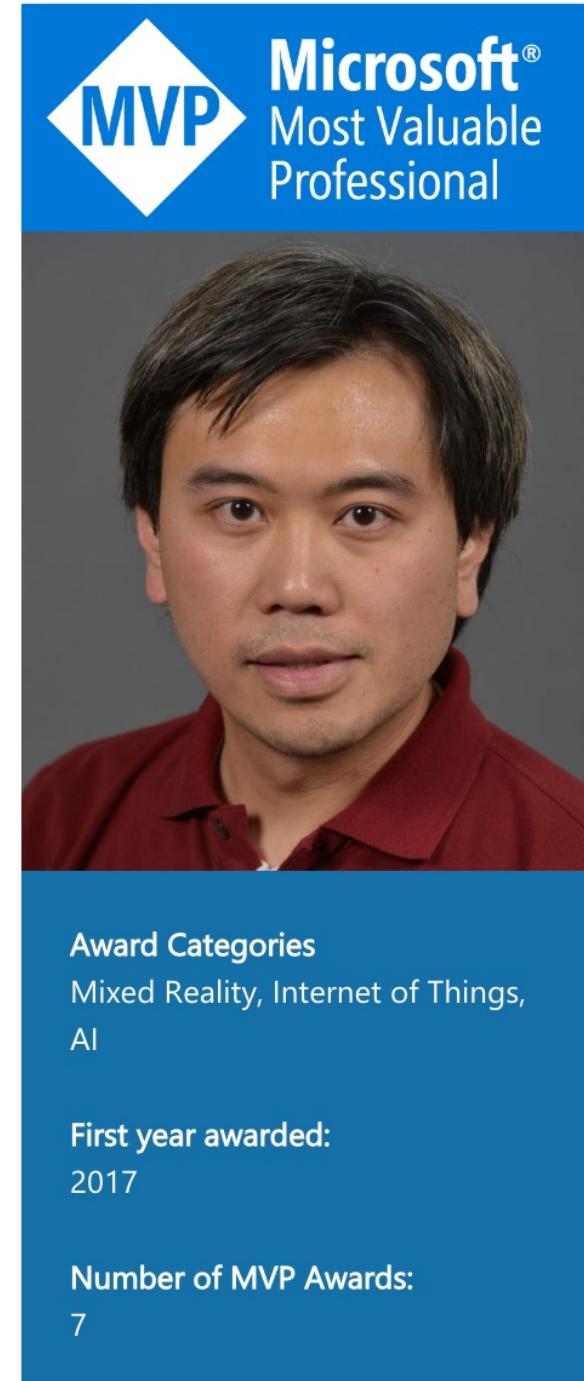


# Mixed Reality for Javascript Devs

---

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

@rondagdag



# SPECIAL THANKS TO ALL OUR AWESOME CAMP SPONSORS!



***Unspecified***  
SOFTWARE CO



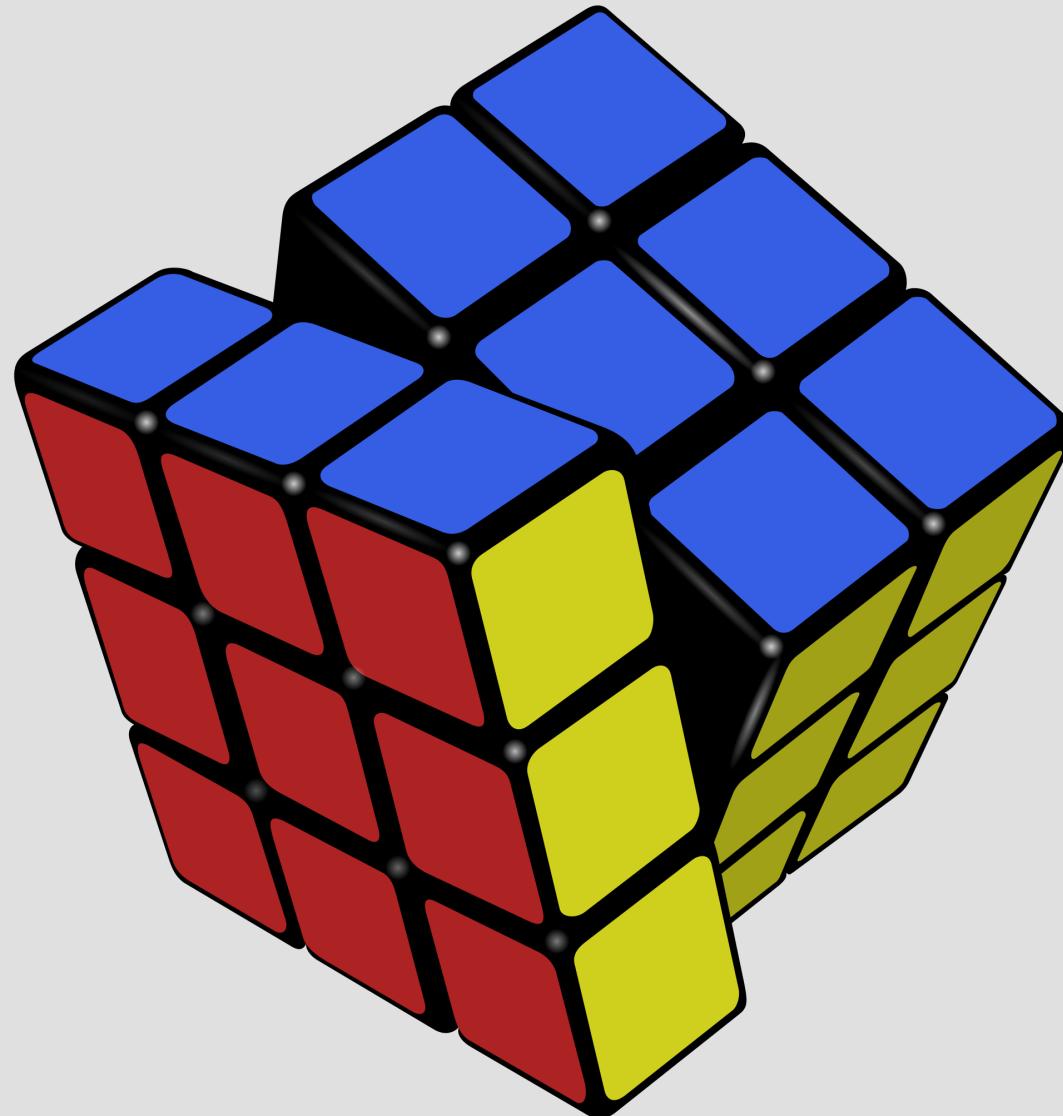
Google Cloud





Mixed Reality Devs  
Virtual Reality  
Augmented Reality  
Javascript Devs

It was  
originally  
called a  
'Magic Cube'



# Agenda

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- What is Mixed Reality?
- What is WebXR?
- Types of Virtual Reality Experiences
- Types of Augmented Reality Experiences
- What are open-source JS libraries available?

