Exploring Virtual Reality (VR) with ArcGIS

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Agenda

- Introduction & Terminology
- Application & Market Potential
- Mobile VR with ArcGIS 360VR
- Desktop VR with CityEngine & Unity
- Mobile AR with AuGeo
- Developing VR/AR Apps with ArcGIS Runtime
Introduction & Terminology

Euan Cameron
VR vs AR
VR - Virtual Reality

Being there
AR - Augmented Reality

Interacting with outside world
MR - Mixed Reality

Mixed presence
Immersive Computing

- Fundamental computer human interaction that is better than anything else
- AR got breakthrough with Pokemon GO
- Passive content / 360 experiences lowest barrier entry for VR
- Terminologies not set yet (...poor marketing people)

We are at the beginning!
Terminology
Terminology
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“Experience”

The term “experience” is used for apps or the actual content. Means it is common industry jargon, e.g. Oculus uses the term to list the apps. As a consequence, people refer to a VR Experience not only as user experience but also as an asset.
Mobile VR vs Console VR vs Desktop VR

- Low price
- Broad reach
- Graphics limited
- Bandwidth limited
- Only 3 DoF

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

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

Set up for Standing Only

Play Standing and Seated VR experiences. Choose this if you have limited space to walk around.
Locomotion & Teleportation
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:
Input Devices
Market Potential

Euan Cameron
VR/AR Market Trends

Worldwide Virtual Reality revenue by segment\(^1\)

<table>
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<th>Year</th>
<th>Consumer software/services</th>
<th>Hardware</th>
<th>Total</th>
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<td>$0.3B</td>
<td>$1.5B</td>
<td>$1.8B</td>
</tr>
<tr>
<td>2017</td>
<td>$1.3B</td>
<td>$3.6</td>
<td>$4.9B</td>
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<tr>
<td>2018</td>
<td>$4.1B</td>
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<td>$9.4B</td>
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SuperData Research VR Data Network, February 2017
VR/AR Market Trends in GIS

VR
- Education, planning, training
  • Mobile
    • Easy, cheap to distribute
  • Desktop
    • Cheaper than travelling to a site
    • Best VR experience possible

AR/MR
- Field operations, resource management, planning
  • Handheld
    • Use existing mobile devices
  • Head-mounted
    • In the field, full scale; In the office, small scale
    • Hands-free for rapid response
    • Most immersive, collaborative 3D experience possible
Customer Specific Scenarios

- **Education**
  - [VR] Show compelling time series data for natural phenomena affected by climate change
  - [VR] Communicate electric infrastructure changes to affected communities
  - [AR/MR] Enable visitors to augment their view of park resources, infrastructure, and history

- **Planning**
  - [VR] Show new development plans for transportation networks to stakeholders
  - [VR] Show new construction plans for energy plants
  - [MR] Visualize and compare building designs, small and full scale

- **Training**
  - [VR] Prepare agents for VIP visits
  - [VR/AR] Prepare firefighters to fight wildfires
  - [VR/MR] Share/collaborate around 3D landscapes with staff without needing to travel to destination

- **Field Operations**
  - [AR] Visualize security infrastructure, report threats in the field, and collaborate
  - [AR] Visualize electrical utility infrastructure, manage assets, evaluate damage, etc.
Customer Trends

- Many do not know what they need until they understand the options

- Most are existing Esri customers

- All are positive and excited about the potential for VR/AR/MR solutions from Esri

- Some have volunteered development staff and funding to work on anything we provide

- Some have started looking outside Esri for solutions
ArcGIS 360 VR
Simon Haegler
Use Cases – Urban Planning

- Simple creation of mobile VR demos for the public
- Quick immersion into design to experience view impact
Creation and Consumption

**Authoring**
upload as 3VR

**Consumption**
download into mobile device/HMD

CityEngine
+ other tools later

360 VR Experience
on ArcGIS Online/Portal

ArcGIS 360 VR
x-platform viewer app
Step 1: Set Camera Bookmarks

How to author a 360 VR Experience?
Step 2: Run .3VR Exporter

How to author a 360 VR Experience?
Step 3: Share on ArcGIS Online

How to author a 360 VR Experience?
Step 4: Consume in ArcGIS 360 VR
How to get the ArcGIS 360 VR App?

- labs.esri.com
What’s New? Support for Gear VR Hand Controller
What’s Next?

- WebVR version Q2 2018 / DevSummit
- Support for Photo Spheres also in Q2
ArcGIS 360 VR Summary

- Get the App at labs.esri.com
- Gear VR Hand Controller now supported
- CityEngine 3VR exporter: Layer and Scenario support
- Share/Consume 360 VR Experiences via ArcGIS Online
- WebVR and Photo Sphere support in Q2 2018

*Try out ArcGIS 360VR at the Native App Booth!*
Desktop VR with CityEngine and Game Engines

Simon Haegler
Unity

• Cross-platform game engine
• Targets mobile, browser, console and desktop games
• Affordable ($0/35/125 per month)
• Relatively easy to use
• Used beyond entertainment e.g. for architectural visualization...

