



VR/AR with ArcGIS

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Agenda

- Introduction & Terminology – Pascal
- Mobile VR with ArcGIS 360VR – Eric
- ~~Premium VR with CityEngine & Game Engines – Pascal~~
→ *Dedicated session on Thursday at 5:30 PM*
- Developing VR/AR Apps with ArcGIS Runtime – Rex & Adrien

Introduction

VR, AR & MR



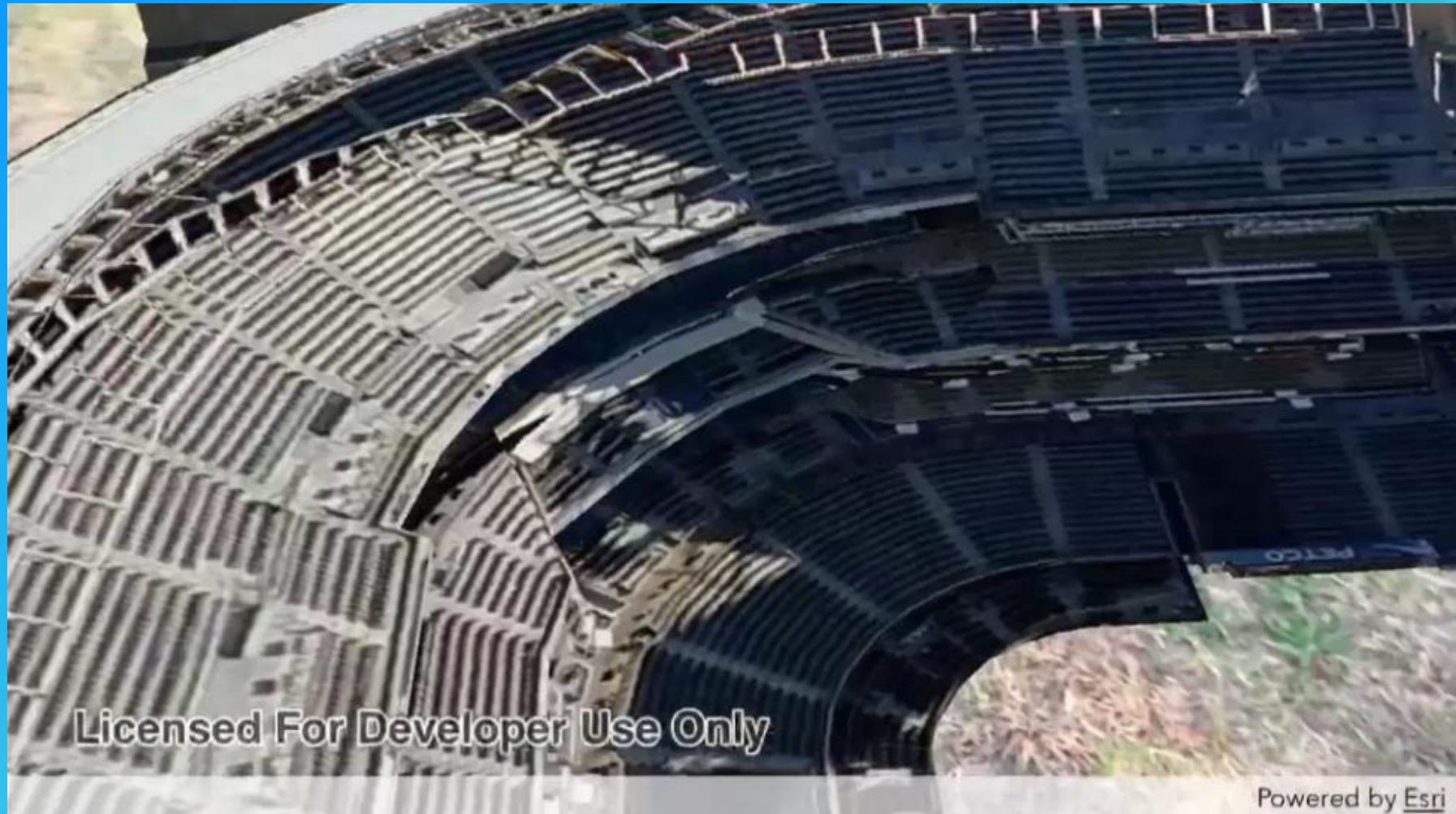
VR - Virtual Reality

Being there



AR - Augmented Reality

Interacting with
outside world

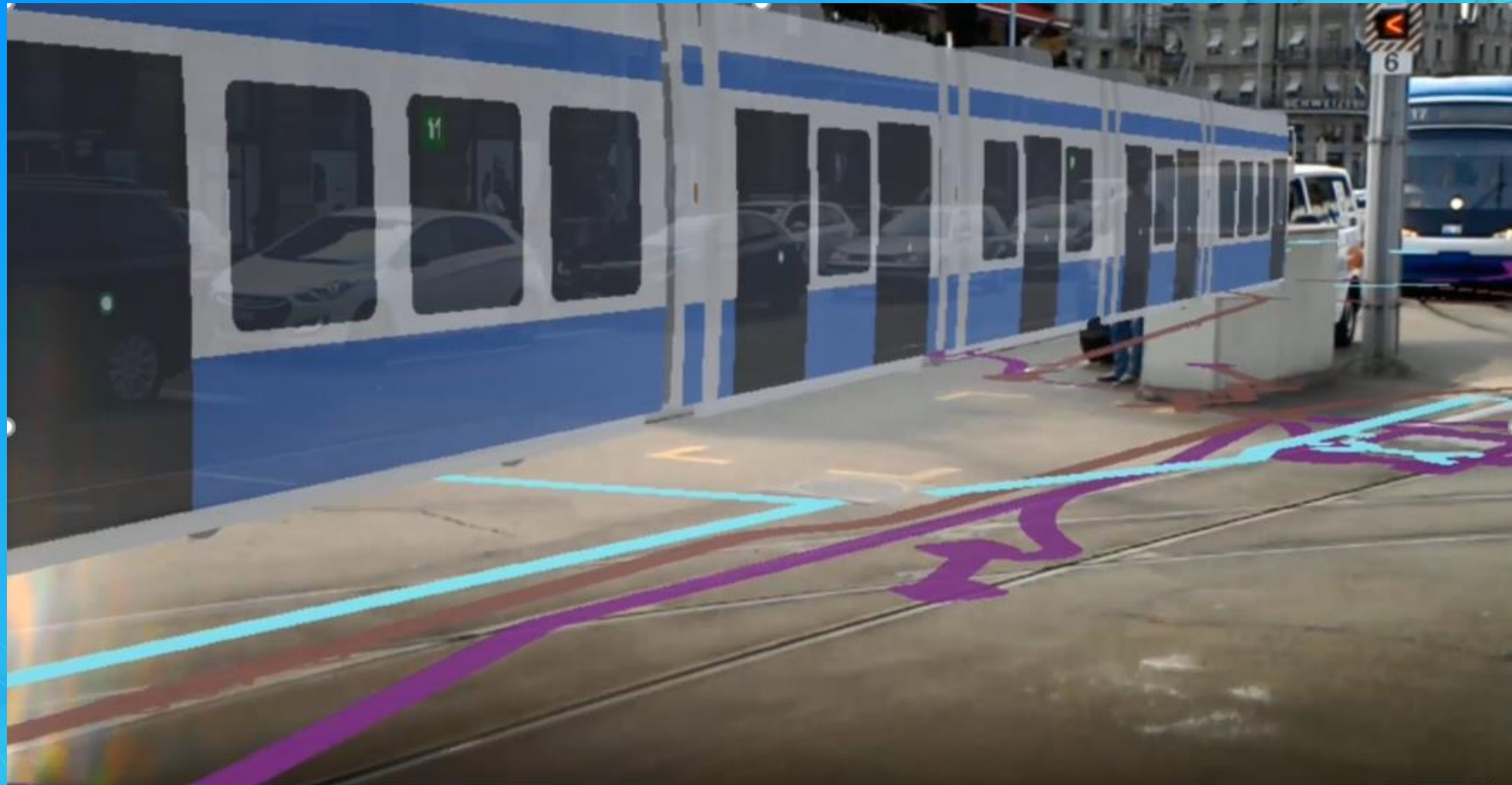


MR - Mixed Reality

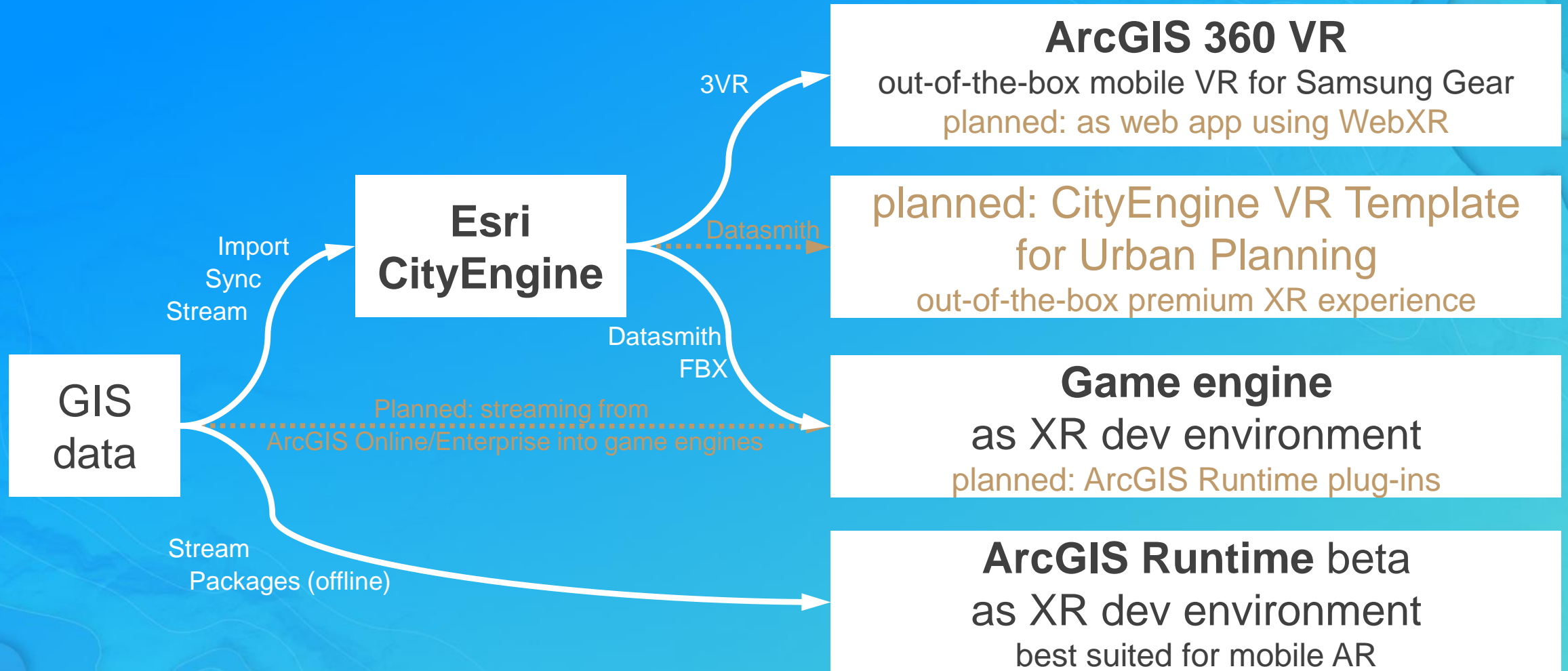
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Mixed
