

<DevSum>

20th edition

Mixed Reality for Web Devs

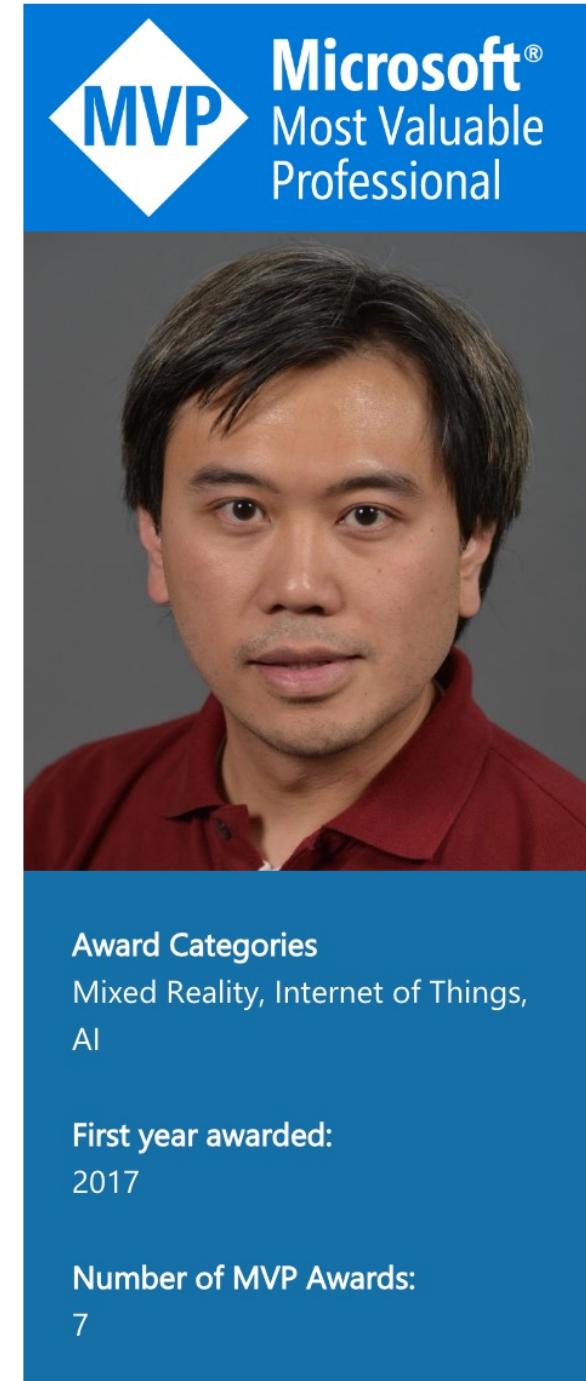
Ron Dagdag



Mixed Reality for Javascript Devs

Ron Dagdag
R&D Engineering
Manager at **7-ELEVEN.**

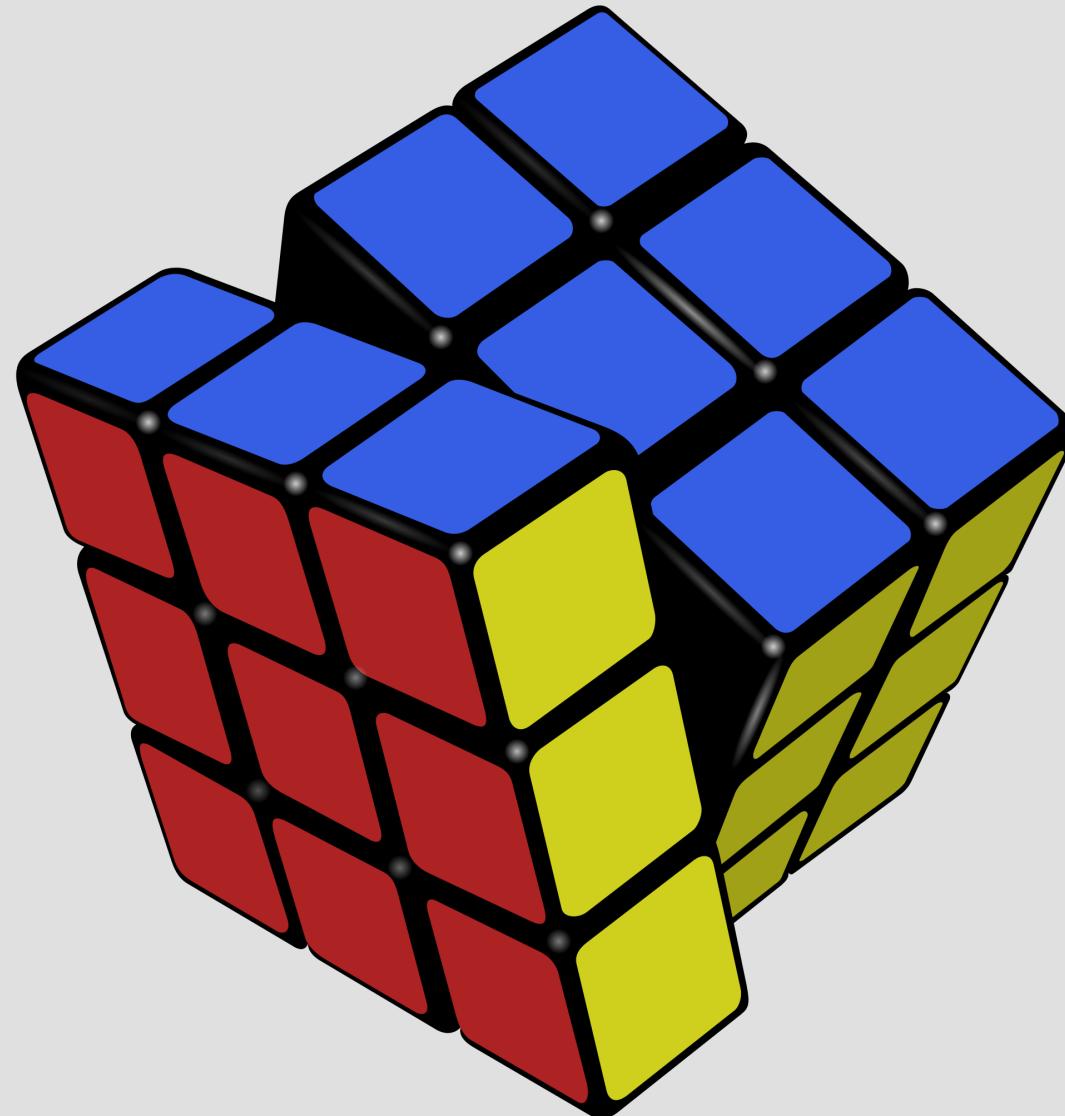
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Mixed Reality Devs
Virtual Reality
Augmented Reality
Javascript Devs

It was
originally
called a
'Magic Cube'



Agenda

- What is Mixed Reality?
- What is WebXR?
- What are open-source JS libraries available?

Github

link



<https://github.com/rondagdag/mr4jsdevs>

Takeaways

What is Mixed Reality?

- Blend physical and digital world

What is WebXR?

- Mixed Reality via web browsers

Types of Virtual Reality Experiences

- Non-immersive, Semi-immersive, Fully-immersive, Social

Types of Augmented Reality Experiences

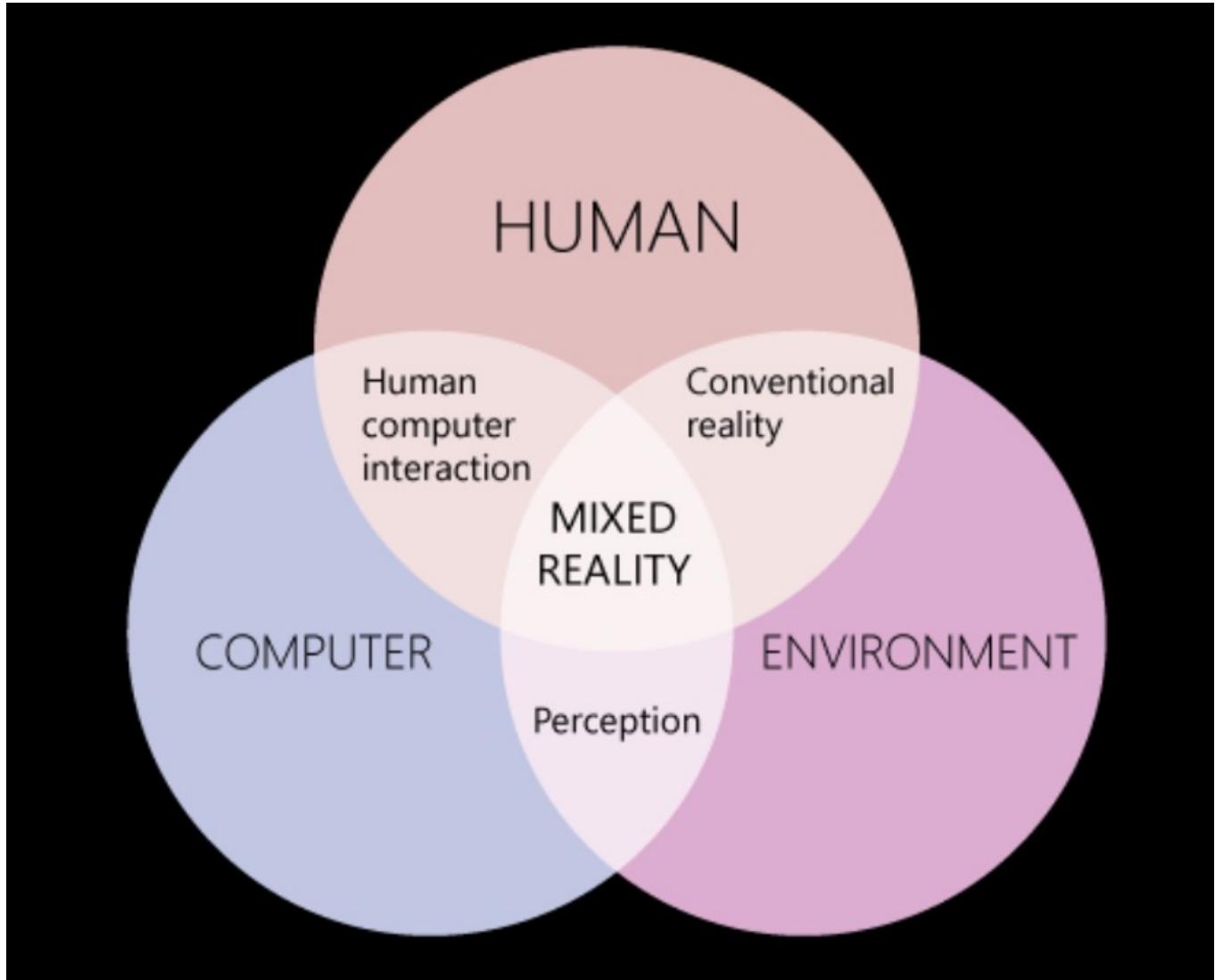
- Marker-based AR, Markerless AR, Location-based AR, Projection-based AR, Superimposition-based AR