→ Entry point to develop VR apps for HTC Vive, Oculus Rift, Gear VR, Hololens, ...
CityEngine: Select, «Export Models...»
Choose FBX, Tweak Settings and Click Finish
Unity: Drag&Drop FBX to Assets & into scene
Move «Main Camera» to center
Enable VR

- Edit, Project Settings, Player
- Check «Virtual Reality Supported»
- Add OpenVR Support
  - Click «+», «OpenVR»
  - Drag above «Oculus»
Start in VR: Press «Play» and experience it e.g. in HTC Vive
Scene Tweaks: Binary Transparency for e.g. Trees

- In «Materials», select all Tree Materials
- Set «Rendering Mode» to «Cutout»
Locomotion Support

- Window, «Asset Store»
- Search «SteamVR Plugin»
- «Import»
- «SteamVR_Settings» Dialog
  - «Accept All»
Add «Player»

- Delete «Main Camera»
- Drag in «SteamVr\InteractionSystem\Core\Prefabs\Player»
Add «teleport» prefab

- Drag in Prefab «SteamVr\InteractionSystem\Teleport\Prefabs\Teleporting>>
Add Teleport Points

- Drag in (multiple) Prefabs
  «SteamVR\InteractionSystem\Teleport\Prefabs\TeleportPoint»
- Optional: Increase their scale
In VR, Teleport Using Click on Wheel
Teleport anywhere

- Click Mesh in Assets
- «Generate Colliders»
- «Apply»
Teleport anywhere

- Select e.g. a street
- Copy & Paste
- Drag in Prefab
  «SteamVr\InteractionSystem\Teleport\Scripts\TeleportArea»
on street copy
In VR, Teleport Anywhere on Street
New in CityEngine 2017.1: Unreal Engine Export

- Collaboration with Epic Games Enterprise Dept
- Urban Planning Workflow
  - CityEngine for design
  - Unreal Engine for high-end visualization/VR
- Unreal Engine Exporter
  - Based on Datasmith API by Epic Games
  - Avoids FBX limitations (performance, materials)
- Unreal vs Unity
  - Unreal Engine for high-end, large-scale visuals
  - Unity famous for cross-platform (mobile) compatibility
Summary: CityEngine Desktop VR

- **CityEngine & Unity**
  - Solution for medium-complexity VR experiences
  - Recommended for Mobile, Desktop, Room-Scale VR
  - Using standard FBX

- **CityEngine 2017.1 & Unreal Engine**
  - Solution for high-end Arch Viz VR experiences
  - Recommended for Desktop, Room-Scale VR
  - Using Epic Games Datasmith API: Better Interop (e.g. Materials)
  - Recent Webinar: [bit.ly/2z0G5aM](bit.ly/2z0G5aM)
  - More content soon (Blog Posts & Tutorials)
AuGeo – augmented reality app

- Show existing ArcGIS point feature layers in an augmented reality experience on a mobile device
- Esri Labs research and development project
- Available in Apple App Store and Google Play
- Source code available through AppStudio
- Github repo available for feedback
ArcGIS Runtime for VR/AR/MR in ArcGIS Platform

• 3D natively on all supported devices
  - Windows, macOS and Linux:
    - HTC Vive, Oculus Rift, Windows 10 VR headsets
  - iPhone, Android, Windows 10 Mobile
    - Google Daydream, Samsung Gear VR, Cardboard and similar hardware

• Native applications are able to access sensors/controllers on devices

• Integrated with the ArcGIS platform
  - Scene Layers, Elevation Sources, Feature Layers, Tile Layers, Map Images Layers...

• Work disconnected
  - Scene Layer Packages, Local Raster Elevation, KML, TPK, model symbols, ...
Full Runtime VR/AR Solution: What is it?

- Add functionality to existing Runtime SDKs

- VR: New “Stereo display” rendering mode
  - Side by side with barrel effect
    - Offset camera for each scene
    - 3D effect

- AR: Transparent background
  - Render on top of camera feed
    - Field of view to match camera feed
Full Runtime Solution: Advantages and Challenges

• Advantages:
  - Easy API to add VR or AR experiences to any 3D Runtime application
  - All the functionality 3D Runtime applications is available
  - Movement sensors will interact with the camera

• Challenges:
  - Runtime is a developer product - Not easy to build pure VR/AR apps with just an SDK
    - Interaction requires targeted development for each hardware platform
    - No developer framework for VR/AR UI
VR/AR Full Runtime Solution: Private Beta program

- November 2017
- Currently limited to Runtime SDK for .Net and Xamarin
  - .NET
  - iOS
  - Android
- Targeting high-end mobile devices
  - Good framerate, high resolution, best chipsets, superior camera
Research combining ArcGIS Runtime and gaming engines

- Runtime can bring GIS content to existing gaming engines
- Good for VR/AR/MR but also any “gaming type” application that needs GIS

- Advantages:
  - Easy cross hardware VR/AR development
  - Mixed Reality (HoloLens) development
  - Good VR/AR/MR UI design experience
  - Integration with the existing VR/AR/MR community
  - Physics and other 3D effects

- We need your feedback
  - What type of apps would you build with this approach?
  - How important is this architecture for your organization, your customers?
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