presence

*Microsoft
HoloLens &
Magic Leap*



XR with ArcGIS



Terminology

in VR, AR & MR



Mobile VR vs Console VR vs Premium VR

- Low price
- Broad reach
- Graphics limited
- Bandwidth limited
- Only 3 DoF, but soon...



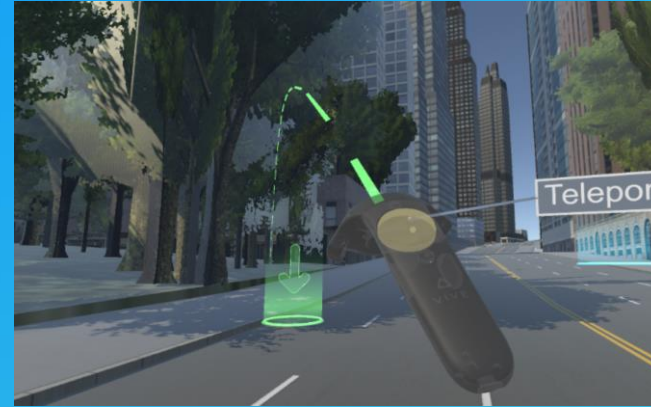
- Easy to use
- Entertainment content
- Walled garden business model



- High cost
- Complex setup
- Free movement
- Advanced input capabilities



Locomotion & Teleportation



→ *motion sickness is major problem for adoption of VR*

Teleportation & Artificial Locomotion

- 45% of experiences avoid locomotion at all due to motion sickness
- 42% use teleportation / portals (= de-facto standard)
- 5% use artificial locomotion (game pads)
- 8% use other techniques



Source: Teleportation and Locomotion from the Trenches: What Movement is Right for You. By Ram Ramakrishnan & Janet Brown. GDC 2017.

Input Devices



Seated vs Standing vs Room-scale



Welcome to Room Setup!

Set up for Room-Scale

Play Room-Scale, Standing, and Seated VR experiences. Choose this if you have at least 2 meters by 1.5 meters, or around 6.5 by 5 feet.



ROOM-SCALE

Set up for Standing Only

Play Standing and Seated VR experiences. Choose this if you have limited space to walk around.