What are open-source JS libraries available?

- ModelViewer, A-Frame, MindAR / Pictarize, BabylonJS, Three.JS

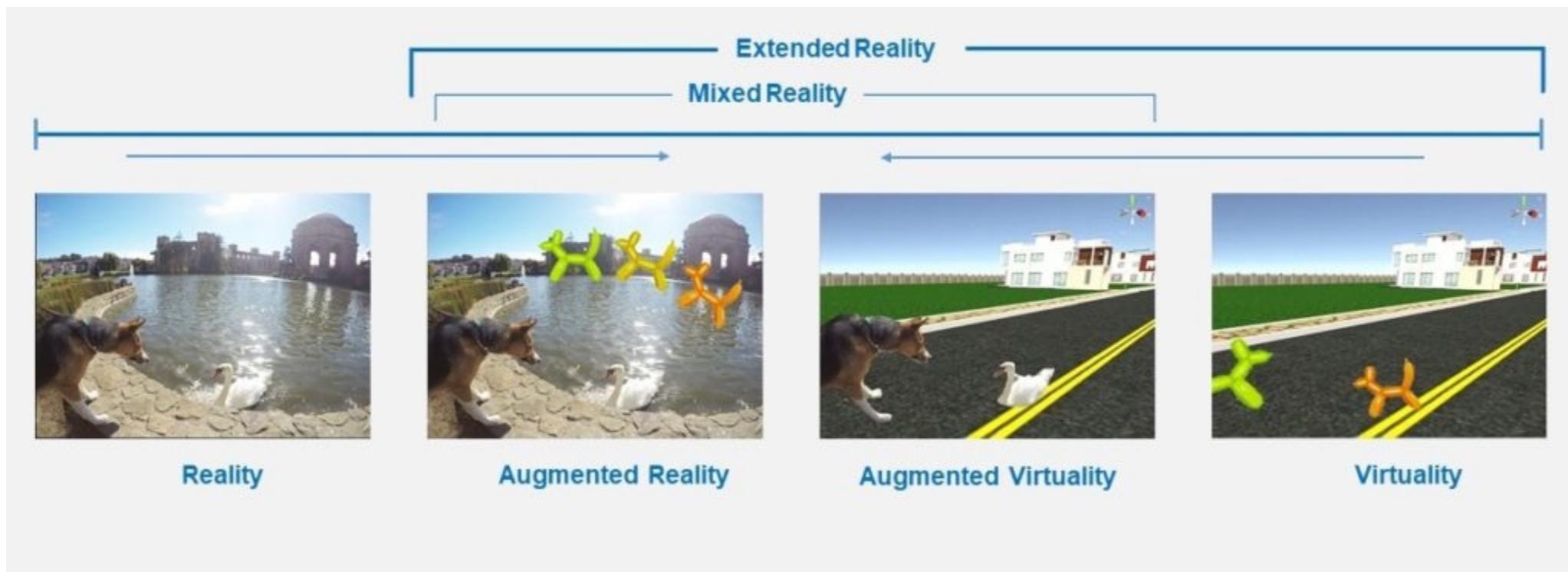
Mixed Reality

- blend physical and digital worlds
- unlocking natural and intuitive 3D
 - Human
 - Computer
 - environmental interaction



Mixed Reality

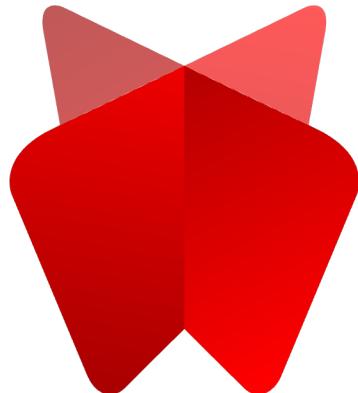
- advancements in computer vision, graphical processing, display technologies, input systems, and cloud computing
 - *Environmental understanding*: spatial mapping and anchors.
 - *Human understanding*: hand-tracking, eye-tracking, and speech input.
 - *Spatial sound*.
 - *Locations and positioning* in both physical and virtual spaces.
 - Collaboration on *3D assets* in mixed reality spaces.



<https://xr4all.eu/xr/>



There are 43
quintillion
possible
combinations



WebXR

- unified API for VR and AR devices
- VR headsets, AR glasses, and smartphones w/ browsers
- web platform and ecosystem
- **<https://immersiveweb.dev/>**
<https://immersive-web.github.io>
- iOS support - still experimental in Apple Vision OS

Advantage of WebXR

**Open
Platform**

Permissionless publishing

Sharable

Send a link

Accessible

Low barrier of entry

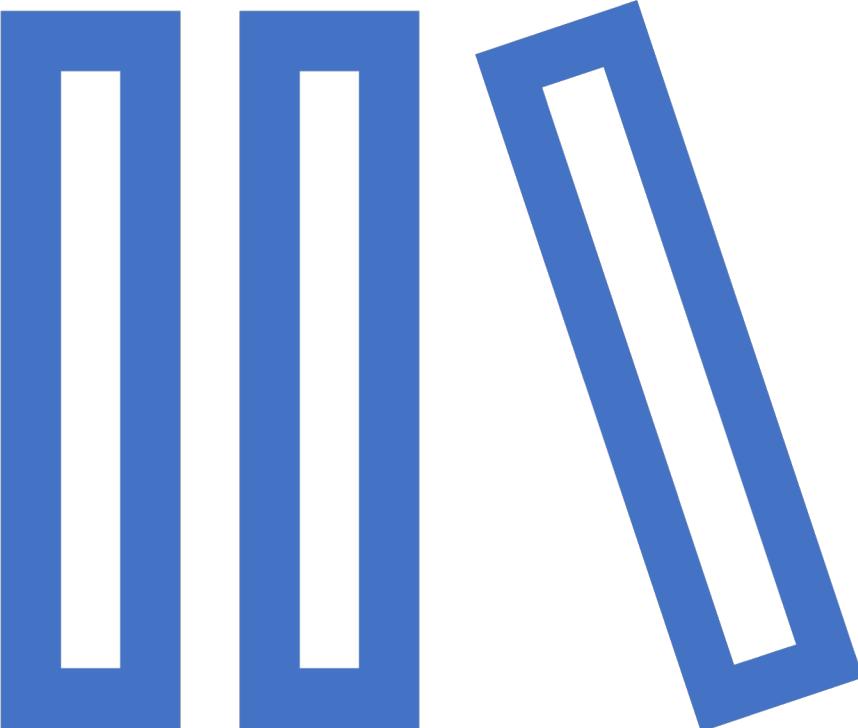
**Cross
Platform**

“Just works”

The world record
is...

Max Park breaks
3x3x3 Rubik's Cube
world record in just
3.13 seconds





Javascript Libraries/Framework Available

- ModelViewer
- A-Frame
- MindAR / Pictarize
- BabylonJS
- Coconut XR
- Three.JS
- MediaPipe
- ReactXR
- PlayCanvas
- Wonderland Engine
- Snap Lens Studio

ModelViewer (modelviewer.dev)



- a custom HTML element
- displaying 3D models and viewing in AR
- <https://modelviewer.dev/editor/>

```
<script type="module" src="https://unpkg.com/@google/model-viewer/dist/model-viewer.js"></script>
<script nomodule src="https://unpkg.com/@google/model-viewer/dist/model-viewer-legacy.js"></script>
```

<!--Use it like any other HTML element-- >

```
<model-viewer src="examples/assets/Astronaut.glb" ar alt="A 3D model of an astronaut" auto-rotate
camera-controls background-color="#455A64"></model-viewer>
```

