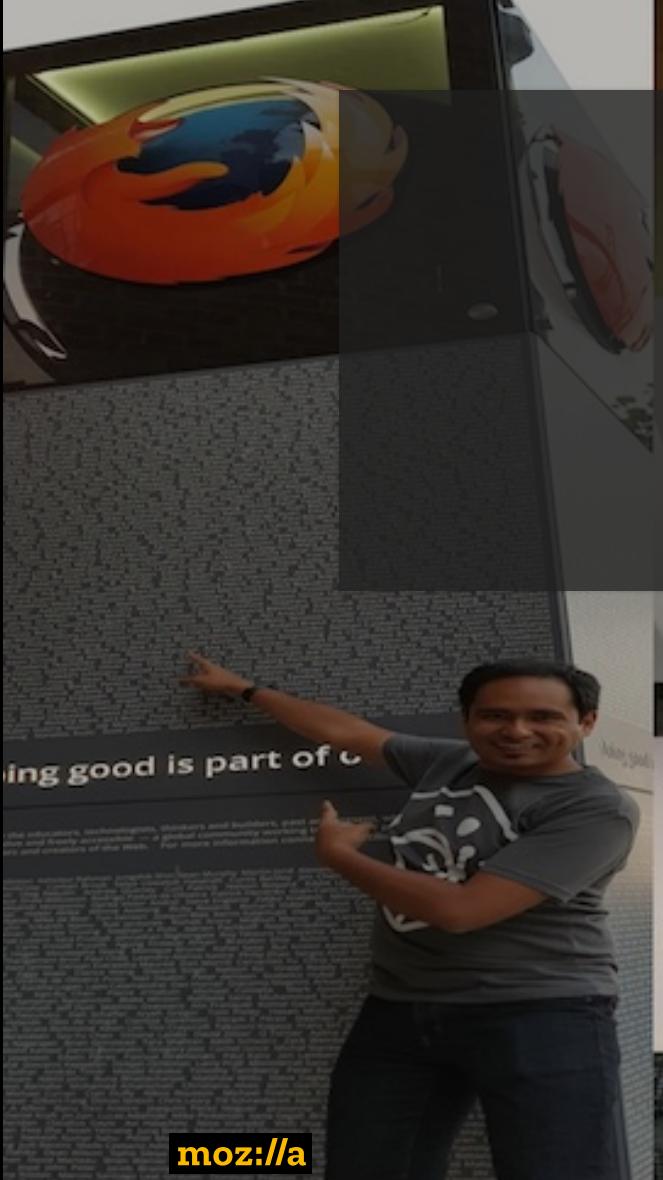


MIXING REAL AND VIRTUAL IN WEBAR - AUGMENTED AND MIXED REALITY FOR EVERYONE

Rabimba Karanjai

Mozilla Mixed Reality Team | Mozilla Tech Speaker, Mozilla
Graduate Student, Rice University
@rabimba

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Rice University / IBM Research / Mozilla

Sp Adobe Spark

WHO ME?