Github  
Link

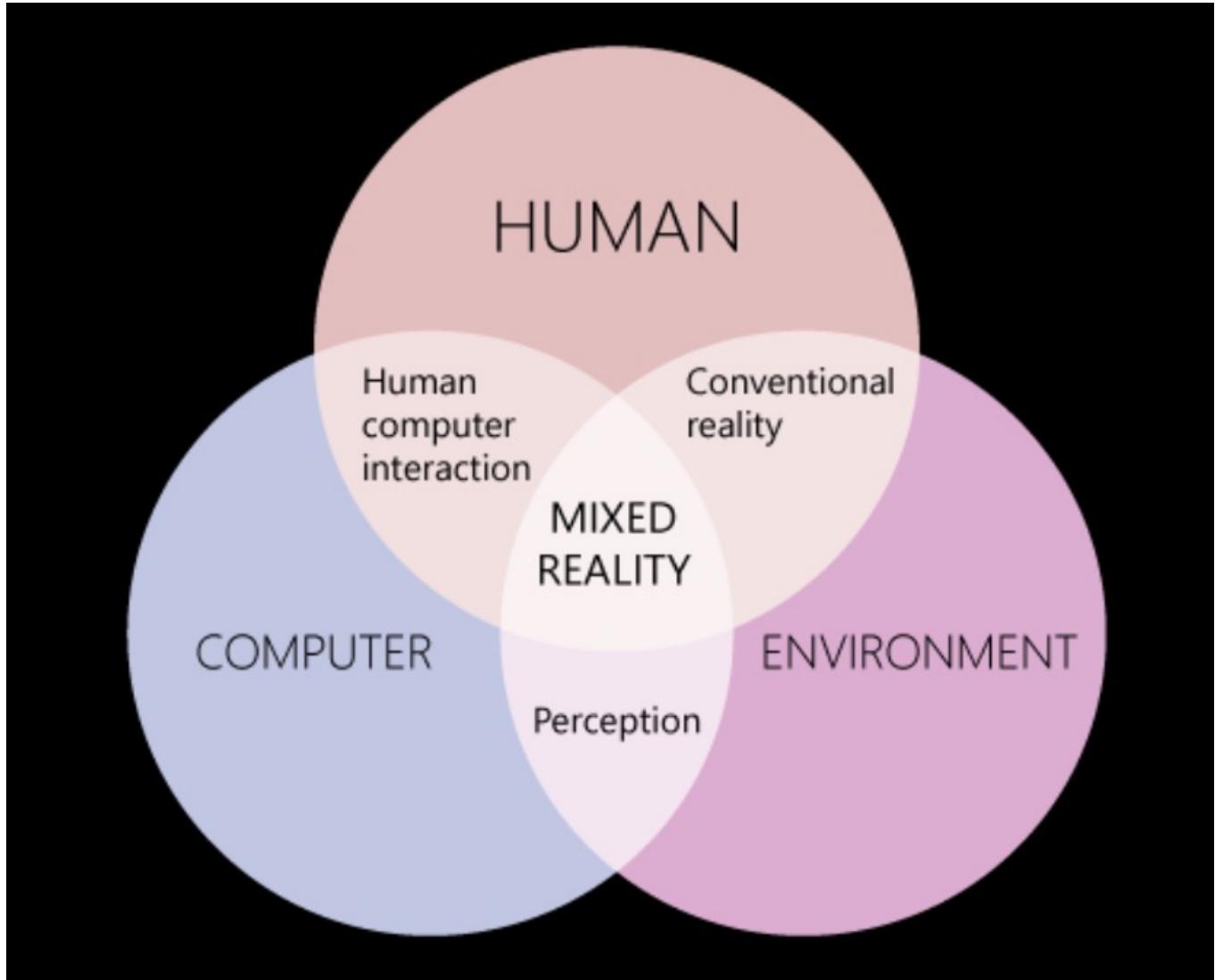


<https://github.com/rondagdag/mr4jsdevs>



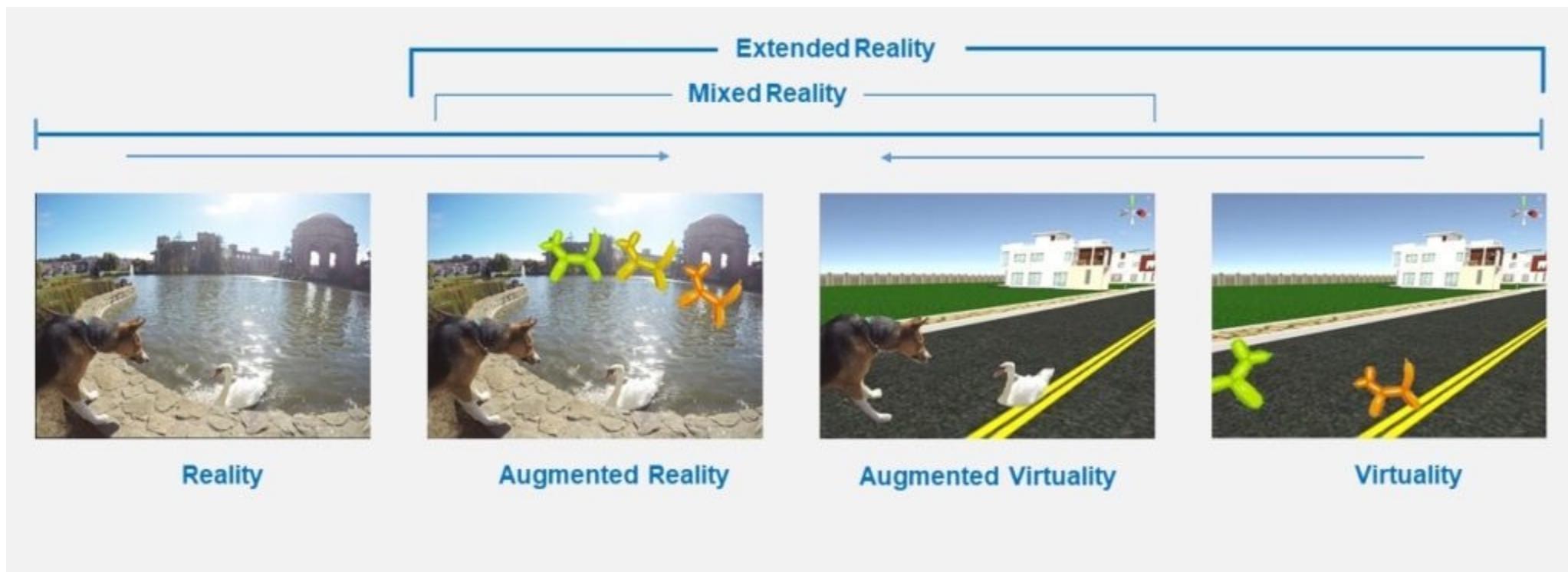
# Mixed Reality

- 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/>

# Types of Virtual Reality experiences

## Non-Immersive VR

- see the real world and virtual objects at the same time
- Video games

## Semi-Immersive VR

- see the virtual world, some visual connection to the real world
- 360 Virtual tour

## Fully-Immersive VR

- completely immerses the user in a virtual world
- blocks out the real world

## Social VR (Collaborative)

- multiple users to interact with each other in a virtual environment



# Types of Augmented Reality experiences

Marker-based AR

- uses a marker, (QR code or image) to trigger display of virtual content

Markerless AR

- uses CV to track the real-world environment and display virtual content without marker

Location-based AR

- uses GPS or CV technologies to display virtual content specific to a location

Projection-based AR

- uses projector to display virtual content onto a real-world surface

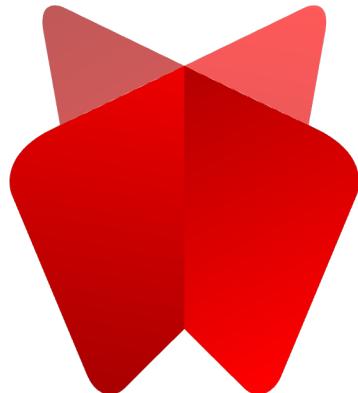
Superimposition-based AR

- replace or overlay virtual objects in real world,
- provide real-time information



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 Vision OS

# Advantage of WebXR

**Open  
Platform**

Permissionless publishing

**Sharable**

Send a link

**Accessible**

Low barrier of entry

**Cross  
Platform**

“Just works”

# What is OpenXR?

---

WebXR	OpenXR
Display/Input Abstraction	Display/Input Abstraction
Website	Installed Apps
OS Independent: Same App	OS Dependent: App per OS

The world record is...