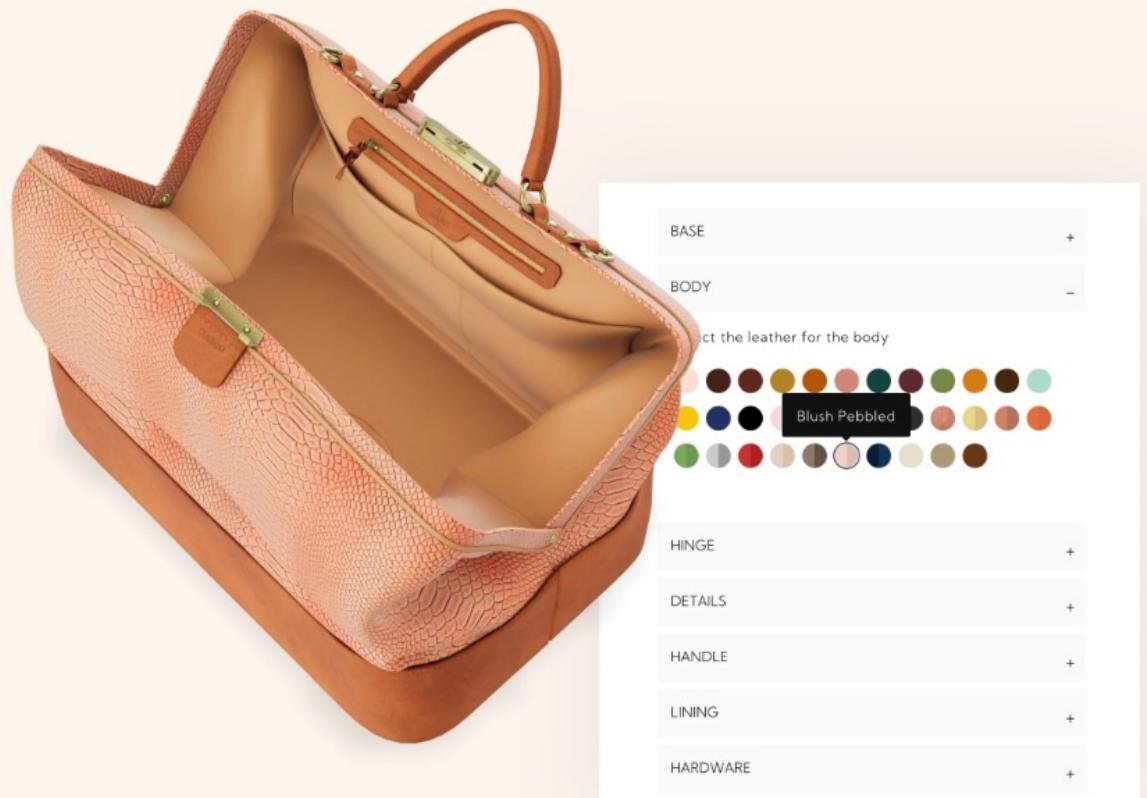


vanVeer

Use The Design Tool

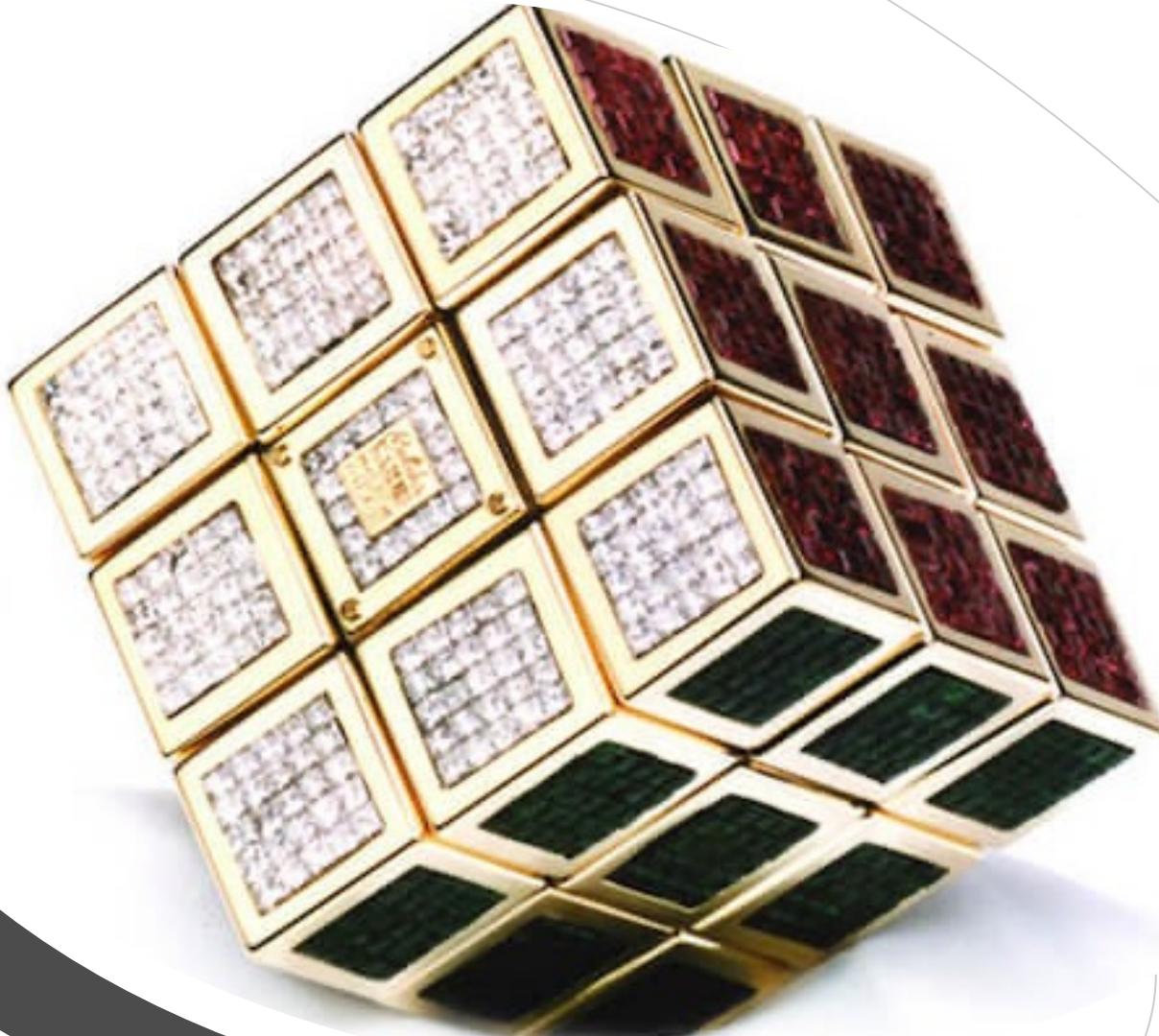
Use our 3D design tools to create your own VanVeer bag. See what your bag will look like within seconds! Design, redesign and start all over again. You can shape, add and change as much as you want until it feels like ooooh... just perfect!

START DESIGNING



<https://vanveer.com/products/original-custom-3d>

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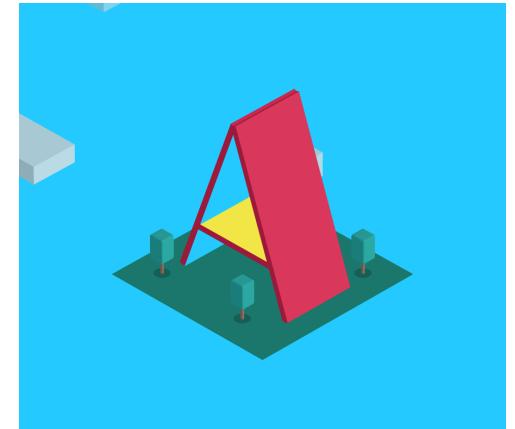
The Masterpiece Cube costs \$2.5 million

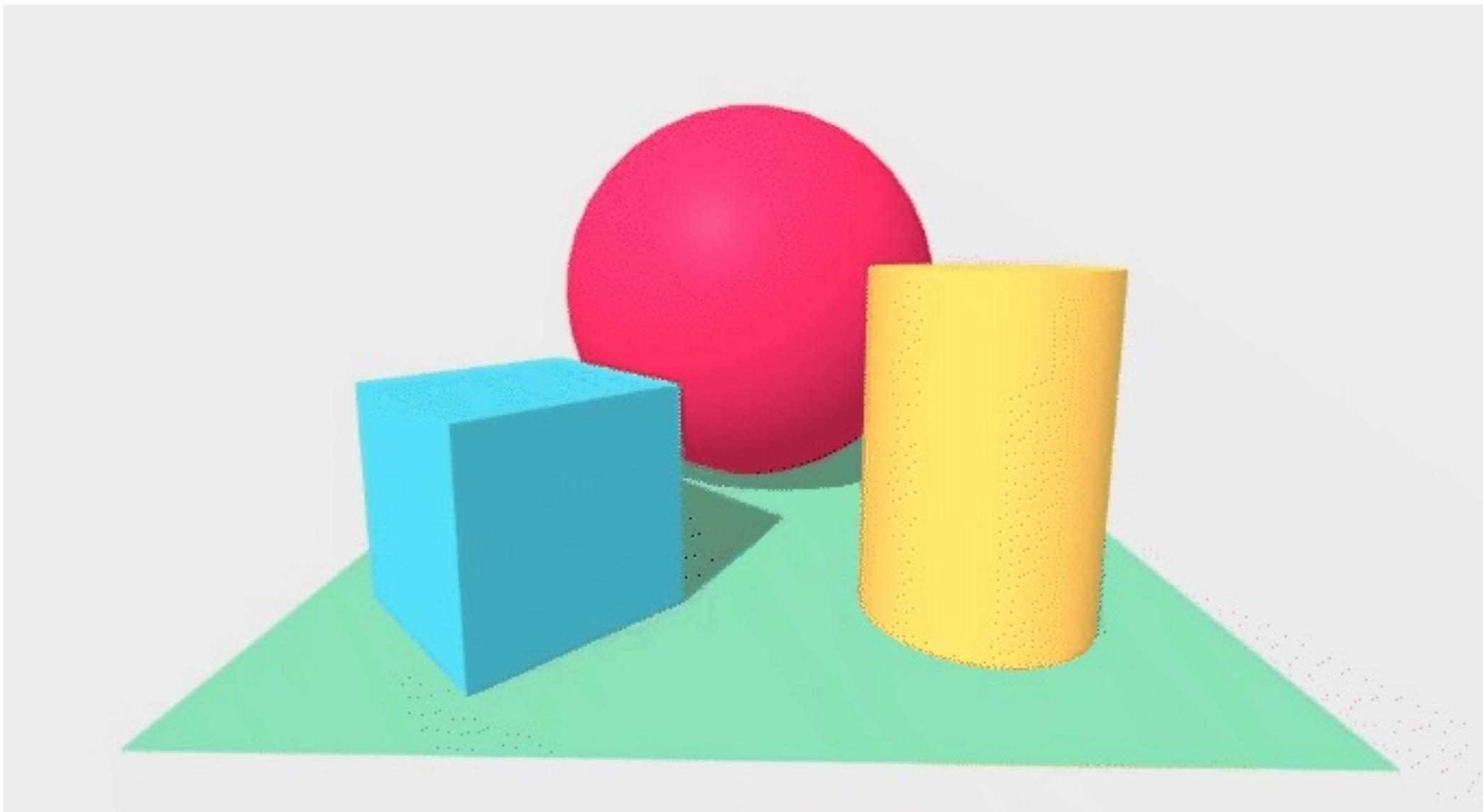
created in 1995 by Diamond Cutters International to commemorate the 15th anniversary