*Me in a Nutshell
personified, in image*

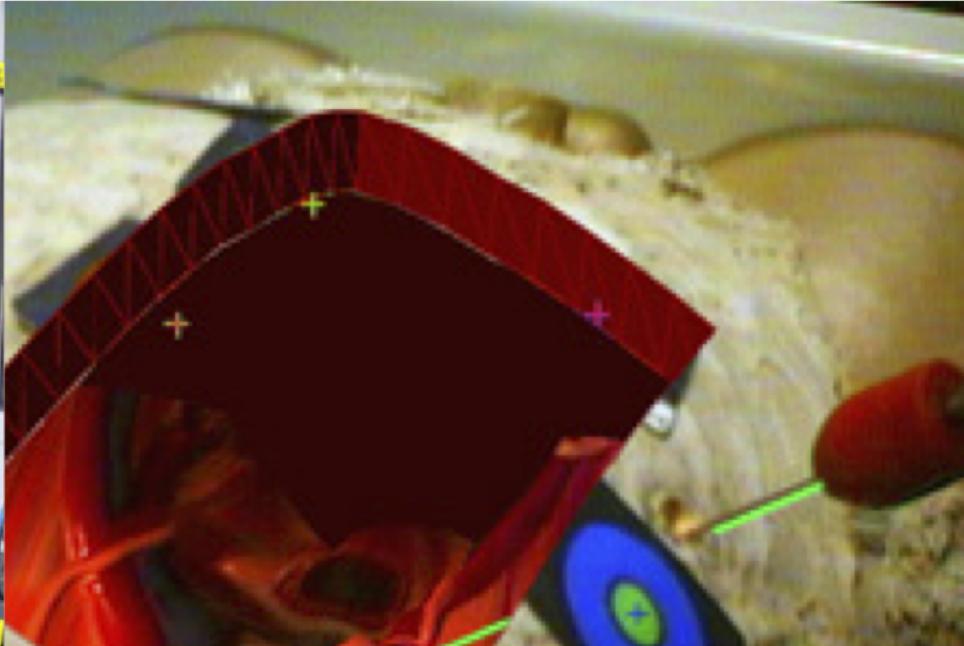


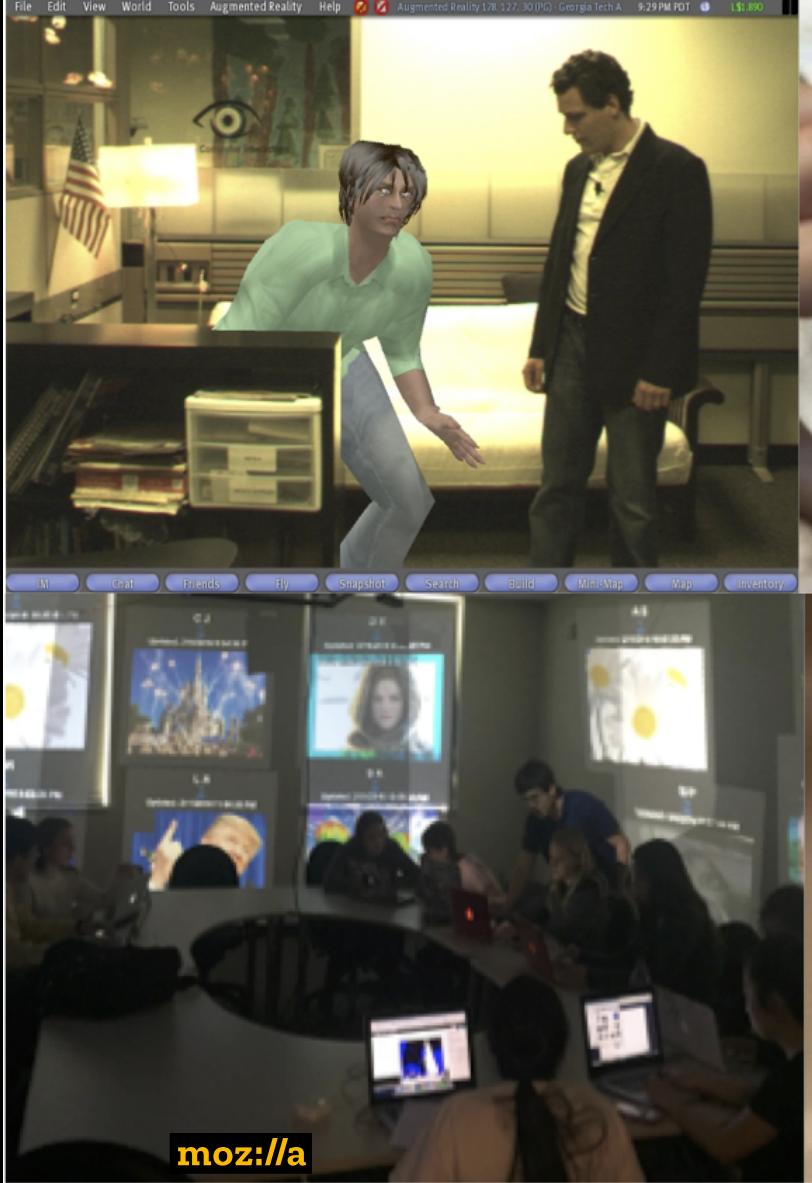
AR? VR? MR?

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

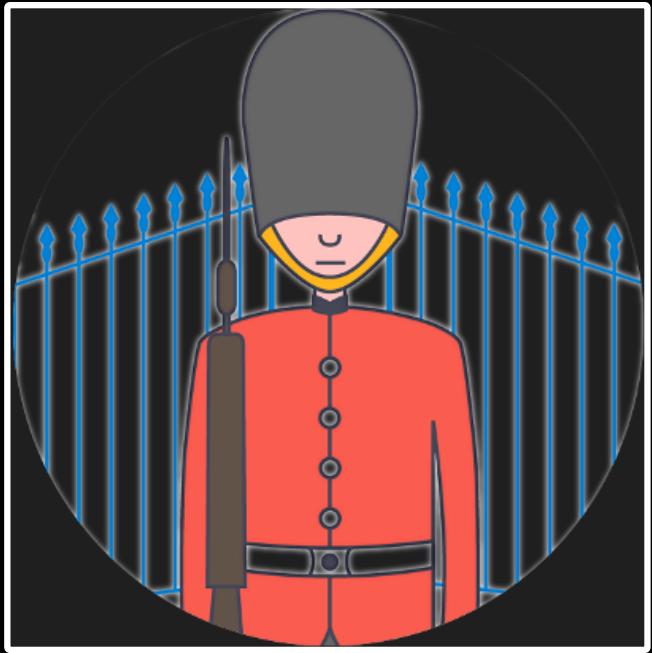
Ivan Sutherland, "The Ultimate Display", mid-1960's

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FRICTION OF VR ECOSYSTEMS



Gatekeepers



Installs

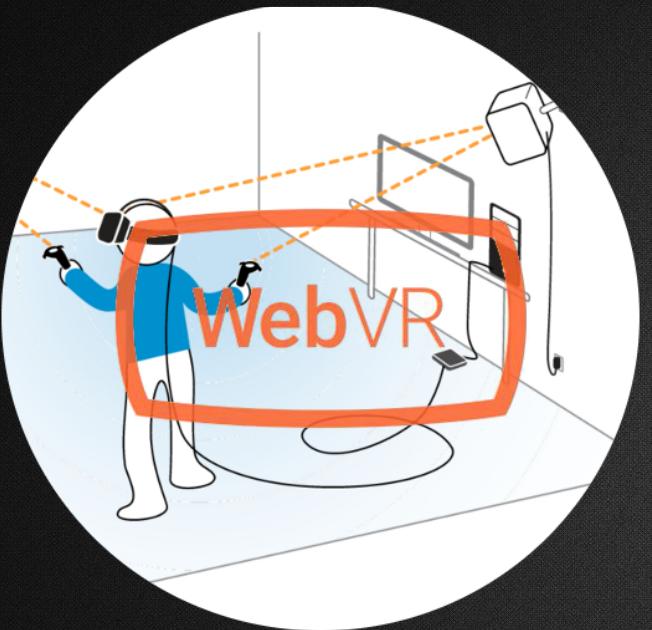


Closed

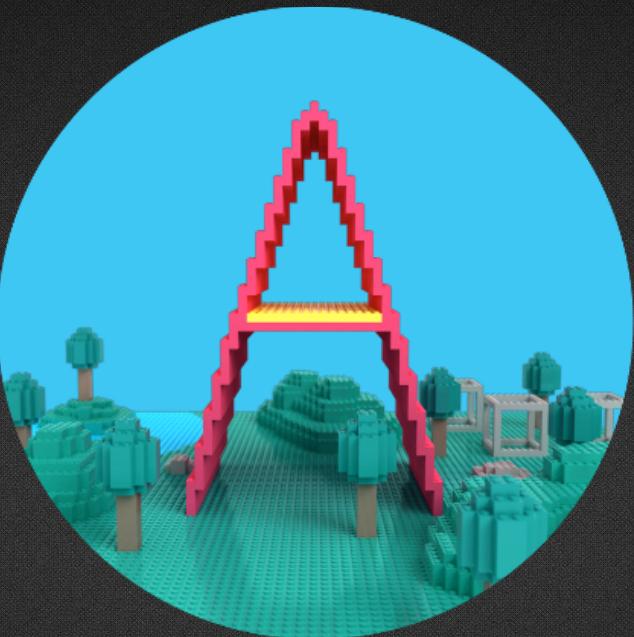
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WHAT ARE THE PROBLEMS WE NEED TO SOLVE?