Yusheng Du from China in 2018 who scored an incredible 3.475 seconds



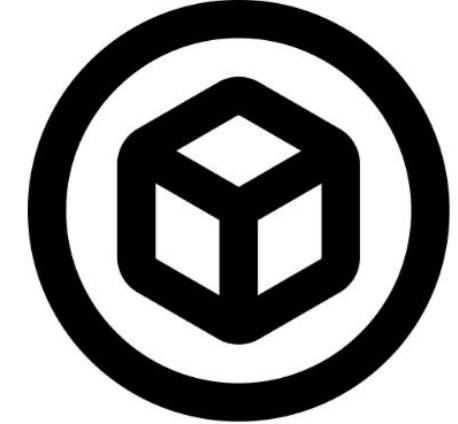


# Javascript Libraries Available

---

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

# ModelViewer ([modelviewer.dev](https://modelviewer.dev))



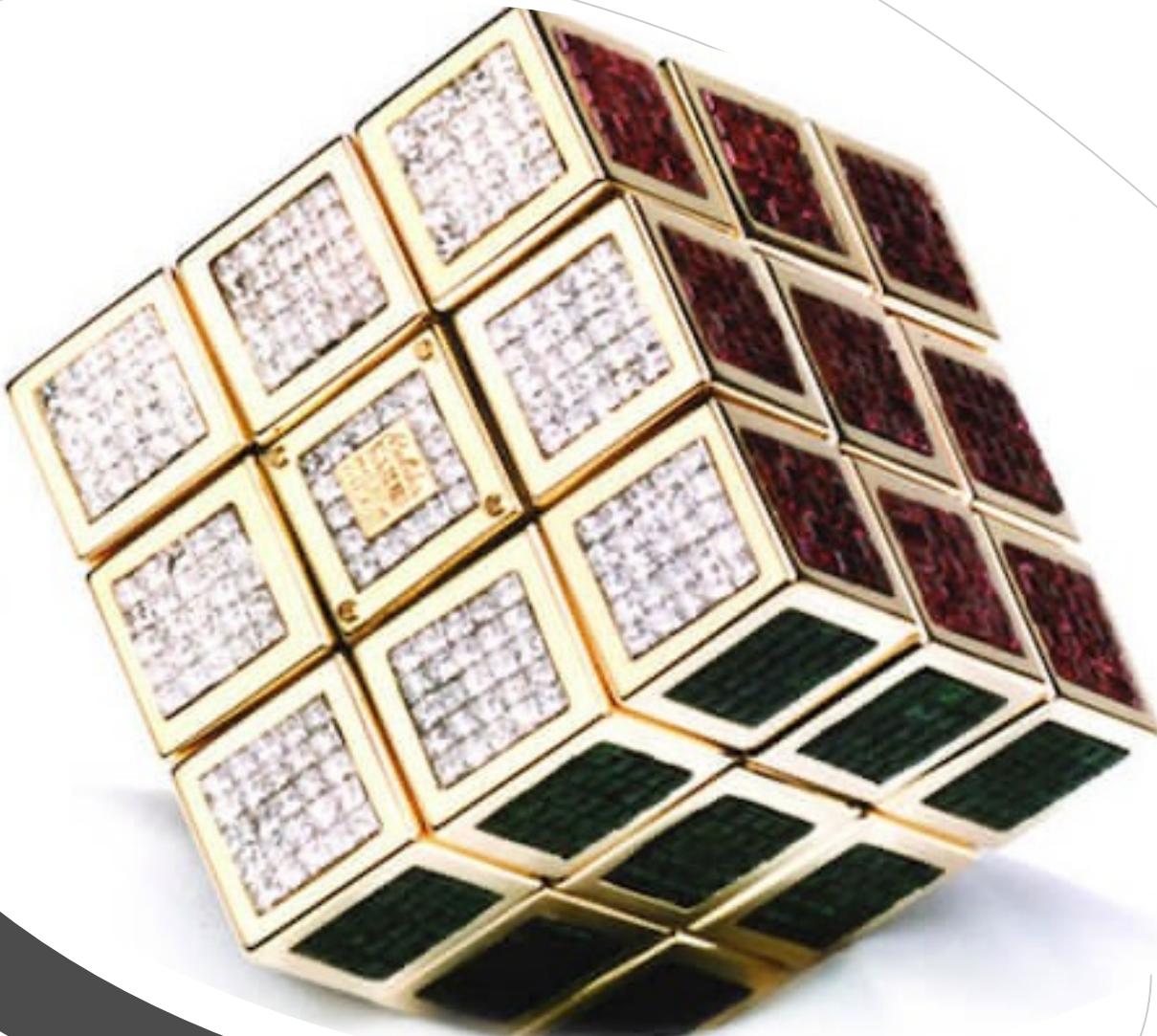
- a custom HTML element
- displaying 3D models and viewing in AR
- <https://modelviewer.dev/editor/>

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





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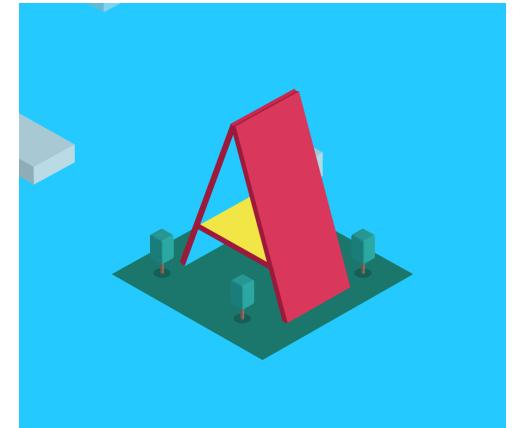
# The Masterpiece Cube costs \$2.5 million