A-Frame (aframe.io)

- web framework for building 3D/AR/VR experiences using a combination of HTML and Javascript.
- <https://aframe.io/examples/showcase/helloworld/>

```
<html>
  <head>
    <script src="https://aframe.io/releases/1.2.0/aframe.min.js"></script>
  </head>
  <body>
    <a-scene>
      <a-box position="-1 0.5 -3" rotation="0 45 0" color="#4CC3D9"></a-box>
      <a-sphere position="0 1.25 -5" radius="1.25" color="#EF2D5E"></a-sphere>
      <a-cylinder position="1 0.75 -3" radius="0.5" height="1.5" color="#FFC65D"></a-cylinder>
      <a-plane position="0 0 -4" rotation="-90 0 0" width="4" height="4" color="#7BC8A4"></a-plane>
      <a-sky color="#ECECEC"></a-sky>
    </a-scene>
  </body>
</html>
```





Entity Component System

Entity

- general-purpose object -> positioned and transformed in a scene.

Component

- behavior or functionality that can be attached to an Entity.
Reusable Modules.

System

- global scope, management, and services for classes of components.
- systems handle the logic, components act as data containers

Box = Position + Geometry + Material

Light Bulb = Position + Light + Geometry + Material + Shadow

VR Controller = Position + Rotation + Input + Model + Grab + Gestures

Ball = Position + Velocity + Physics + Geometry + Material

Player = Position + Camera + Input + Avatar + Identity

```
<script src="https://aframe.io/releases/1.4.2/aframe.min.js"></script>
<script src="./components/obelisk.js"></script>

<a-scene webxr="requiredFeatures: anchors,local-floor"
vr-mode-ui="enterAREnabled: true; enterVREnabled: false">
<a-assets>
  <a-asset-item id="rubikscube" src="../rubiks_cube.glb"></a-asset-item>
</a-assets>
<!-- obelisks -->
<a-entity position="0 0 -1.5" obelisk="cubemap: assets/cubemaps/rubixcubeworld;
bottomModel: #rubikscube; sphereImage: assets/moon_texture.jpg" freeze-
workaround></a-entity>
</a-scene>
```



Someone solved a Rubik's Cube while skydiving!

- Dan Knight jumped out of a plane
- solve the puzzle in the 30 seconds it took him to fall to the ground

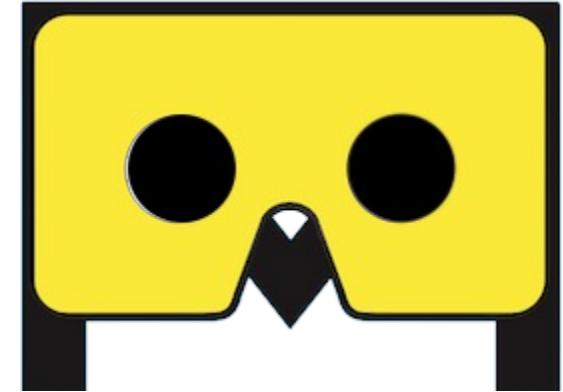


<https://www.youtube.com/watch?v=dtRsKWAECb8>

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MindAR

- web augmented reality library.
- supports Image Tracking and Face Tracking.
- <https://hiukim.github.io/mind-ar-js-doc/>



<https://hiukim.github.io/mind-ar-js-doc/tools/compile>

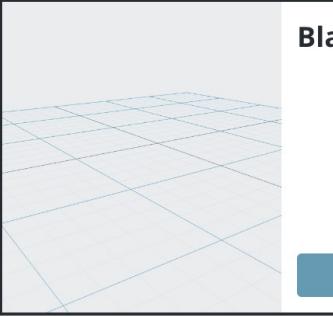
```
<html>
  <head>
    <script src="https://aframe.io/releases/1.3.0/aframe.min.js"></script>
    <script src="https://cdn.jsdelivr.net/npm/mind-ar@1.2.0/dist/mindar-image-aframe.prod.js"></script>
  </head>
  <body>
    <a-scene mindar-image="imageTargetSrc: ./rubiks.mind;" color-space="sRGB" renderer="colorManagement: true,
physicallyCorrectLights" vr-mode-ui="enabled: false" device-orientation-permission-ui="enabled: false">
      <a-assets>
        <a-asset-item id="avatarModel" src="../rubiks_cube.glb"></a-asset-item>
      </a-assets>
      <a-camera position="0 0 0" look-controls="enabled: false"></a-camera>
      <a-entity mindar-image-target="targetIndex: 0">
        <a-gltf-model rotation="0 0 0 " position="0 0 0.1" scale="5 5 5" src="#avatarModel" animation="property: position;
to: 0 0.1 0.1; dur: 1000; easing: easeInOutQuad; loop: true; dir: alternate">
      </a-entity>
    </a-scene>
  </body>
</html>
```

Pictarize Studio

web based drag-n-drop editor, building and publishing interactive web AR apps with 3D models, videos, audios and texts!

Projects Create Project...

Create a blank project or start from a template X



Blank Project

Create



Slideshow

- multiple videos
- carousel effect (script)

Clone



Flash Cards

- multiple targets
- background music
- audio on click (script)

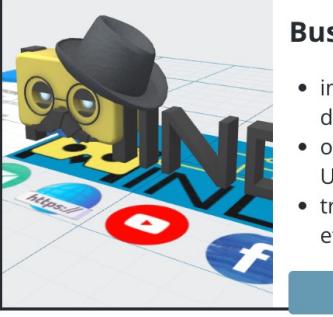
Clone



Performance

- real persons
- green screen background removal

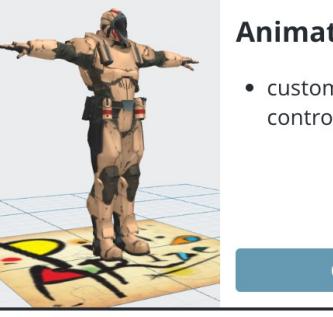
Clone



Business Card

- information display
- open external URLs
- transition effects (script)

Clone



Animated Models

- custom animations control (script)

Clone

<https://pictarize.com/>

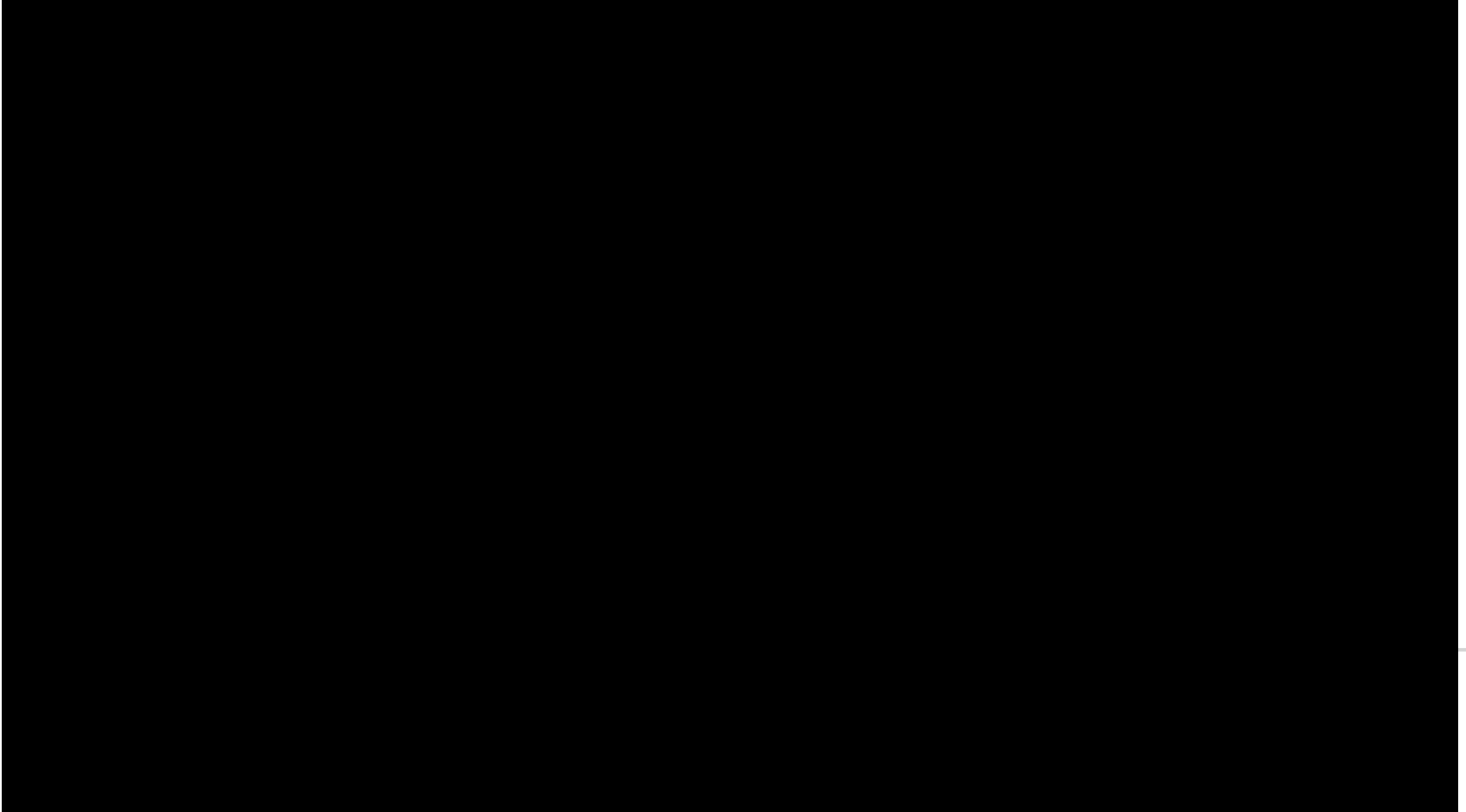
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Pictarize Studio