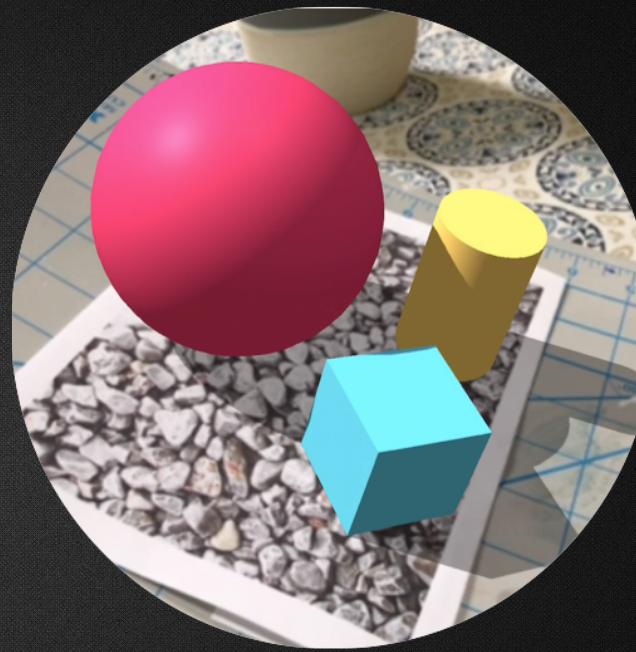
- Browser level technology
- Platform independent AR/VR/MR frameworks
- Lightweight authoring
- Content creation
- Services for world knowledge, persistence
- Social service
- Search and Discovery