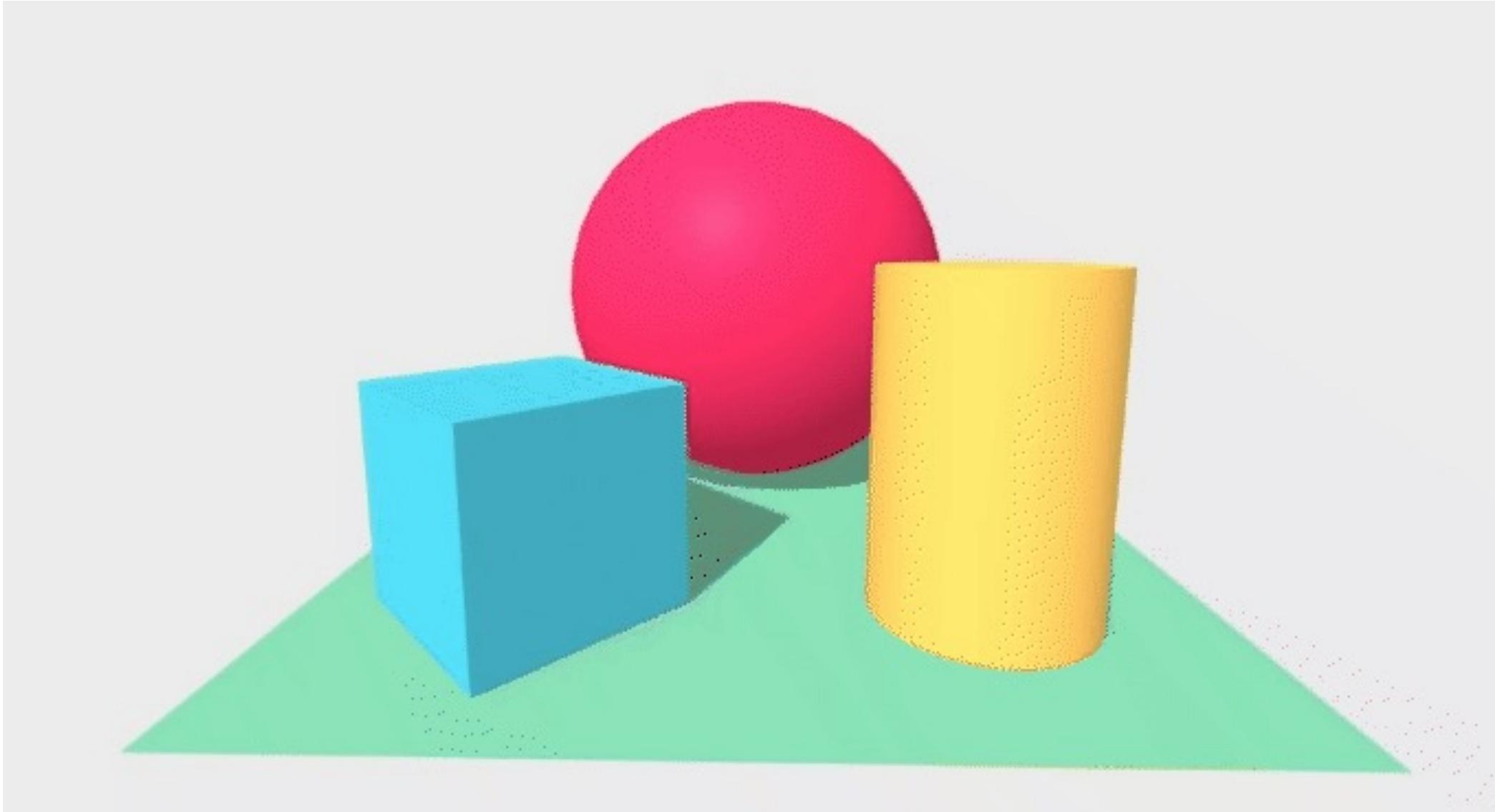
created in 1995 by Diamond Cutters International to commemorate the 15th anniversary

# 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>
```





<ctrl> + <alt> + i on any **A-Frame** scene to open up the Inspector

# 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

# 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>

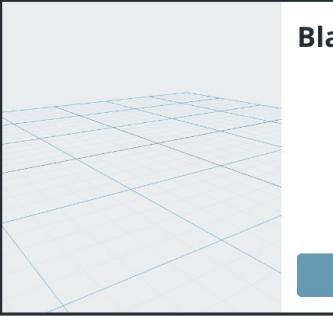
```
<html>
  <head>
    <script src="https://aframe.io/releases/1.3.0/aframe.min.js"></script>
    <script src="https://cdn.jsdelivr.net/npm/mind-ar@1.2.0/dist/mindar-image-aframe.prod.js"></script>
  </head>
  <body>
    <a-scene mindar-image="imageTargetSrc: ./rubiks.mind;" color-space="sRGB" renderer="colorManagement: 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)

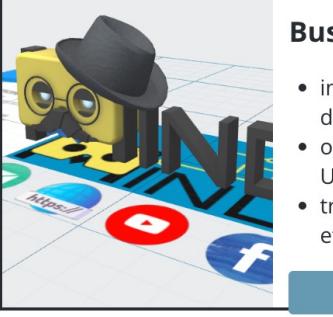
Clone



**Performance**

- real persons
- green screen background removal

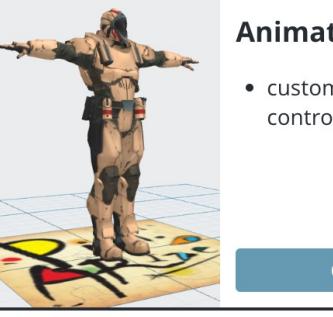
Clone



**Business Card**

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

Clone



**Animated Models**

- custom animations control (script)