STANDING ONLY

Positional Tracking


- **Outside-in:** Cameras placed in stationary locations & markers on devices (HMD & controllers)
→ *extendable, better controllers*
- **Inside-out:** Cameras on HMD, marker-less tracking of position changes in relation to environment
→ *simpler setup, the future*



INTRODUCING VIVE TRACKER
FOR DEVELOPERS

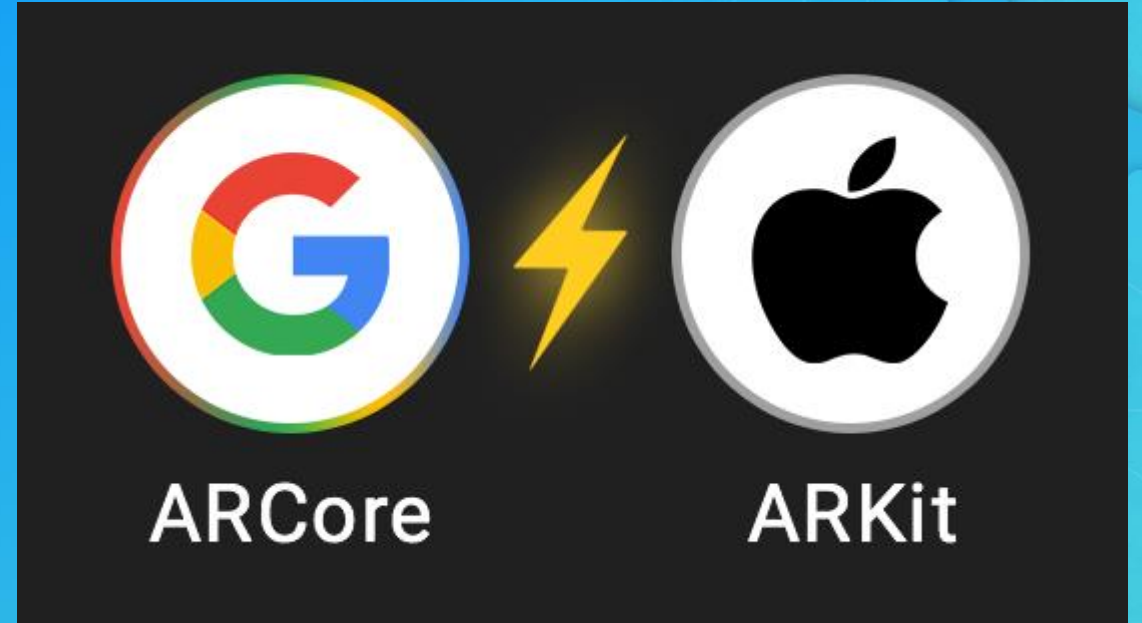
Bring any real-world object into your virtual world! Add it to specially-designed accessories to play your favorite games.

[Get Details](#) [Buy Now](#)



Apple's ARKit & Google's ARCore

- Inside-out motion tracking using camera(s) incl depth sensing (occlusion soon?)
- Environmental understanding (mainly plane detection)
- Light estimation/perception
- ...



Global Positional Tracking



Accuracy:

- GPS: ~10m, outside-only
- Wi-Fi: ~2m
- Beacon: ~1m
- RFID: ~1m



Global Positional Tracking

Same challenge as with phones:

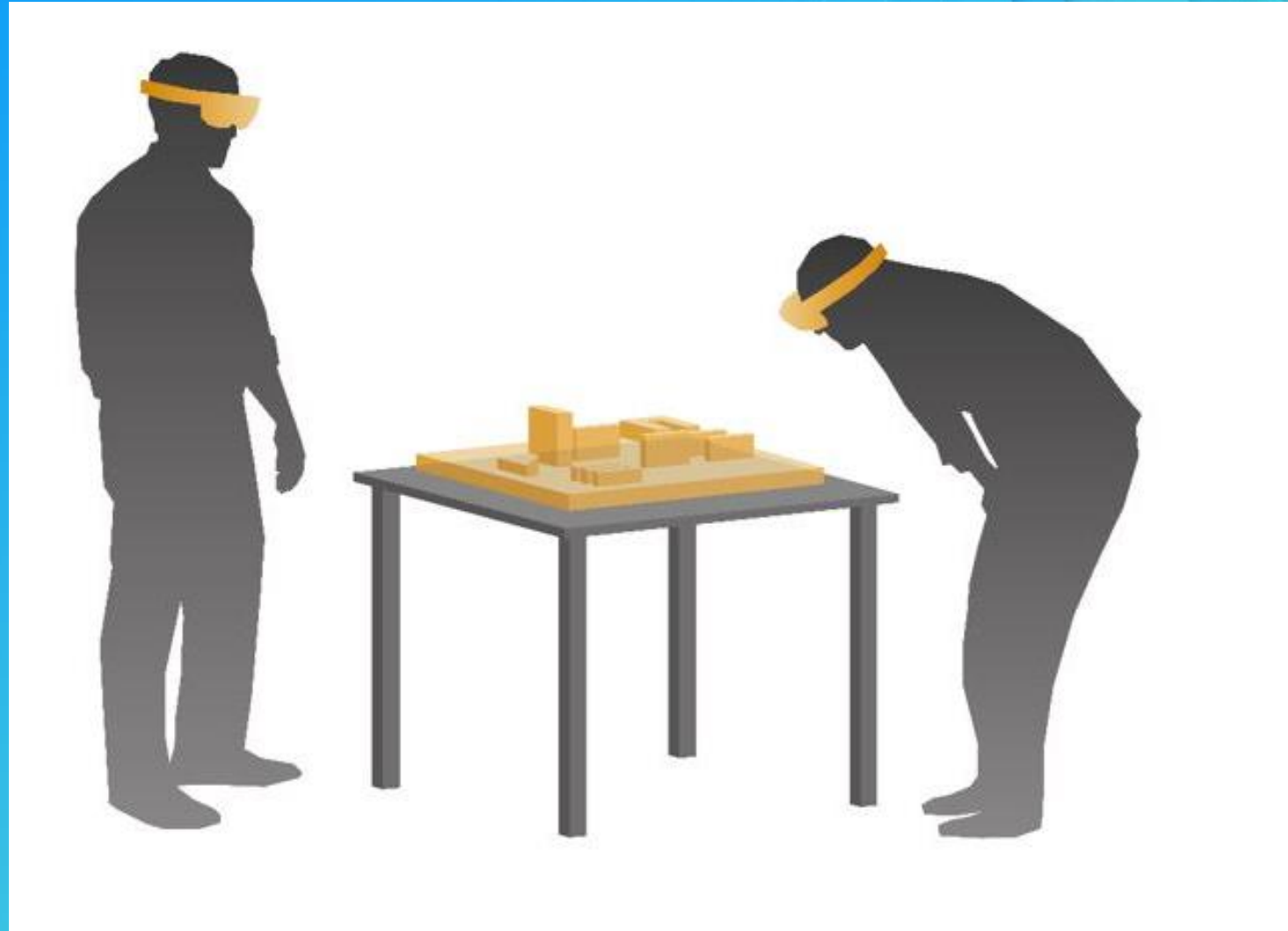
- Inside-out motion tracking, but
- *Needs initial position*



The “Tabletop” UX

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- Common UX pattern in MR, VR & AR
- Collaborative
- Intuitive, people relate to table
- No motion sickness



Player 1



ArcGIS 360 VR

Mobile focused VR Experience



City of Zurich Architectural Competitions



Plaster Models



Virtual Reality



Interactive 3D Model for
Round Table Discussion

ArcGIS 360° VR



Scenario 1

Scenario 2

ArcGIS 360° VR - Vision

“Immersion made easy.”

“Putting the world in perspective,
past, present, and future
quickly and easily.”

(Currently an [Esri Labs project](#), will evolve into a full offering)