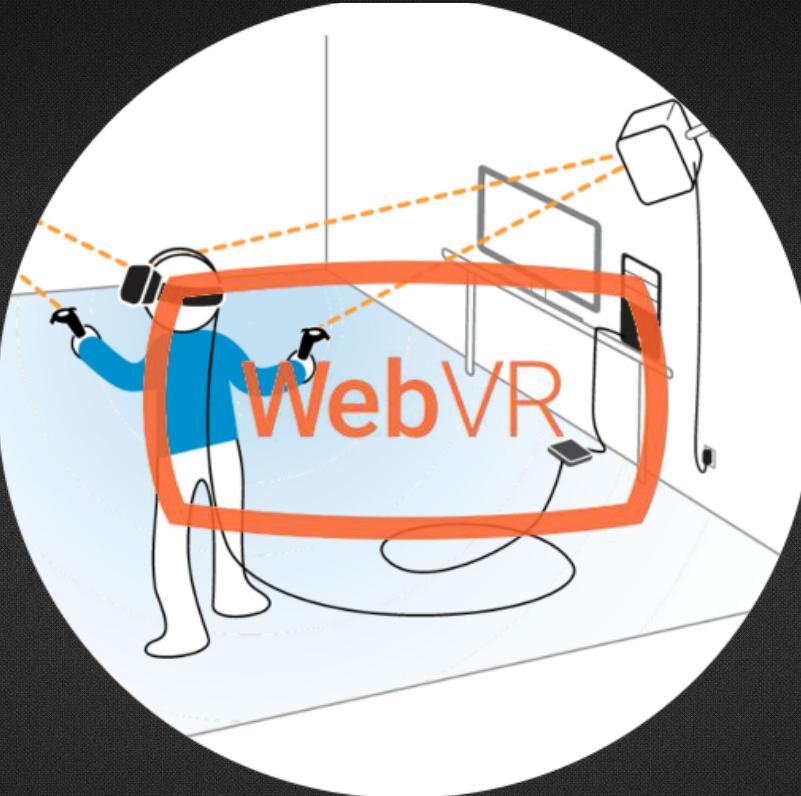
Tech:
WebVR



Frameworks:
AFrame



Tech:
WebAR



*Tech:
WebVR*

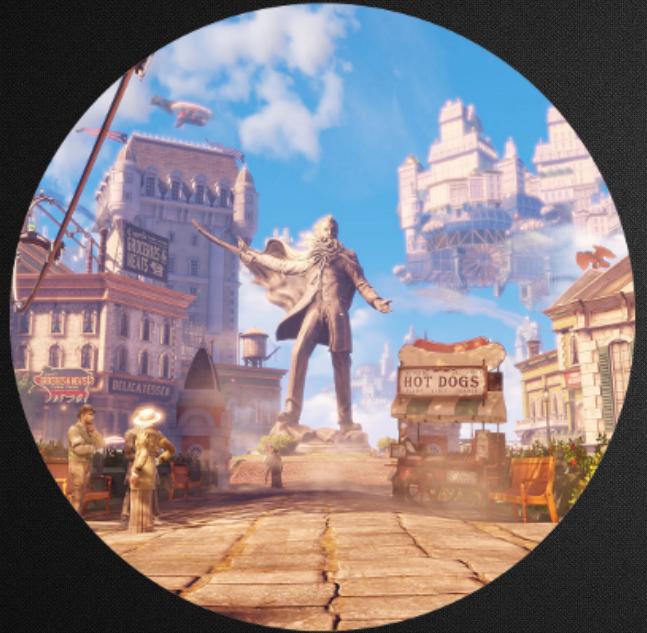
moz://a



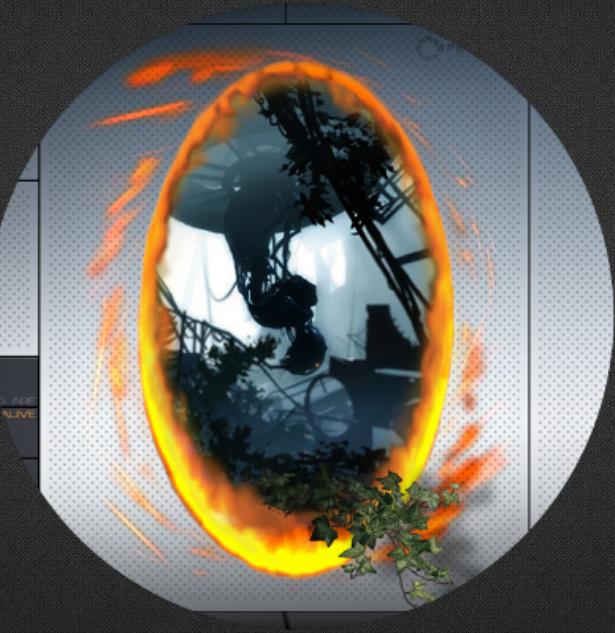
moz://a

WEBVR

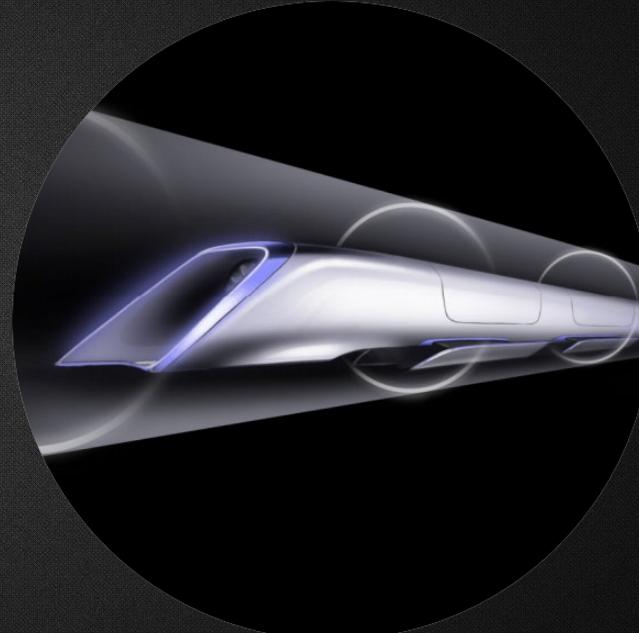
An open virtual reality platform with the advantages of **the Web**



Open



Connected



Instant

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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



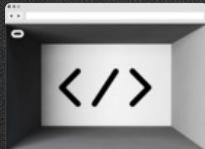
Microsoft Edge



Chromium



Chrome for Android



Oculus Carmel



Samsung Internet



Mobile Polyfill

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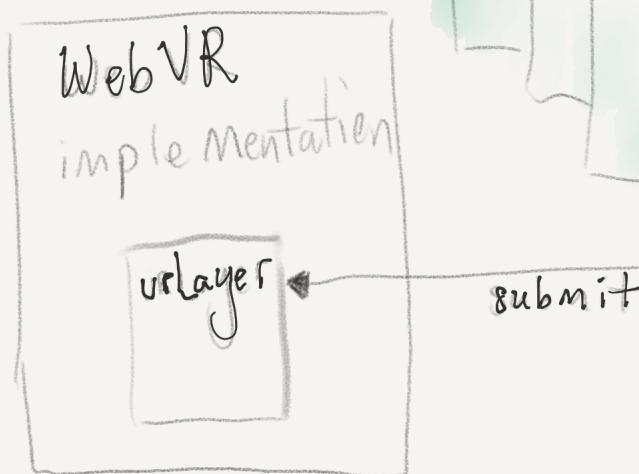
Browser

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Browser for VR

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```
29 color:#111;
30 opacity: 1;
31 text-decoration: none;
32 }
33 width:35px;
34 height:35px;
35
36
37 }
38 </style>
39 </head>
40
41 <body>
```

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

```
42 IMPORT WEBVR POLYFILL
```

```
I SET UP CAMERA
```

```
SET UP LIGHTS
```

```
44
45 <div id="links">
```

```
46 <a href="http://cabbibo.com/2013/07/10/initializing-a-webvr-scene-with-threejs/">INITIALIZE SCENE</a>
```

```
47 <a href="http://cabbibo.com/2013/07/10/adding-camera-and-lights-to-a-webvr-scene-with-threejs/">SET UP CAMERA</a>
```

```
48 <a href="http://cabbibo.com/2013/07/10/adding-lights-to-a-webvr-scene-with-threejs/">SET UP LIGHTS</a>
```

```
49 <a href="http://cabbibo.com/2013/07/10/listening-for-window-resize-and-motion-events-in-a-webvr-scene-with-threejs/">LISTEN TO WINDOW RESIZE MOTION</a>
```

```
50 </div>
```

```
52 <script src = "lib/leap.min.js" type="text/javascript"></script>
53 <script src = "lib/underscore.js" type="text/javascript"></script>
54 <script src = "lib/jquery.min.js" type="text/javascript"></script>
55 <script src = "lib/TrackballControls.js" type="text/javascript"></script>
56 <script src = "lib/SubdivisionModifier.js" type="text/javascript"></script>
57 <script src = "lib/PhysicsRenderer.js" type="text/javascript"></script>
58 <script src = "lib/VREffect.js" type="text/javascript"></script>
59 <script src = "lib/VRCamera.js" type="text/javascript"></script>
```

```
60 <script src = "lib/VRControls.js" type="text/javascript"></script>
61 <script src = "lib/VRControls.js" type="text/javascript"></script>
62 <script src = "lib/VRControls.js" type="text/javascript"></script>
```

```
46 <a href="http://cabbibo.com/2013/07/10/initializing-a-webvr-scene-with-threejs/">INITIALIZE SCENE</a>
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```
47 <a href="http://cabbibo.com/2013/07/10/adding-camera-and-lights-to-a-webvr-scene-with-threejs/">SET UP CAMERA</a>
```

```
48 <a href="http://cabbibo.com/2013/07/10/adding-lights-to-a-webvr-scene-with-threejs/">SET UP LIGHTS</a>
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49 <a href="http://cabbibo.com/2013/07/10/listening-for-window-resize-and-motion-events-in-a-webvr-scene-with-threejs/">LISTEN TO WINDOW RESIZE MOTION</a>
```

```
52 <script src = "lib/leap.min.js" type="text/javascript"></script>
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54 <script src = "lib/jquery.min.js" type="text/javascript"></script>
55 <script src = "lib/TrackballControls.js" type="text/javascript"></script>
56 <script src = "lib/SubdivisionModifier.js" type="text/javascript"></script>
57 <script src = "lib/PhysicsRenderer.js" type="text/javascript"></script>
58 <script src = "lib/VREffect.js" type="text/javascript"></script>
59 <script src = "lib/VRCamera.js" type="text/javascript"></script>
```

```
60 <script src = "lib/VRControls.js" type="text/javascript"></script>
61 <script src = "lib/VRControls.js" type="text/javascript"></script>
62 <script src = "lib/VRControls.js" type="text/javascript"></script>
```