Clone

<https://pictarize.com/>

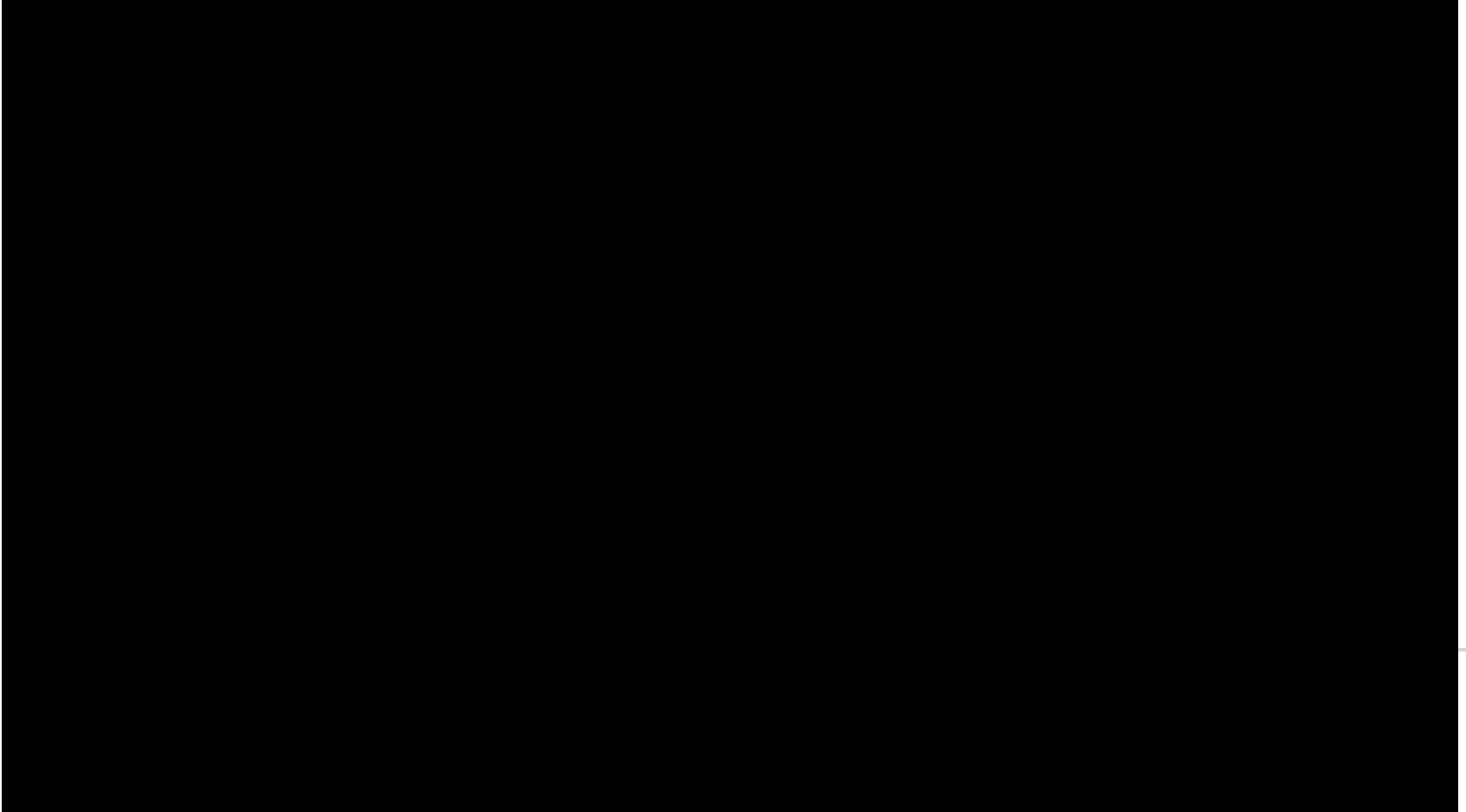
@rondagdag

# 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 built using TypeScript
- 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