<https://pictarize.com/>



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Largest Rubik's Cube

<https://youtu.be/SkwIRTX2ecA?t=35>

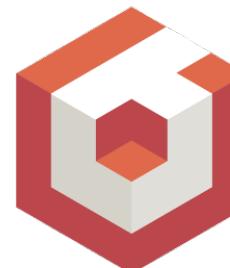
BabylonJS

- real-time 3D game engine
- TypeScript support
- full WebXR support out of the box, including gaze and teleportation support, AR experimental features
- open-source library to create 3D experiences, animations, and games in the browser
- fast, efficient, and flexible



BabylonJS

- tools for creating interactive 3D scenes
- create 3D models, manipulate camera movements, lighting/shadows/animations.
- physics simulation, collision detection
- Supported Devices
 - Android Phones
 - Hololens 2
 - Quest
 - Apple Vision Pro



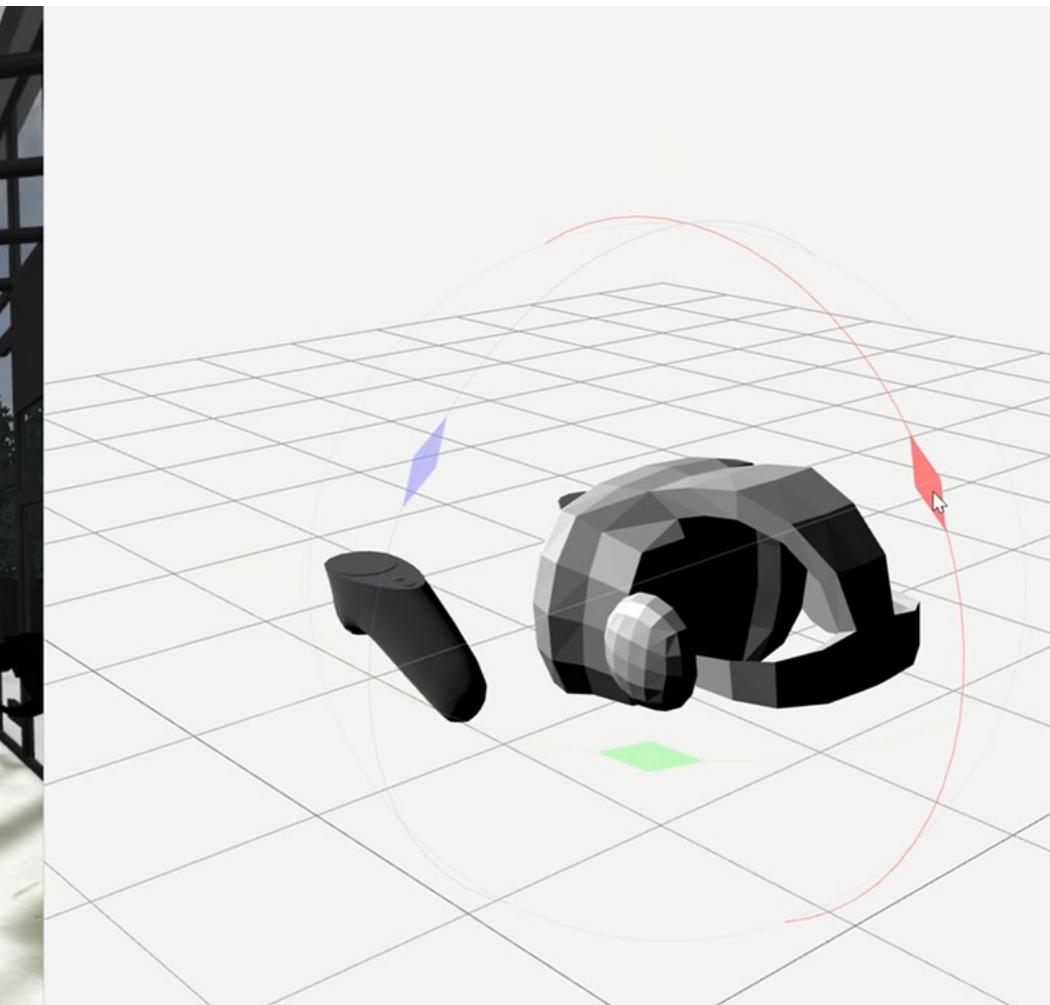
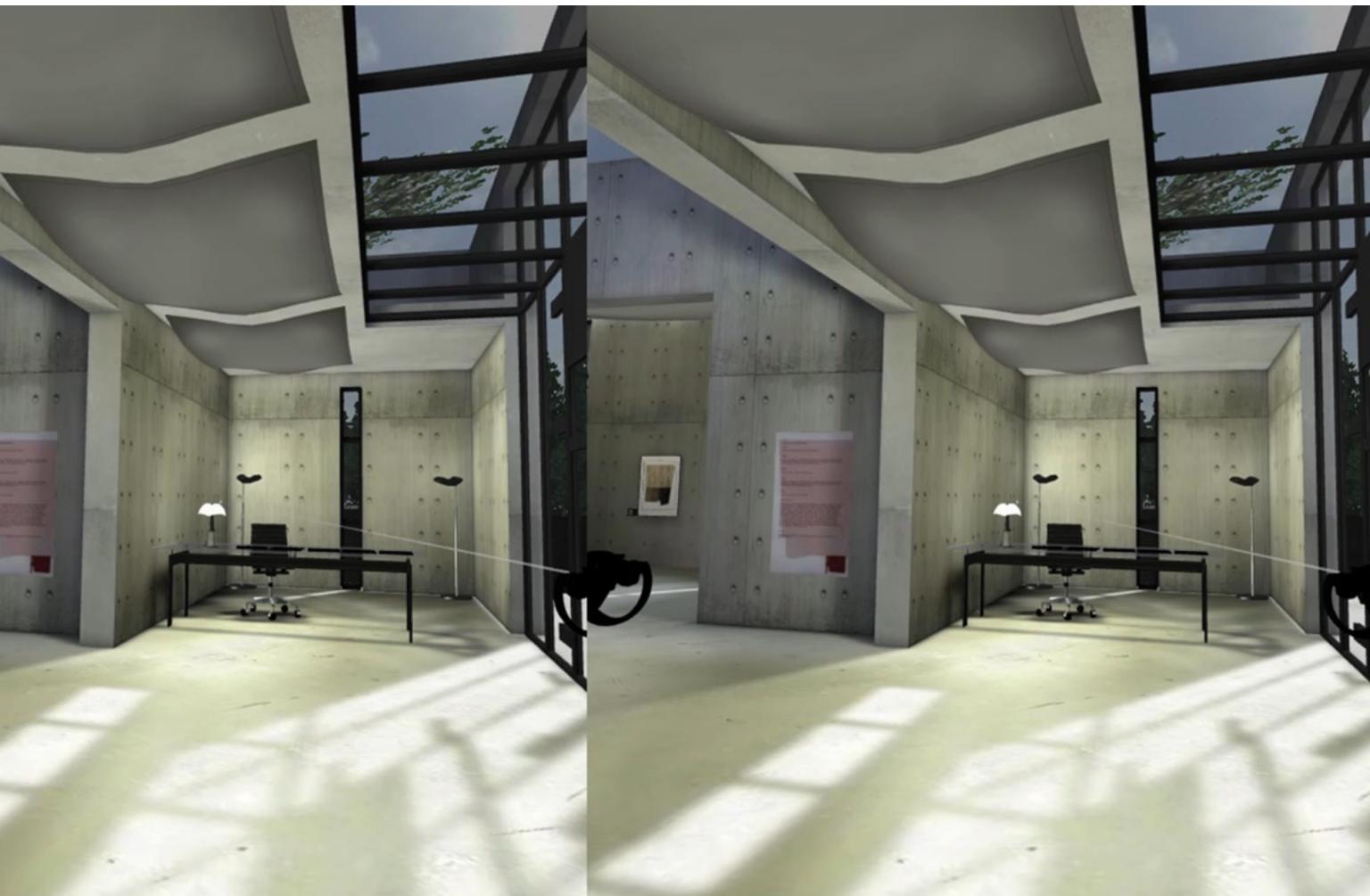
babylon.js

```
var createScene = function () {
    // Playground needs to return at least an empty scene and default camera
    var scene = new BABYLON.Scene(engine);
    var camera = new BABYLON.FreeCamera("camera1", new BABYLON.Vector3(0, 5, -10), scene);

    // Async call
    BABYLON.SceneLoader.Append("https://www.babylonjs.com/Scenes/Espilit/",
        "Espilit.babylon", scene, async function () {
            var xr = await scene.createDefaultXRExperienceAsync(
                {floorMeshes: [scene.getMeshByName("Sols")]}));
        });

    return scene;
};
```