```
CREATE RENDER LOOP
```

```
PRELOAD ASSETS
```

```
DEAL WITH METATAGS AND MOBILE
```





Frameworks:
AFrame

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HELLO WORLD

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

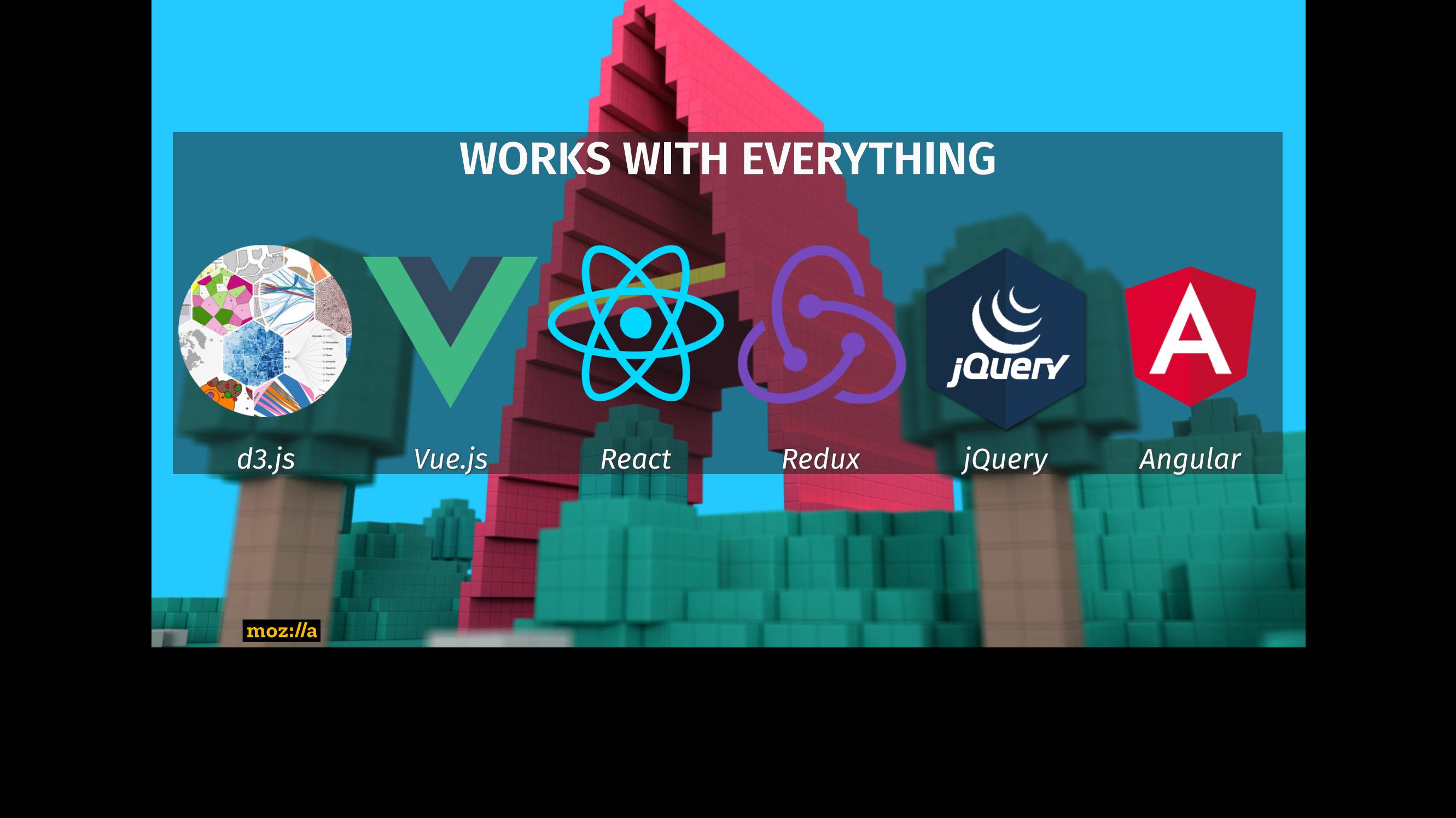
    </a-scene>
</html>
```

moz://a

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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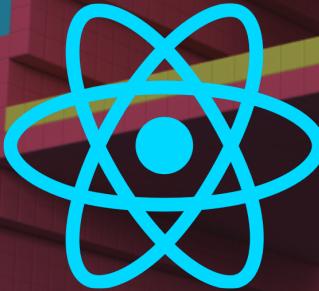
WORKS WITH EVERYTHING