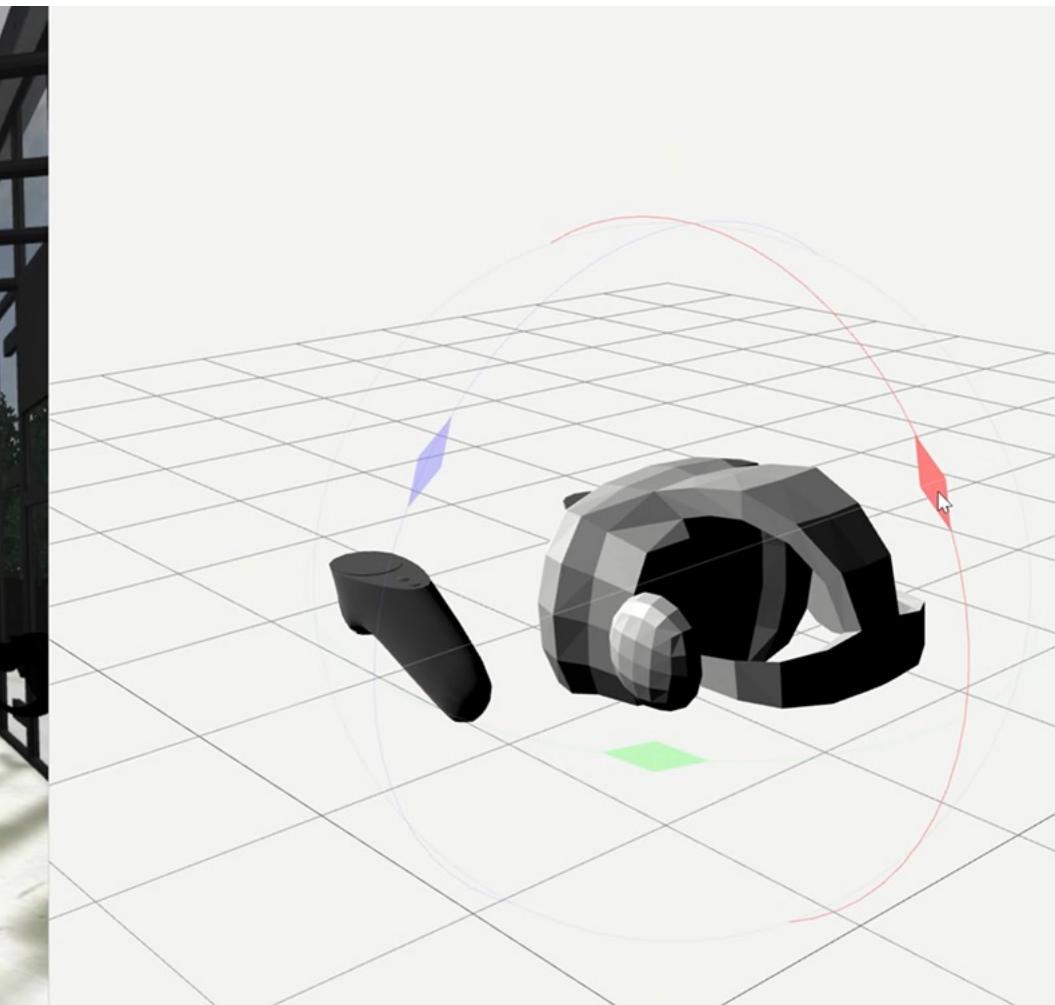
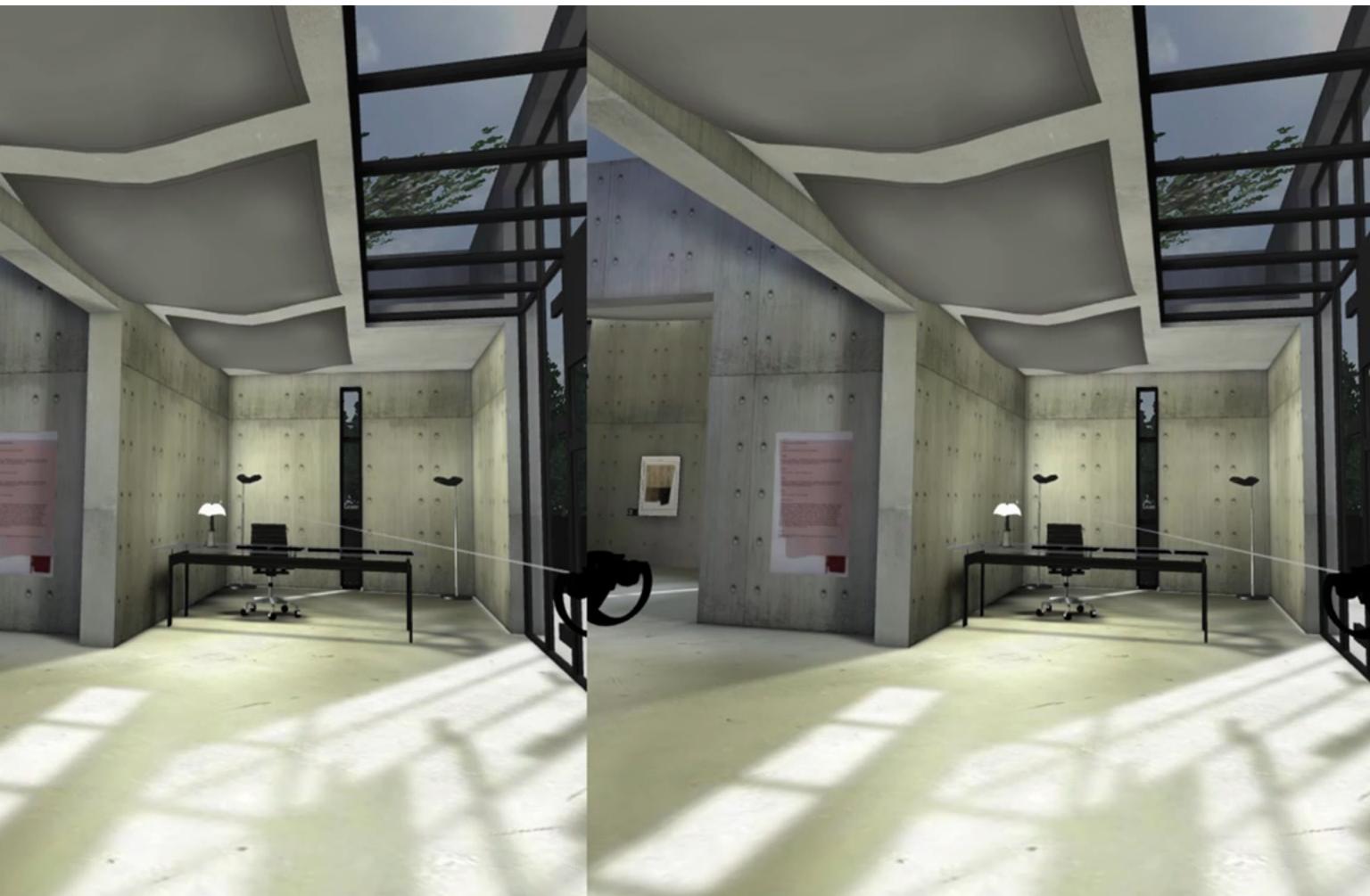


```
var createScene = function () {
    // Playground needs to return at least an empty scene and default camera
    var scene = new BABYLON.Scene(engine);
    var camera = new BABYLON.FreeCamera("camera1", new BABYLON.Vector3(0, 5, -10), scene);

    // 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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←

Mudguard 2/16

→

Boucle

Leather

Pearlized Snake

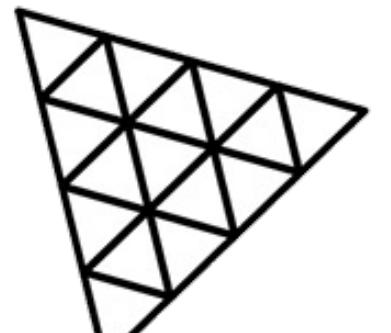


<https://www.nike.com/u/nike-air-max-90-futura-by-you-custom-shoes-10001633/4614153224#Builder>

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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>

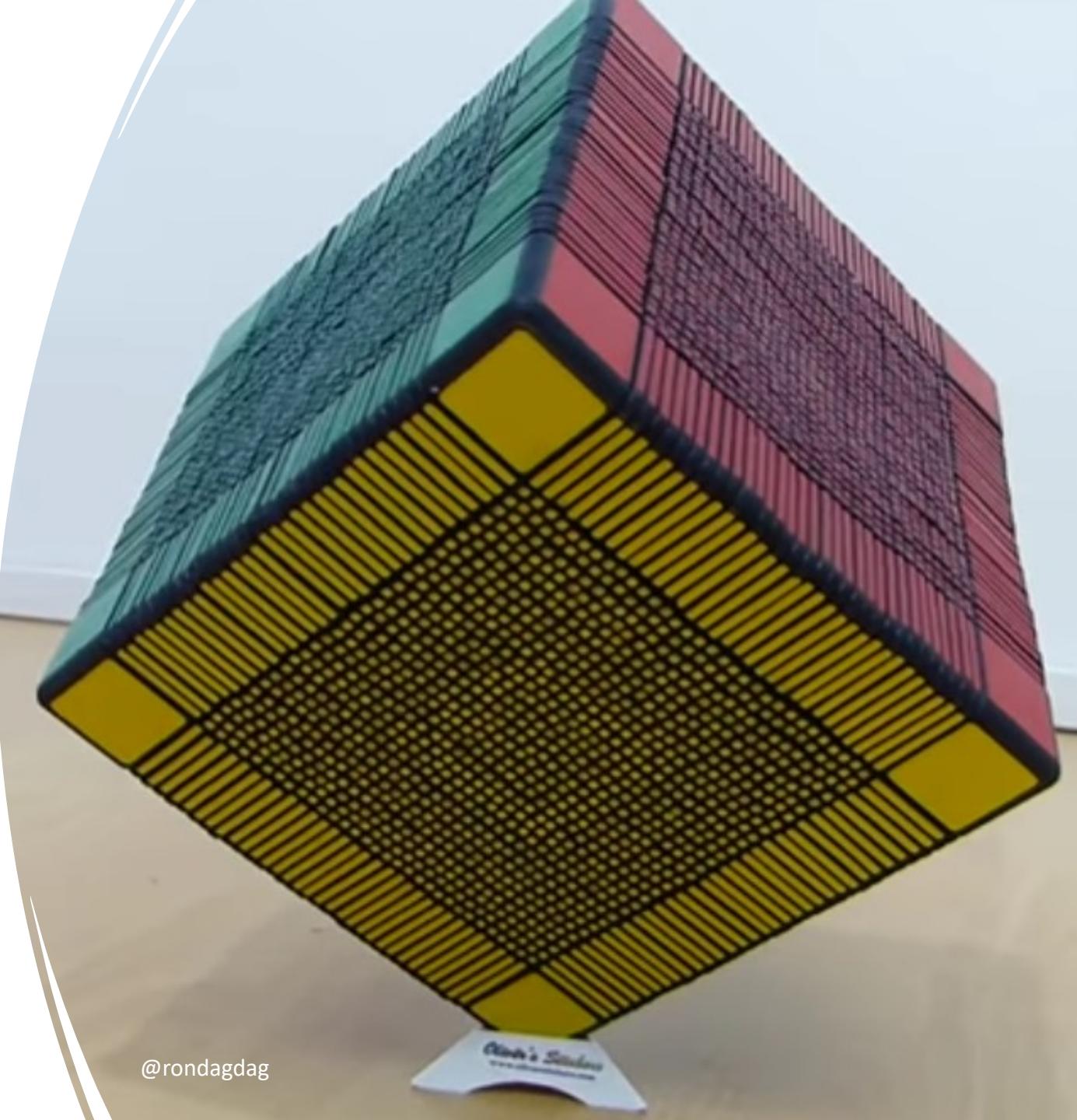


three.js



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

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

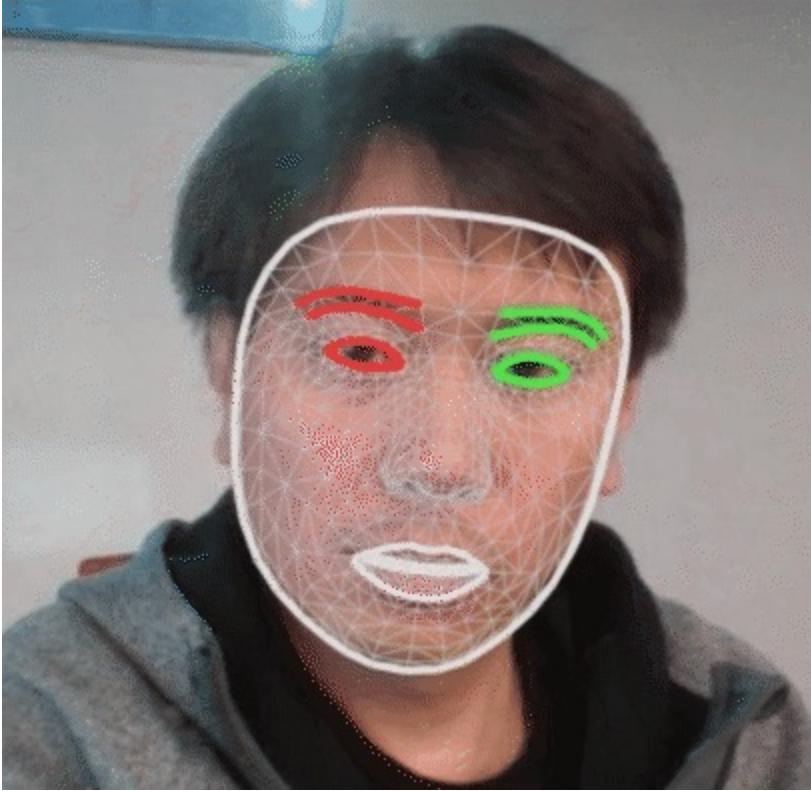