<https://playground.babylonjs.com/#JA1ND3#164>



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Nike By You Shoes



←

Mudguard 2/16

→

Boucle

Leather

Pearlized Snake

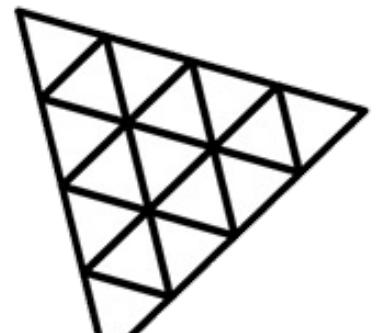


<https://www.nike.com/w/nike-by-you-shoes-6ealhzy7ok>

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three.js

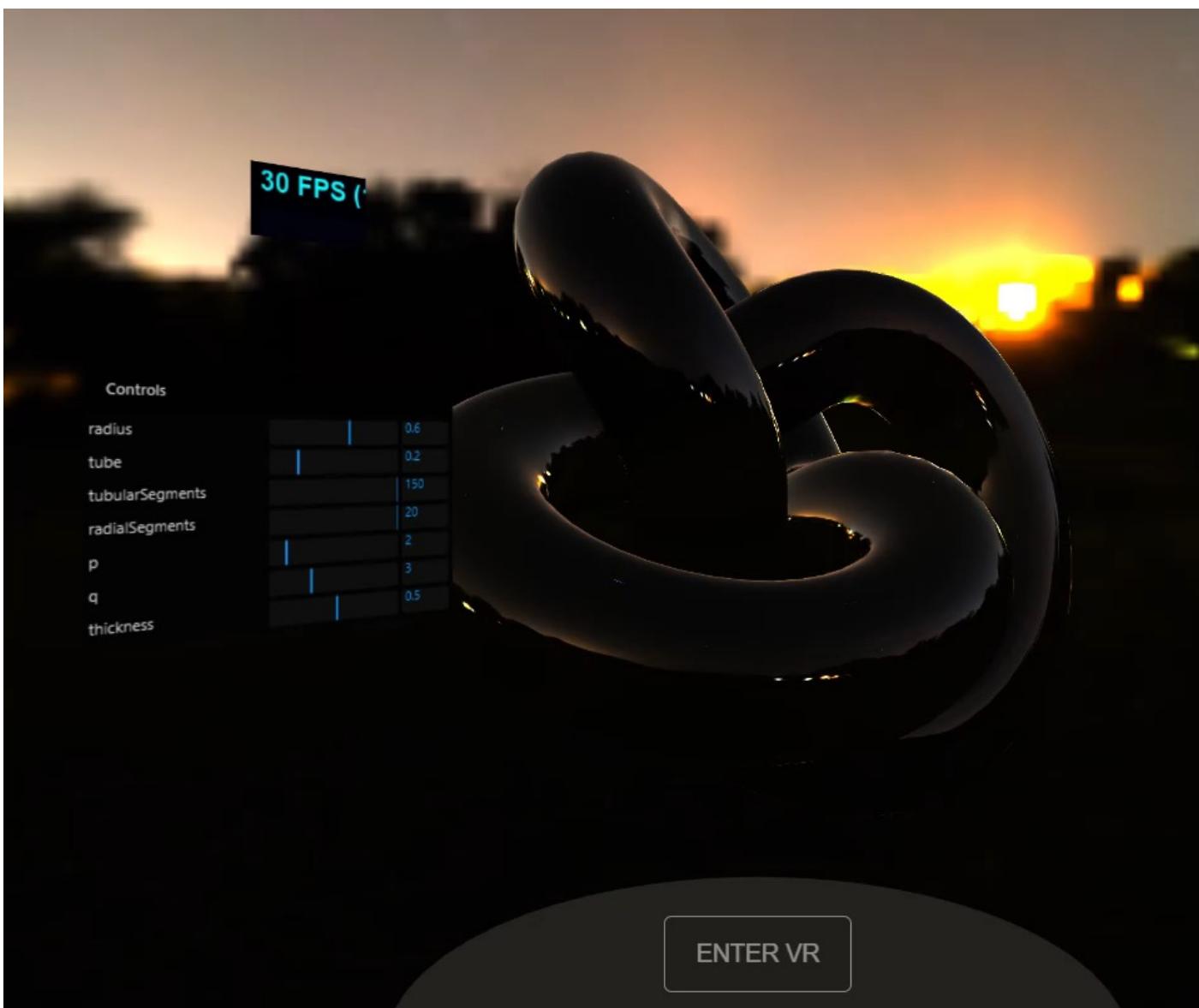
- Open source, cross-browser JavaScript library
 - Large community, good docs, and many examples.
 - create and display animated 3D computer graphics in a web browser
-
- <https://threejs.org/examples/?q=webxr>
 - <https://developers.google.com/ar/develop/webxr/hello-webxr>



three.js

WebXR and Three.JS

- <https://intro-to-webxr.glitch.me/>
- <https://glitch.com/edit/#!/intro-to-webxr>

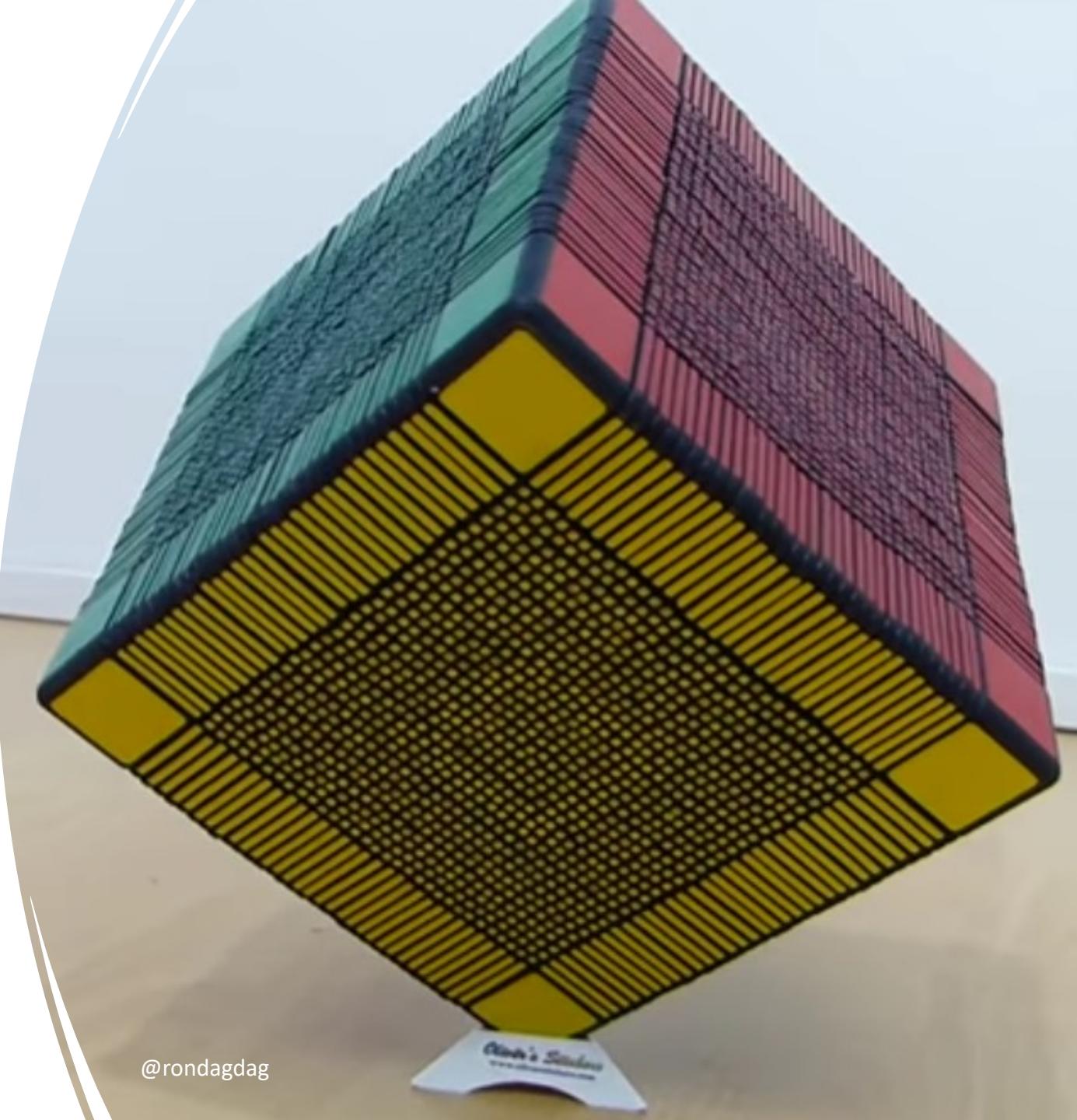


https://raw.githubusercontent.com/mrdoob/three.js/master/examples/webxr_vr_sandbox.html