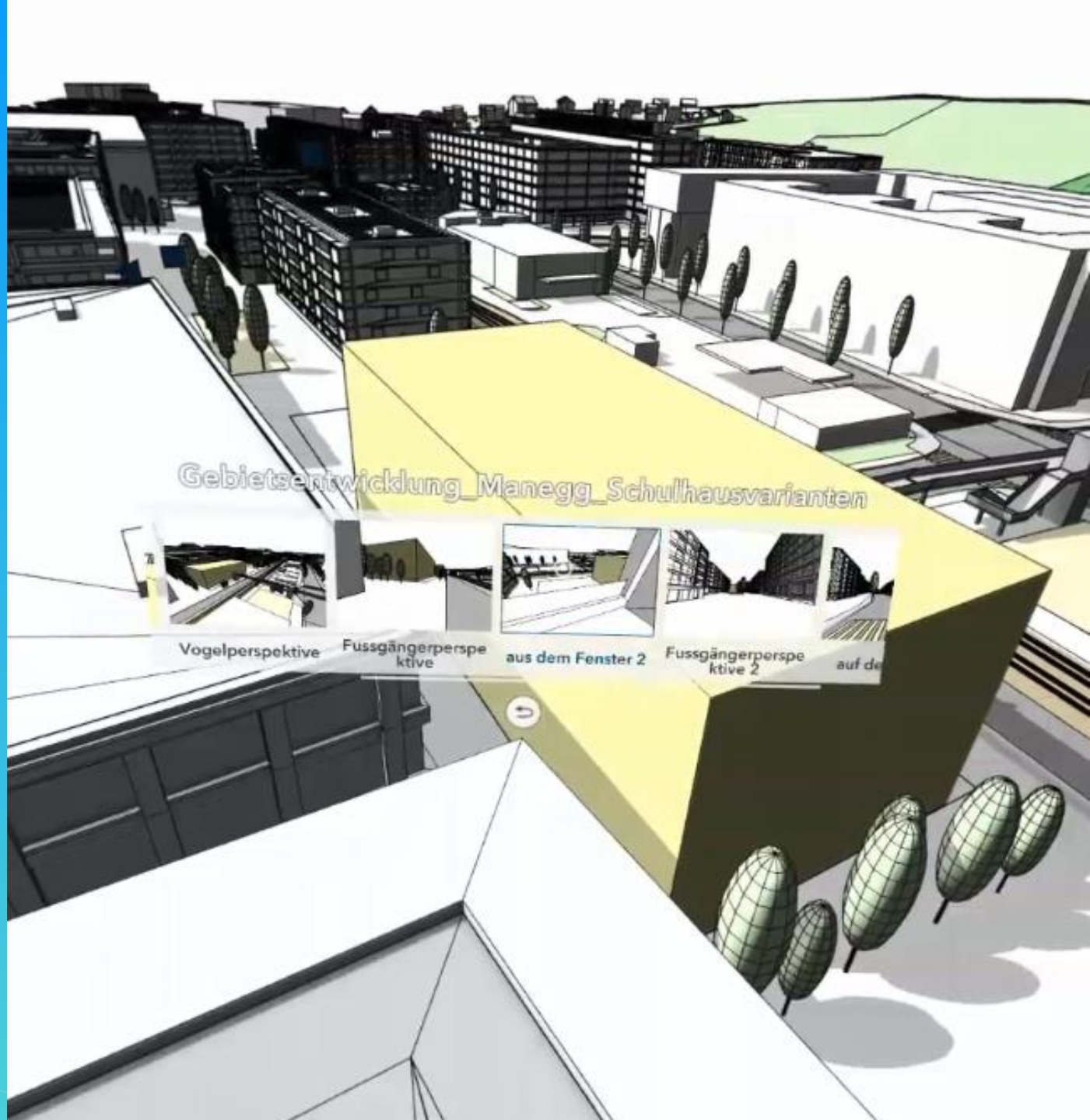
Use Cases

Simple creation of mobile VR demos for the public

To showcase urban redevelopments to the public, CityEngine users like the City of Zurich are looking for a simple CE-scene-to-VR solution that is easy to use (= one-click publish) and easy to setup (= *mobile* VR that does not require high-end PC). Planned to be used on trade shows / booths, public show rooms / installation, and architectural competition viewing events.

Quick immersion into design to experience view impact

CityEngine users interested in VR would like to quickly immerse into their 3D scenes to review the design. However they want a simple, iterate-able workflow and not a complicated 3D data pipeline to Unity. Also they want to share the VR experience (mainly for review by peers, not yet by the public). The typical design question that VR can answer better than every other visualization: *“How does the new neighboring building impact the view from the balcony?”*.

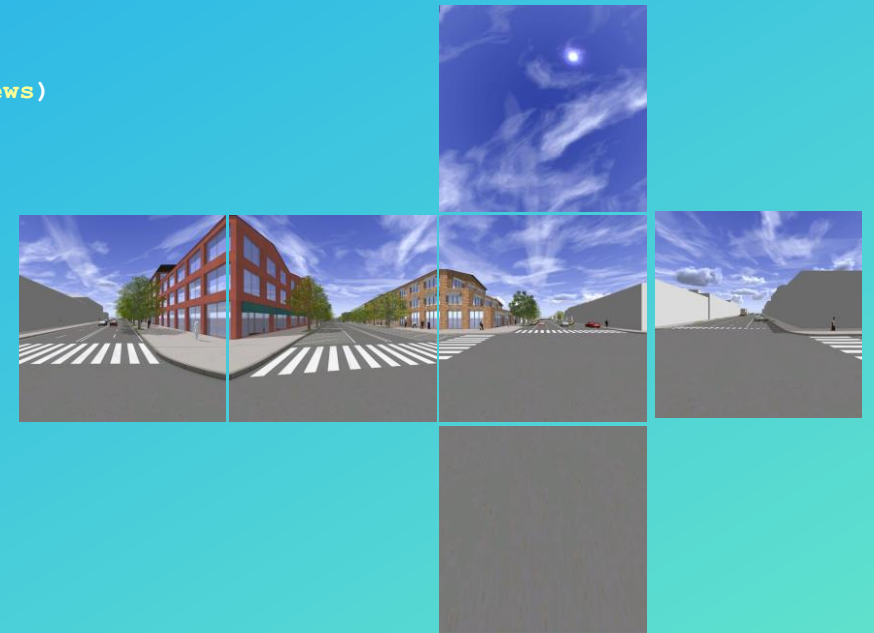


ArcGIS 360 VR Experience & 360 Viewer

- **A new Esri supported format: .3VR**
 - Composed of multiple rendered photospheres
 - Can store views from multiple locations
 - Can switch between locations using visual bookmarks in scene
 - Each location can store multiple states, such as design scenarios
 - Can switch between scenarios
- **How is it authored:** Created from CityEngine scenes, with plans in the future to support authoring from other applications, and consumption of spherical photography
- **How is it viewed:** In a VR application for Samsung Galaxy (eventually other devices). Additional support for viewing by a web app.