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# Mediapipe

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

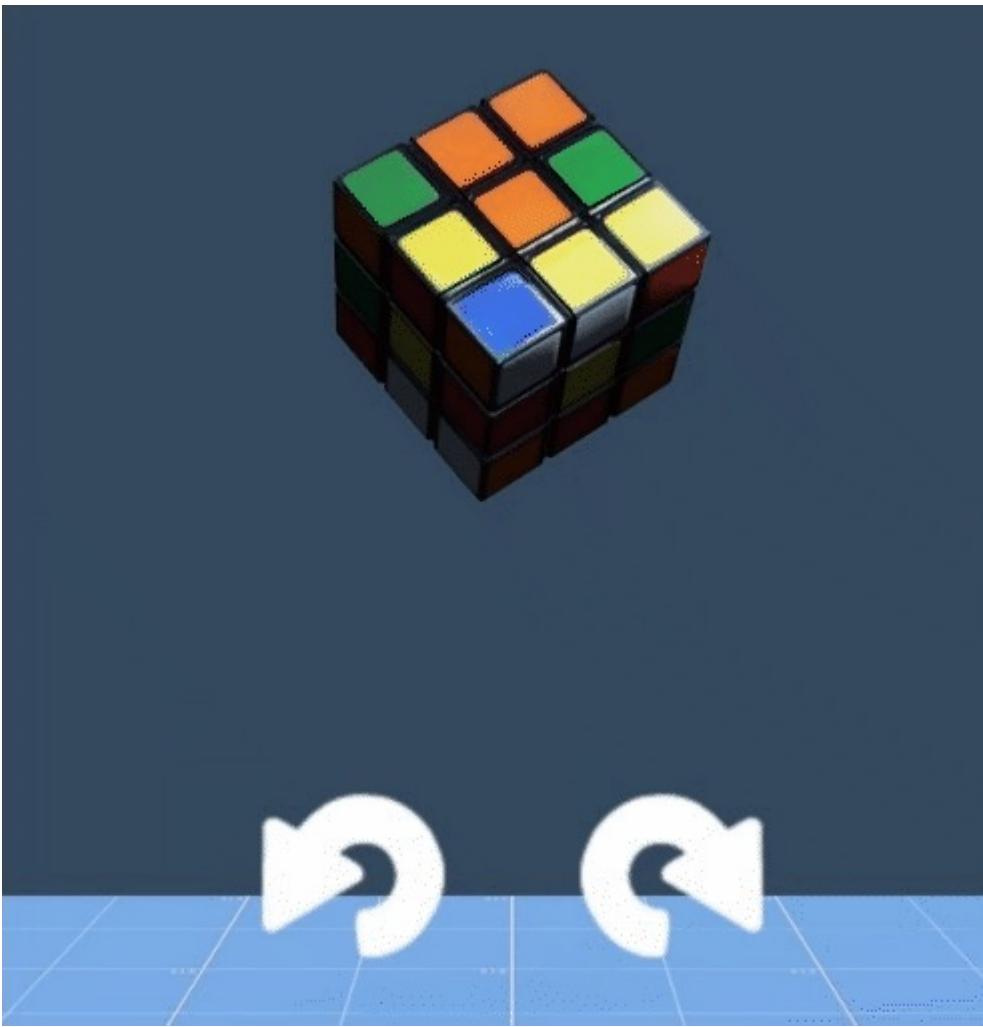
| Solution                                   | NPM Package   | Example   |
|--|---|---|
| <a href="#"><u>Face Mesh</u></a>           | <a href="#"><u>@mediapipe/face_mesh</u></a>           | <a href="#"><u>mediapipe.dev/demo/face_mesh</u></a>           |
| <a href="#"><u>Face Detection</u></a>      |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



# PlayCanvas

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





# Snap Lens Studio

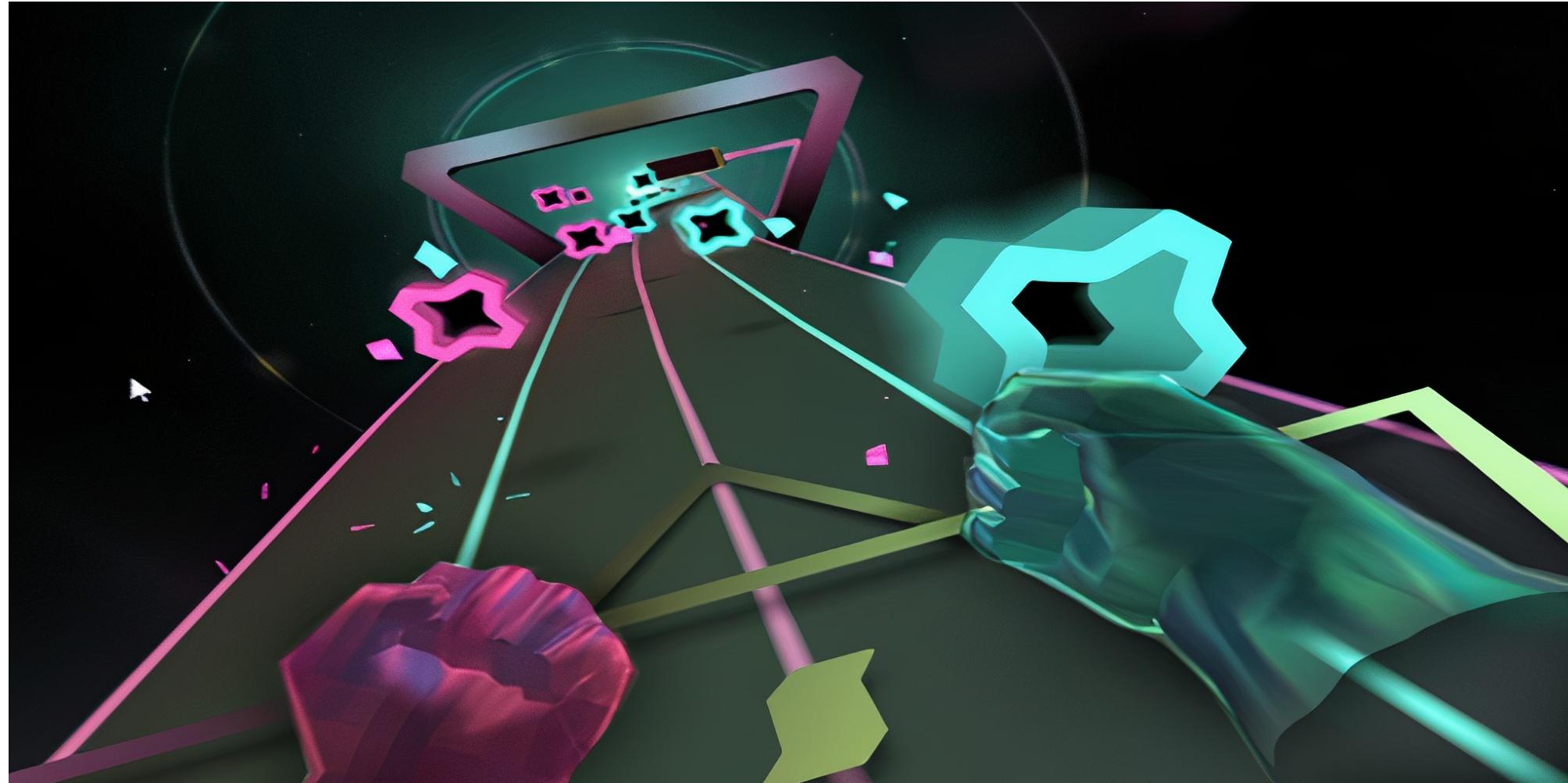


- scripting engine for creating rich interactive experiences
- respond to
  - touch input
  - play animation and audio
  - modify Scene Objects.
- Helper Script - Behavior Script, Tween Manager, World Object Controller
- API Reference - <https://docs.snap.com/api/home#lens-studio>

# Snap Lens Studio