<https://developers.google.com/ar/develop/webxr/hello-webxr>

WORLD RECORD $33 \times 33 \times 33$ RUBIK's CUBE

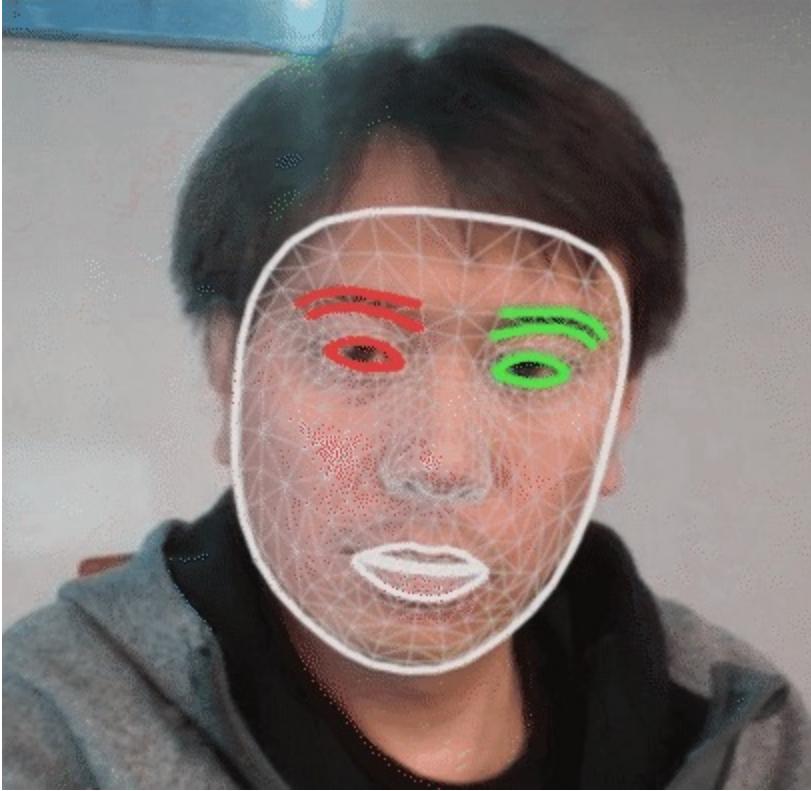


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Mediapipe

open-source framework, cross-platform, multi-device apps - computer vision and media processing

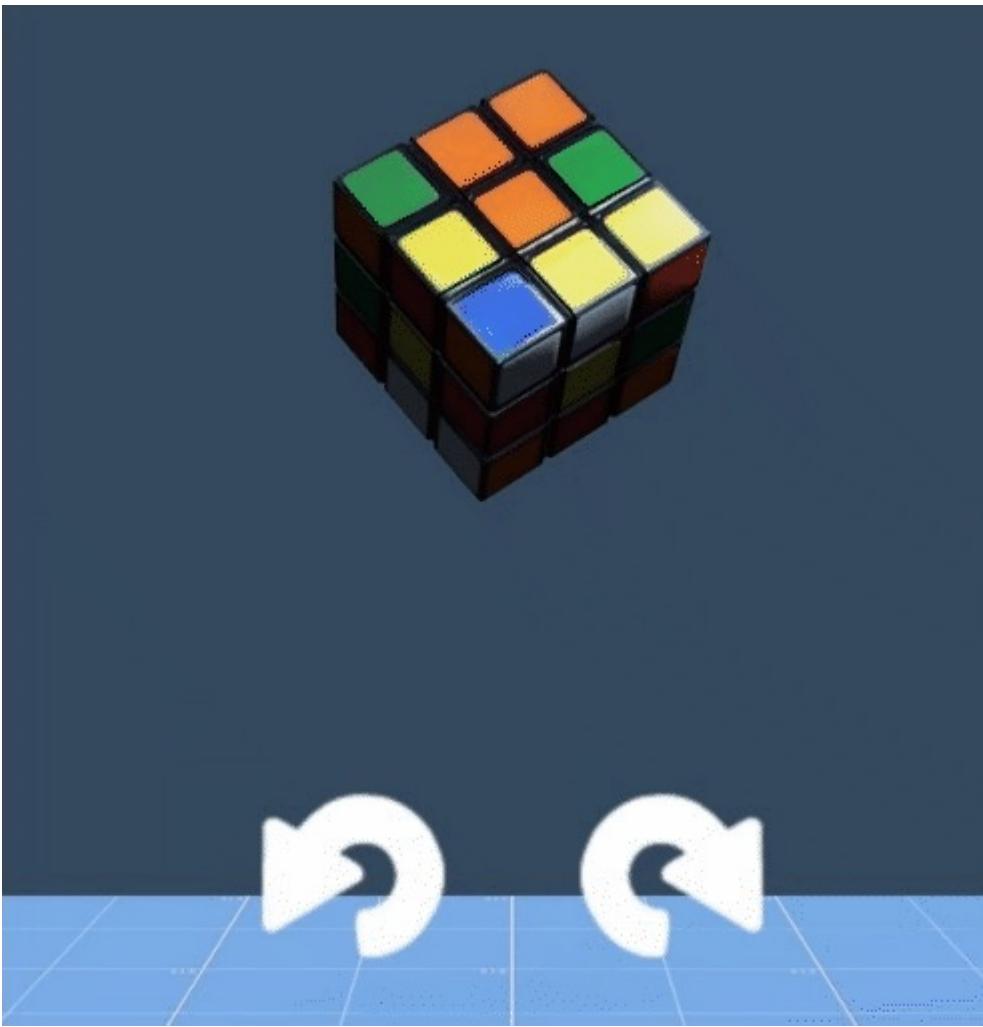
Solution	NPM Package	Example
<u>Face Mesh</u>	<u>@mediapipe/face_mesh</u>	<u>mediapipe.dev/demo/face_mesh</u>
<u>Face Detection</u>	<u>@mediapipe/face_detection</u>	<u>mediapipe.dev/demo/face_detection</u>
<u>Hands</u>	<u>@mediapipe/hands</u>	<u>mediapipe.dev/demo/hands</u>
<u>Holistic</u>	<u>@mediapipe/holistic</u>	<u>mediapipe.dev/demo/holistic</u>
<u>Objectron</u>	<u>@mediapipe/objectron</u>	<u>mediapipe.dev/demo/objectron</u>
<u>Pose</u>	<u>@mediapipe/pose</u>	<u>mediapipe.dev/demo/pose</u>
<u>Selfie Segmentation</u>	<u>@mediapipe/selfie_segmentation</u>	<u>mediapipe.dev/demo/selfie_segmentation</u>



PlayCanvas

- open source HTML5 game engine
- built on WebGL and glTF
- building games, playable ads,
- visualizations, VR and AR.





Wonderland Engine



- development platform for web-based graphics applications
- optimized WebAssembly-based runtime and shaders
- Visual Editor
 - convenient setup of 3D scenes
 - integrated live-reloading webserver
- JavaScript/TypeScript API allows any JavaScript library and Browser API.
- Implement custom, reusable components and configure them in the editor
- <https://wonderlandengine.com/getting-started/quick-start-mr/>

Wonderland Engine

```
import {Component, Property} from '@wonderlandengine/api';

/**
 * rotate component
 */

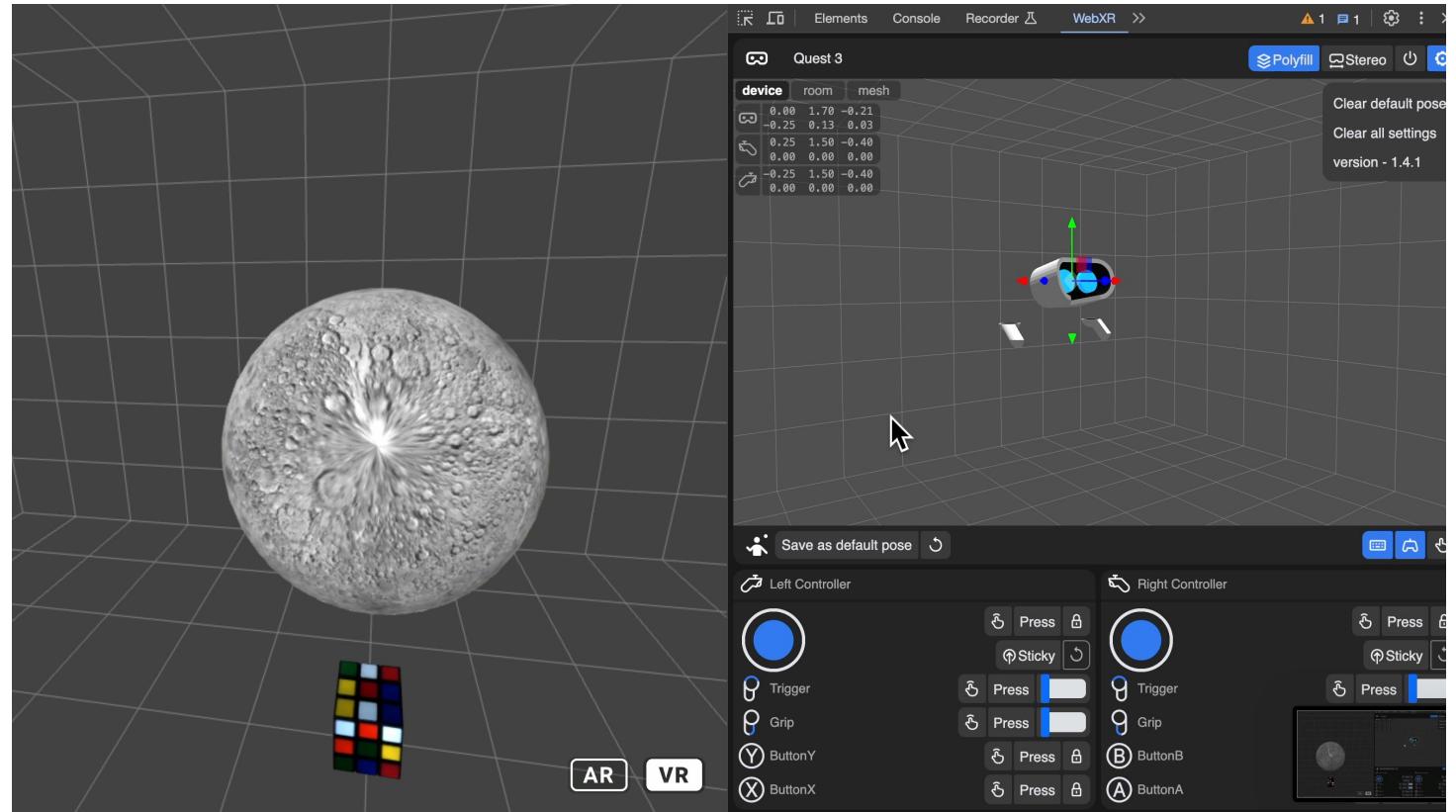
export class Rotate extends Component {
    static TypeName = 'rotate';
    /* Properties that are configurable in the editor */
    static Properties = {
        cubeMesh0bject: Property.object(),
        speed: Property.float(1),
    };

    start() {
        console.log('start() with param', this.param);
    }

    update(dt) {
        /* Called every frame. */
        this.cubeMesh0bject.rotateAxisAngleDeg0bject([0, 1, 0], this.speed * dt);
    }
}
```