3VR Specification

```
{
  "views": [                                # list of views
    {
      "name": "State Street Park",
      "camera": {
        "position": [ 27.5,-105.0625,255.07031 ],
        "positionGlobal": [ -14680503.451115916,171302.8003556006,3268198.8452125844 ],
        "tilt": 57.601192,
        "heading": -43.801823
      },
      "content": [                            # list of scenarios (per view)
        {
          "scenarioRef": "./scenarios/0"      # ref to scenario ('orthogonal' to views)
          "dataRef": "./data/0",            # ref to panorama and its thumbnail
        }, ...
      ]
    }, ...
  ],
  "data": [                                  # list of panorama pics (stored in ./resources/)
    {
      "cube": {                              # encoding type is cube map
        "href": "./resources/State_Street_ParkScenario_1.jpg",
        "thumbnail": "./resources/State_Street_ParkScenario_1_preview.jpg",
      }
    }, ...
  ],
  "scenarios": [                             # list with info on scenarios
    {
      "name": "Scenario 1",
      ...
    }, ...
  ],
  "scene": {                                 # coordinate system info etc
    "crsGlobal": "EPSG:3857",
    "crsLocal": "EPSG:2229",
    ...
  }
}
```



Creation and Consumption

Authoring

generate JPG panoramas with
index.JSON & upload as .3VR



CityEngine
+ other tools later



360 VR Experience
on ArcGIS Online/Portal

Consumption

download index.JSON &
request/cache JPG panoramas

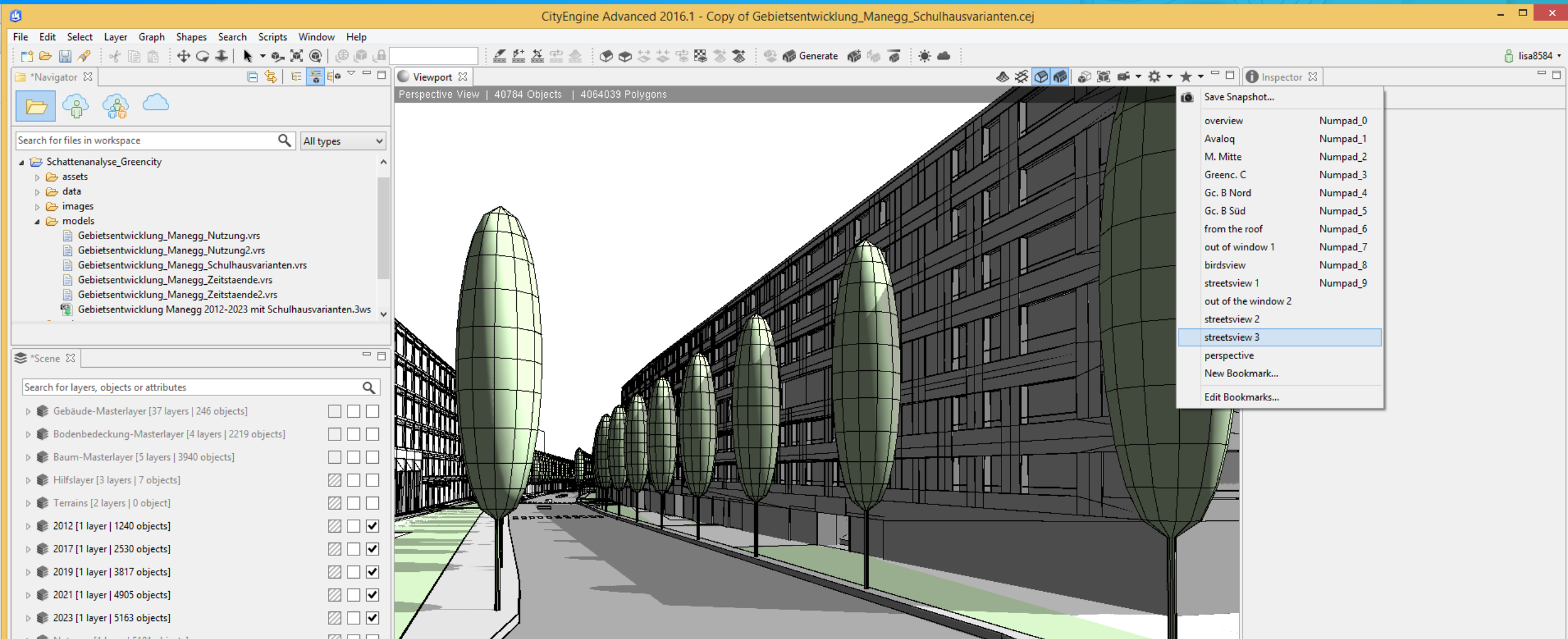


ArcGIS 360 VR
x-platform viewer app

