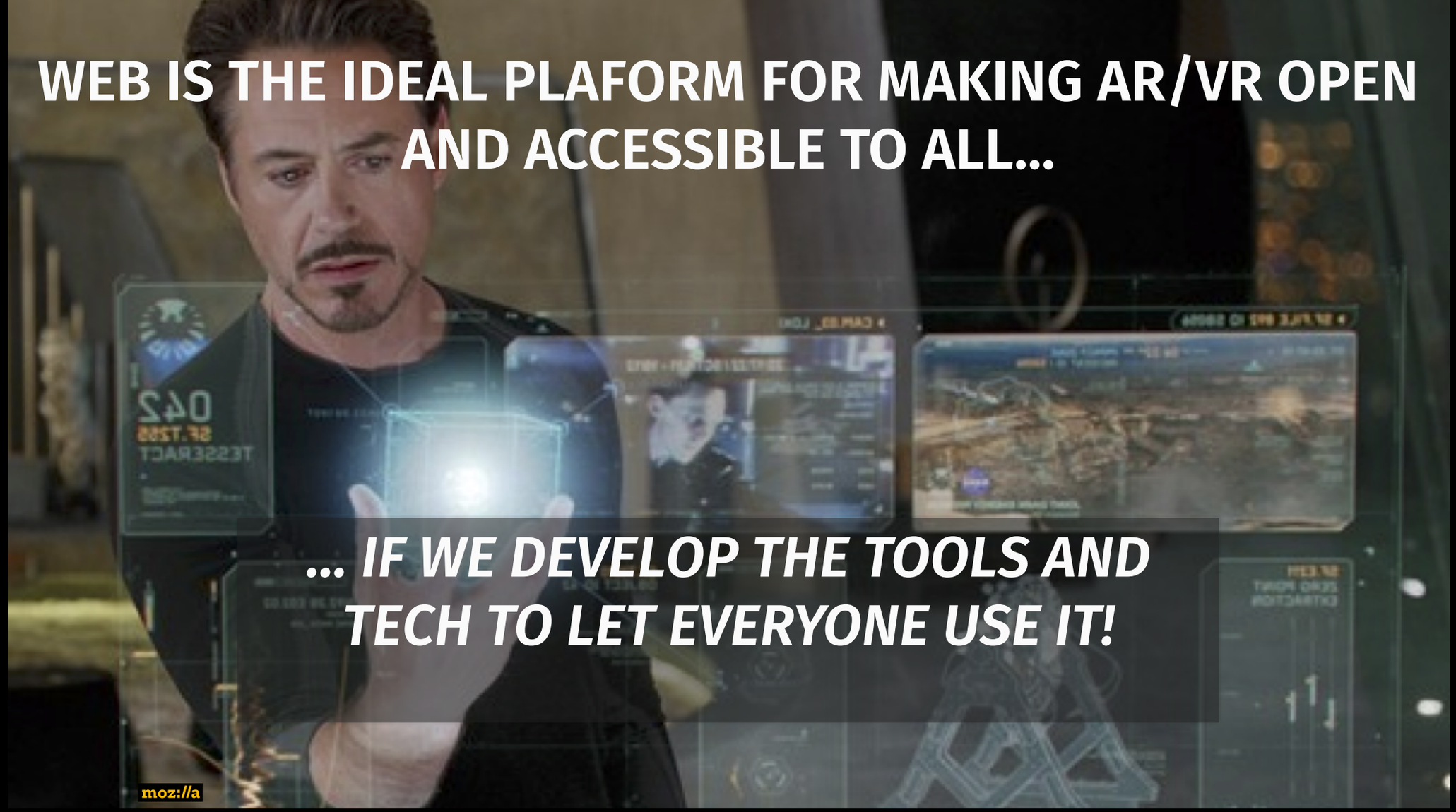
```
let box = new THREE.Mesh(
    new THREE.BoxBufferGeometry(0.1, 0.1, 0.1),
    new THREE.MeshPhongMaterial({ color: '#DDFFDD' })
)
```

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!
ISS Maintenance using PRIDE w/ Traclabs
moz://a
Done


index.html – Glitch
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
<a-box position="-1 0.5 1" cursor-listener rotation="0 45 0" width="1" height="1" depth="1" color="#4CC3D9" ></a-b
<a-entity billboard position="0 3 0">
<a-entity rotation="0 45 0">
<a-entity css-object="div: #mydiv" scale="0.01 0.01 0.01" rotation="0 0 0" position="0 0 0.5"></a-entity>
<a-entity css-object="div: #mydiv2" scale="0.01 0.01 0.01" rotation="0 -90 0" position="-0.5 0 0"></a-ent
</a-entity>
</a-entity>
<a-cylinder position="1 0.75 1" cursor-listener radius="0.5" height="1.5" color="#FFC65D"></a-cylinder>
<a-plane rotation="-90 0 0" cursor-listener width="4" height="4" color="#7BC8A4"></a-plane>
</a-entity>
<ar-camera>
<a-entity id="myCursor" cursor="fuse:true; fuse-timeout: 1000"
position="0 0 -0.1"
geometry="primitive:ring; radiusInner: 0.001; radiusOuter: 0.0015"
material="color: #2E3A87; opacity:0.3;">
</a-entity>
</ar-camera>
</ar-scene>
<script>
var arScene = document.querySelector('ar-scene');
var content = document.querySelector('#helloworld');
// the ar-camera has an argon reference frame attached, so when it gets it's first value,
// we'll get this event
arScene.addEventListener("referenceframe-statuschanged", function () {
var camera = document.querySelector('ar-camera');
var vec = camera.object3D.getWorldDirection();
vec.multiplyScalar(-10);
vec.y -= 1;
content.setAttribute("position", {x: vec.x, y: vec.y, z: vec.z});
})
</script>
</body>
</html>
https://argon-example.glitch.me
moz://a
New!

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!

THANKS!

Contact me: rabimba@mozilla.com and @rabimba

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/DevWeekAustin2017

Thanks to everyone who worked on WebXR and Argon. Shoutout to @blairmacintyre and @TrevorFSmith

moz://a