d3.js



Vue.js



React



Redux



jQuery



Angular

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COMMUNITY

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

moz://a



ART - A-PAINTER

@mozillavr

moz://a

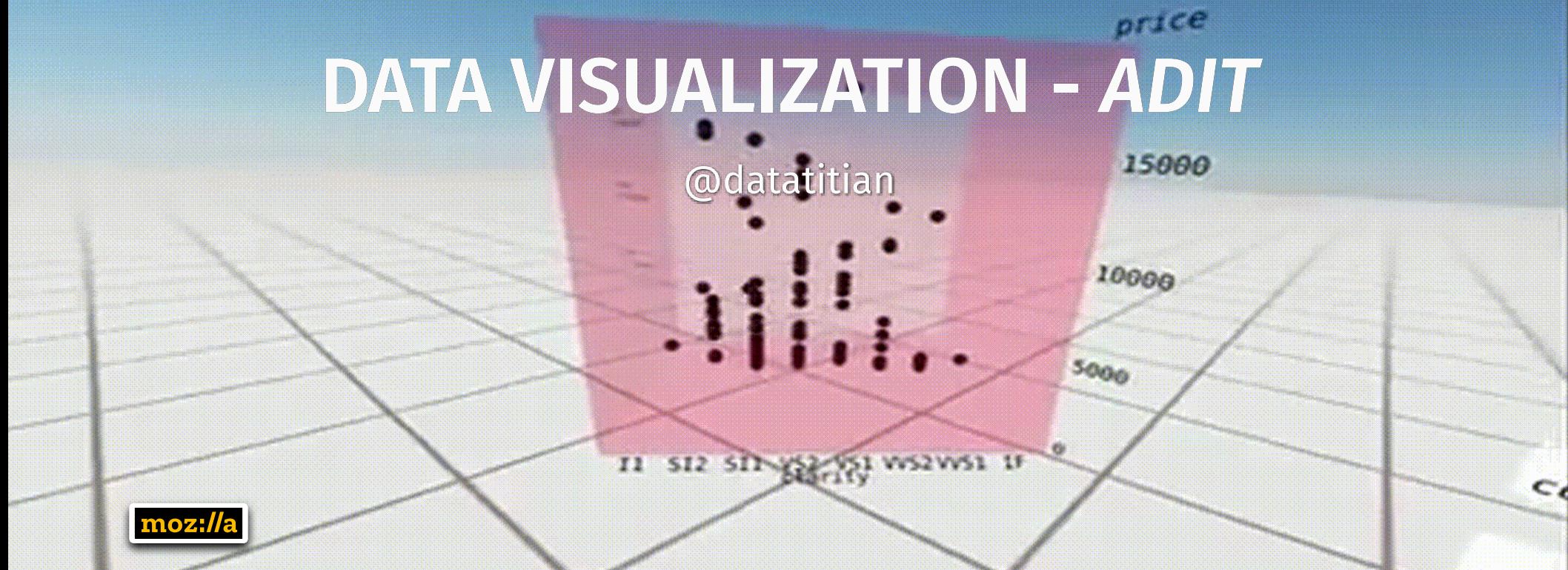
JOURNALISM – FEAR OF THE SKY

Amnesty International UK



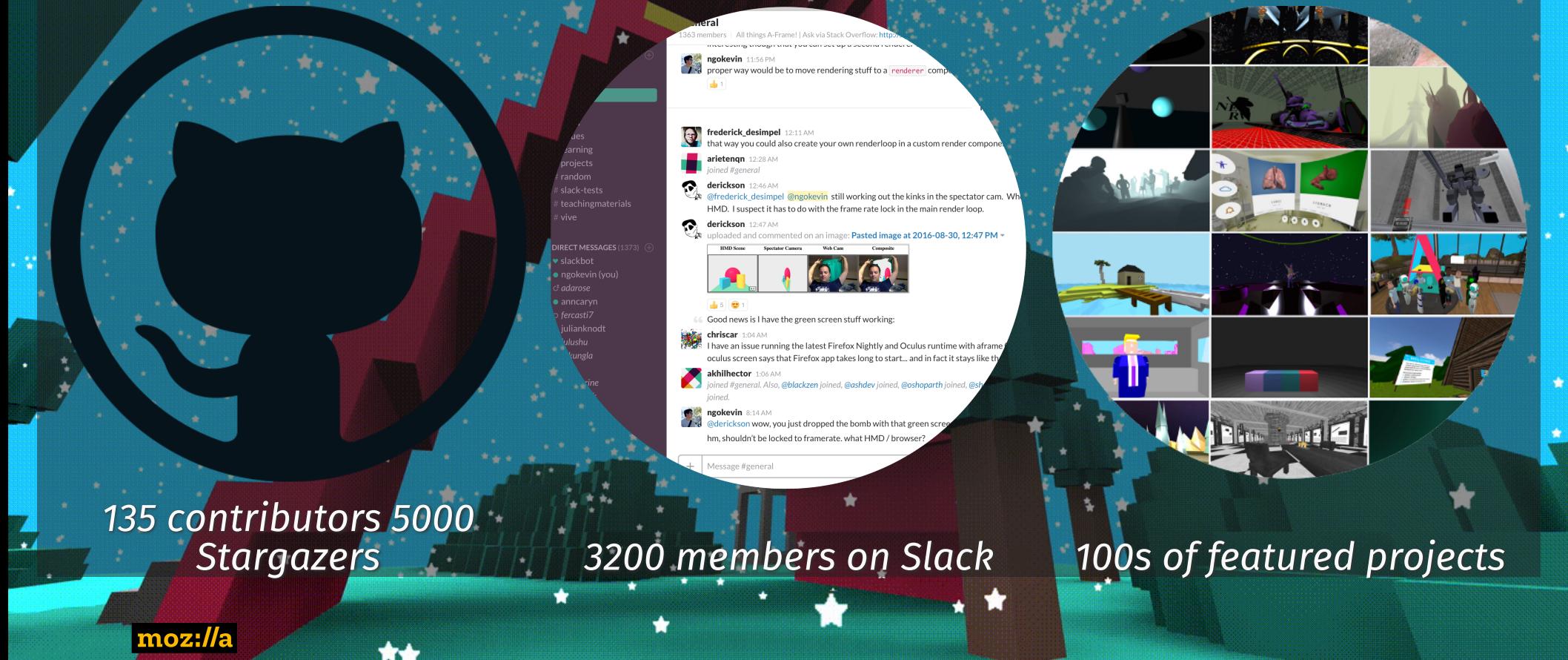
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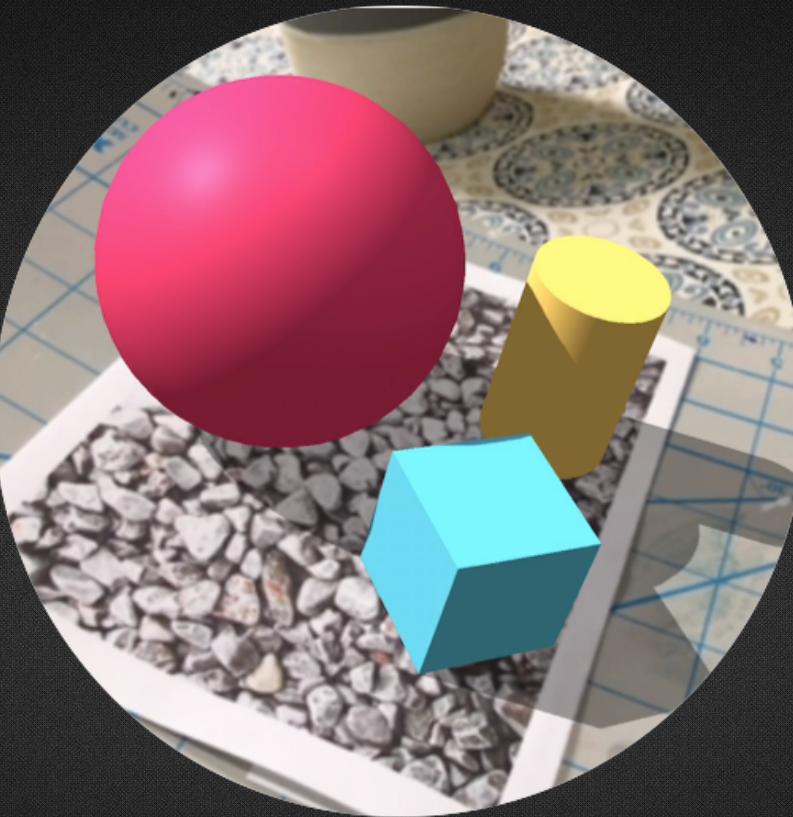
DATA VISUALIZATION - ADIT



AFRAME.IO

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





*Tech:
WebAR*

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Augmented Reality - Native Acceleration



Tracking and Positioning

WEBAR DOESN'T EXIST YET

But how close are we?