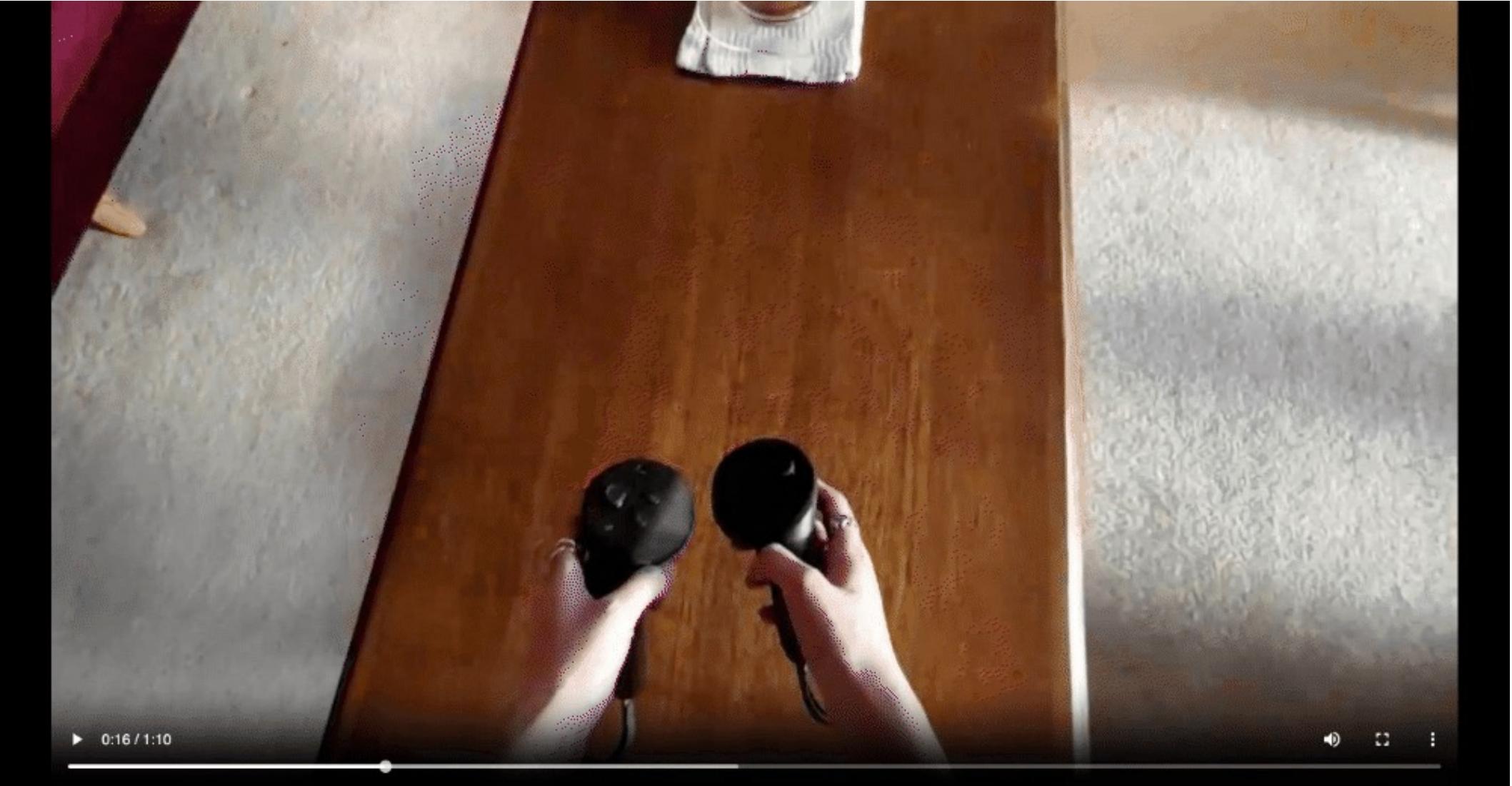
Chromium Tools

- Meta - [Immersive Web Emulator](#)
- Mozilla - [WebXR API Emulator](#)



<https://github.com/Pico-Developer/awesome-webxr-development>

<https://spatialfusion.io/>







Robots can
solve it in
under one
second.

https://youtu.be/cS2g_C6M7Bs?t=123

Summary

What is Mixed Reality?

- Blend physical and digital world

What is WebXR?

- Mixed Reality via web browsers

What are open-source JS libraries available?

- ModelViewer, A-Frame, MindAR, BabylonJS, Three.JS, Mediapipe, PlayCanvas, Wonderland Engine

Github

link

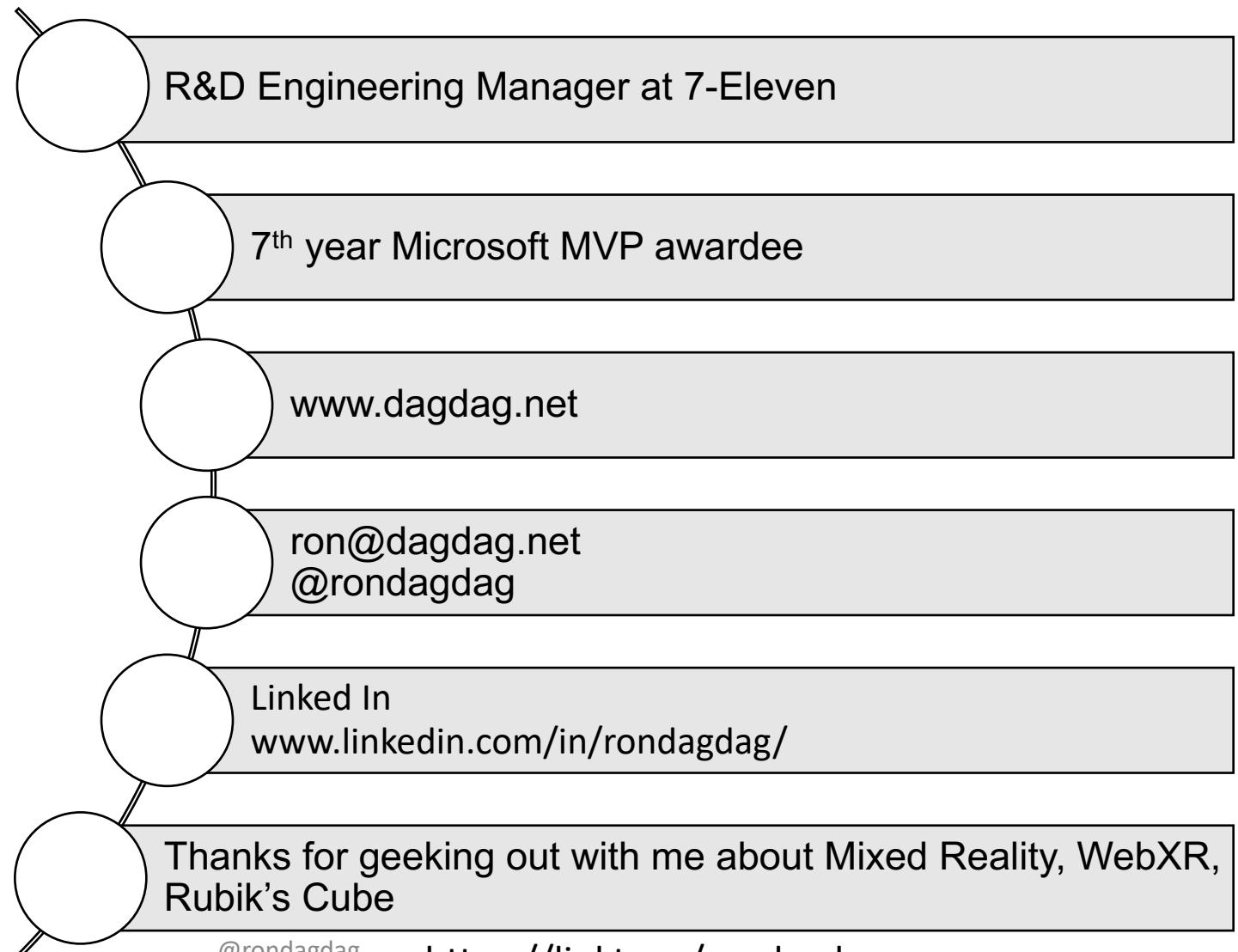


<https://github.com/rondagdag/mr4jsdevs>



About Me

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