```
// -----JS CODE-----  
  
//@input SceneObject targetObj;  
//@input string tweenName;  
  
var event = script.createEvent("MouthOpenedEvent");  
event.faceIndex = 0;  
event.bind(function (eventData) {  
    global.TweenManager.startTween(script.targetObj, script.tweenName);  
    print("Mouth was opened on face 0");  
});
```

- <https://moonrider.xyz/>
- <https://experiments.withgoogle.com/collection/webxr>
- <https://immersive-web.github.io/webxr-input-profiles/packages/viewer/dist/index.html>





Robots can  
solve it in  
under one  
second.

---

[https://youtu.be/cS2g\\_C6M7Bs?t=123](https://youtu.be/cS2g_C6M7Bs?t=123)

Github  
Link



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



# Summary

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



Holden Garcia  
Camp Counselor



# Rubik's Cubes - Not Just for Geniuses Anymore!



Wednesday, July 26, 2023 - 4:00 PM CDT, for 1 hour.

- Regular, 60 minute presentation
- 📍 Room: 6

family

cubing

geeklings

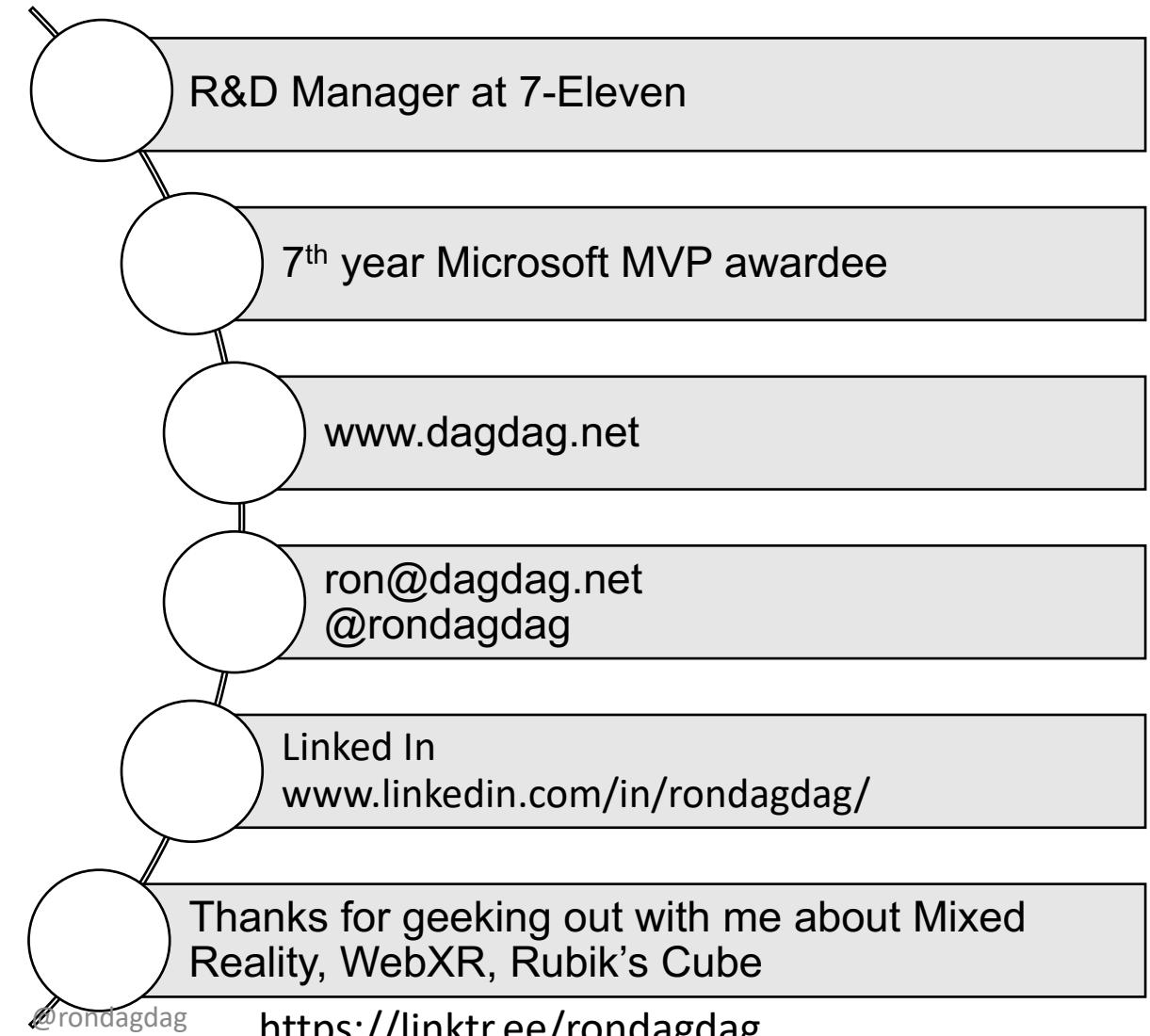
kids

# About Me

Ron Dagdag



<https://that.land/3rqyrsS>



# Session Feedback



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Next Year!*

WI  24  
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CONFERENCE

JULY 29TH - AUG. 1ST