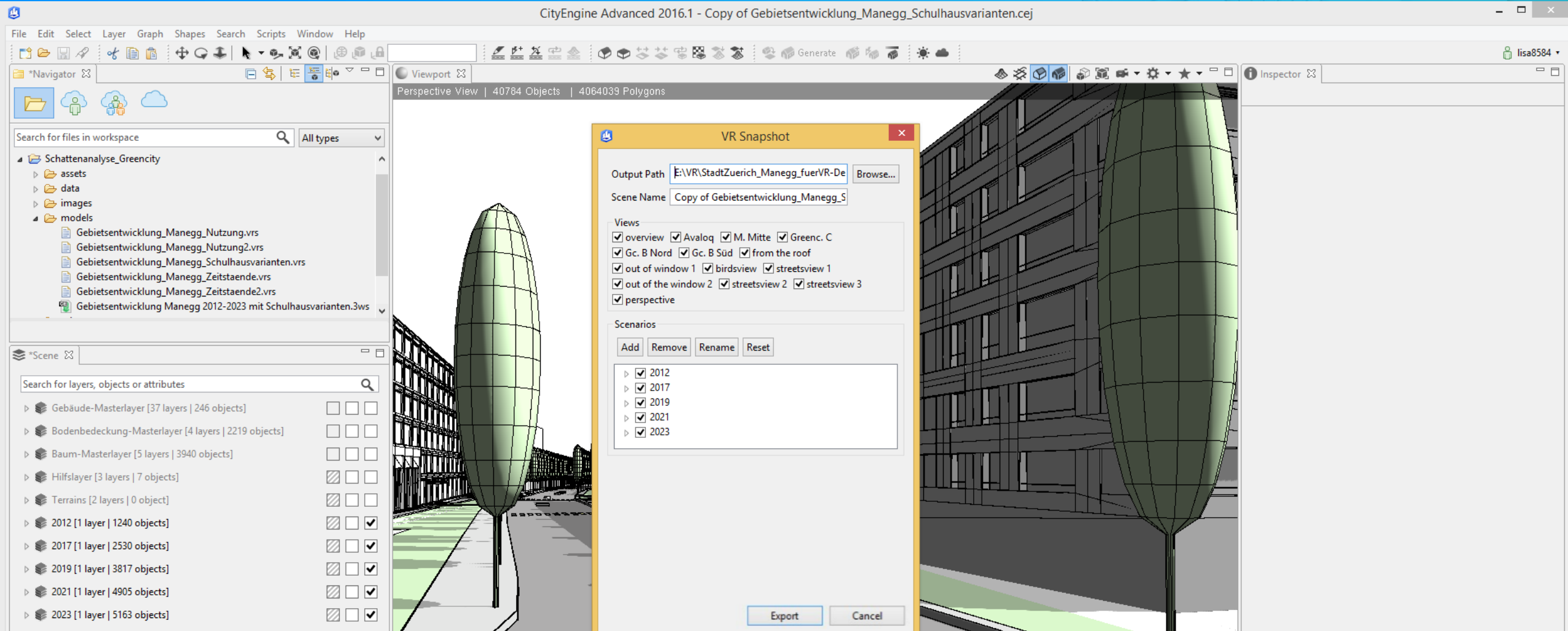
Authoring



Step 1: Set the viewpoints in a 3D scene



Step 2: One-click creation of .3VR item



Esri Labs ArcGIS 360 VR

Esri Labs is proud to present ArcGIS 360 VR. The ArcGIS 360 VR app allows you to quickly immerse yourself into 3D city models by teleporting to static viewpoints and comparing different urban design scenarios. These VR experiences can be easily created with the 3D modeling software, [CityEngine](#), and are hosted on ArcGIS Online, the cloud platform of the global smart mapping leader, Esri. Rather than relying on high-performance graphics computers and cumbersome wired VR accessories, a simple smartphone paired with an affordable wireless headset are all that is required to be immersed in a ArcGIS 360 VR experience.

"By using ArcGIS 360 VR, our planning board and jurors can now study the impact of new architectural developments and urban planning scenarios from the perspective of pedestrians and citizens." Christian Huerzeler, project manager at the Department of Urban Planning in Zurich.

The app is available for the Samsung Gear VR headset on the Oculus platform. Join this Esri Labs project and we will send you a promo code to access the app.

Requirements

Samsung Gear VR headset

Join this Esri Labs project

Roadmap

Mid Term

Web app for VR Experience
Web app for simple screen viewing
360 Photo Support
Refined view to view selection

Long Term

Support Perspective Imagery Service
Support externally referenced media (maybe)
Interactive Measurement
Pop-Ups from referenced buddy services
Video/Animation