KHRONOS™ GROUP

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Download 3D
augmentation object
and scene data



Compute Low Latency
3D Applications for
display by optical system

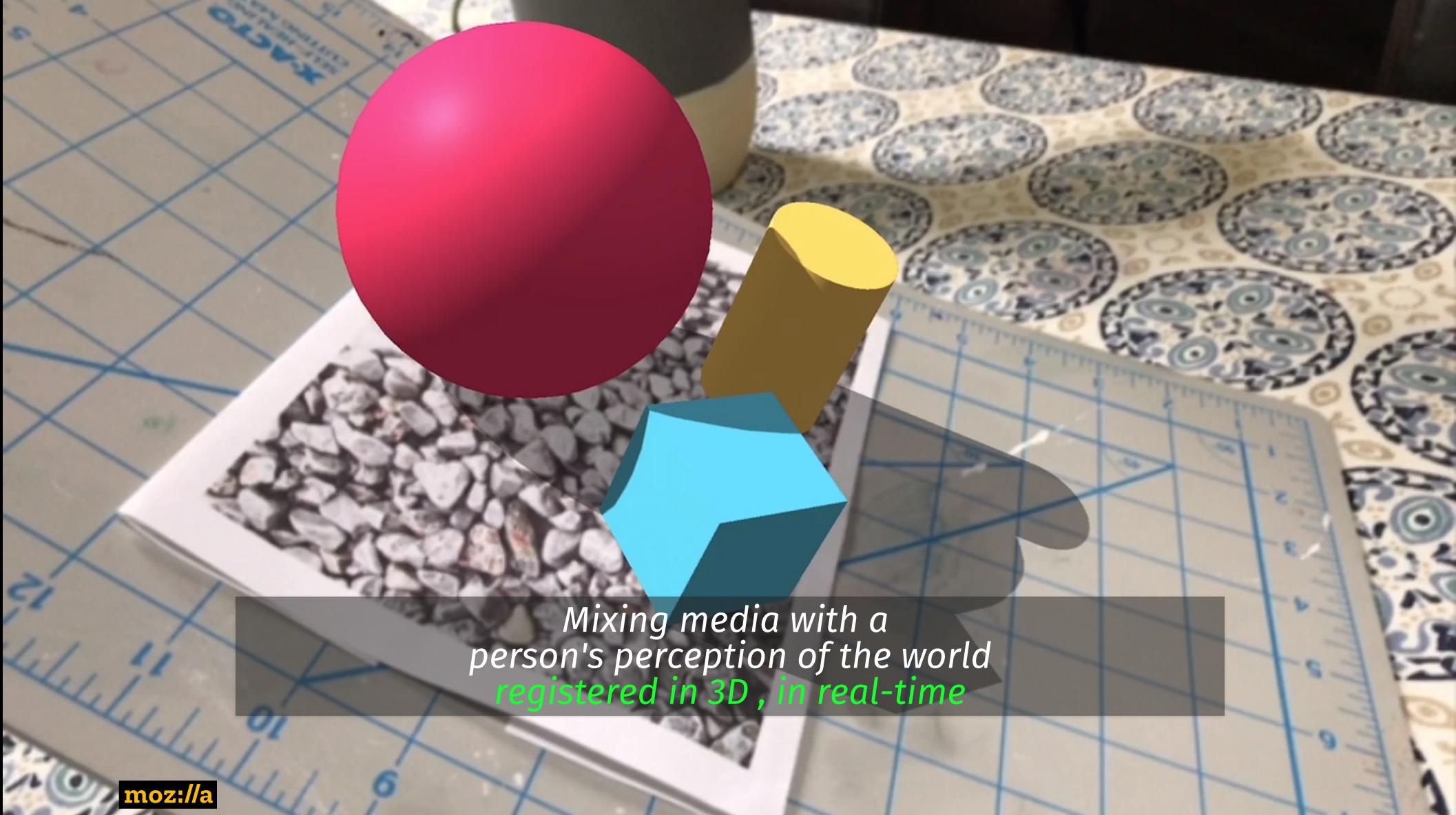
Vulkan.

AR Application

Interact with sensor, haptic
and display devices



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Tap anywhere to start

THE CHALLENGE OF AR

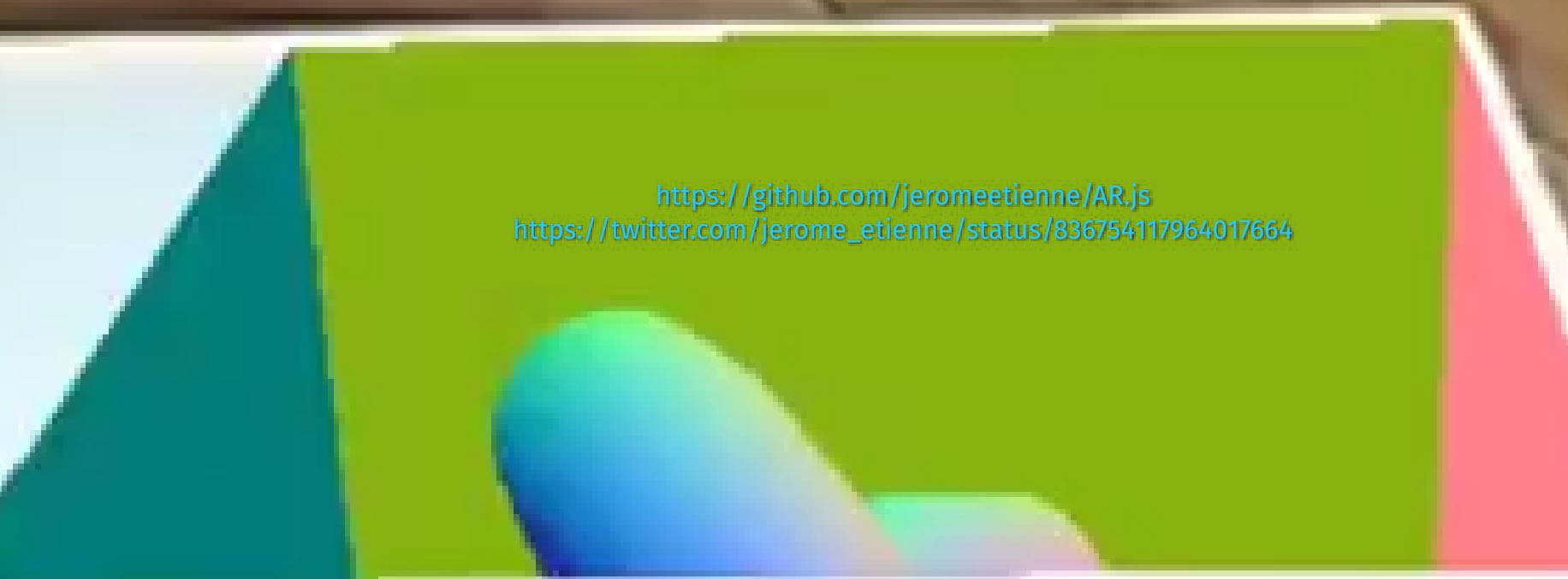
*Must display in **real time** (akin to VR)*

*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](#)
WebRTC `getUserMedia` + JS tracking
Added by [Fredrik Blomqvist](#) and [Jerome etienne](#)



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

https://twitter.com/jerome_etienne/status/836754117964017664



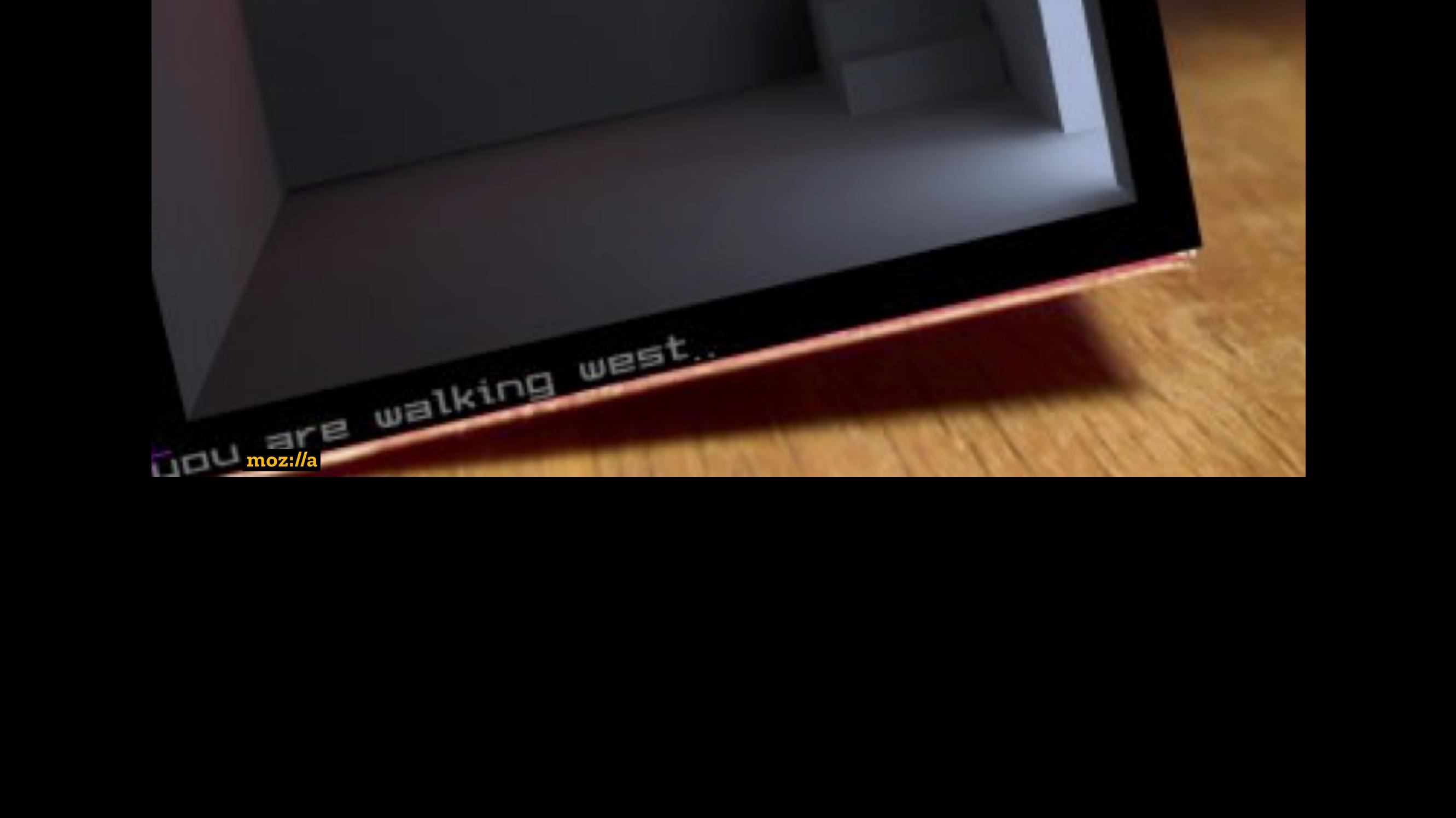
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IN THE LONG RUN, THIS SIMPLE APPROACH
WILL NOT BE ENOUGH

*VERY LITTLE WORLD KNOWLEDGE,
TIGHTLY COUPLED TO SPECIFIC TECHNOLOGY,
DOESN'T LEVERAGE PLATFORM 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. In the foreground, there is a dark, semi-transparent overlay with white text.

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-SPEC FC SENS NG 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 VS ...



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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](#).

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

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

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

(and more soon)

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!*

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THANKS!

Contact me: karanjai.moz@gmail.com and [@rabimba](https://twitter.com/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/DallasAlumniday18>

Thanks to everyone who worked on WebXR and Argon. Shoutout to [@blairmacintyre](https://twitter.com/blairmacintyre) and [@TrevorFSmith](https://twitter.com/TrevorFSmith)

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