Esri CityEngine and the Oculus Rift: GIS for Next-Generation Virtual Reality

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• The entertainment industry continues to strive for more efficient and cost-effective workflows while at the same time meeting the demands of consumers that long for more immersive and interactive environments. In this session, we will discuss the capabilities and workflows associated with creating the real world in Esri CityEngine for use in the Unity game engine and Oculus Rift headset.
• How many of you have played some kind of game recently? Though your phone, xbox, playstation?
• Video games have moved beyond the stereotype of simple entertainment and are now a serious technological and cultural force to be reckoned with.
• Can we blend a spatial environment and social networking functionality into a single platform?
• Yes, you just have to look at today’s large multiplayer gaming environments to see people joining in to solve very complex problems often using maps.
Virtual Reality is All About Location

- **Sense of Place** – Most games today have a spatial component, and these virtual worlds are becoming more complex and sophisticated.
- **Context** – As the gaming industry matures we see games becoming grounded in real (sometimes historical) locations.
- **Physics** – The ability to render a 3D city model offers the chance to walk down the street.
How does Esri Interface with this Game Engine Technology?

CityEngine 2014

- CityEngine as a software had its initial widespread adoption in film and game development as a method of modelling large urban areas. We have seen this adoption continue to grow.

- Used in movies such as Cars 2, Total Recall, Man of Steel, Transformers 4.
Procedural Modeling

Data Centric and Rule Based

1. Base Geometry
2. Procedural Rules
3. Generated 3D Model

Base geometry → Iterative refinement → Final 3D model
Saving Time and Costs

Rule based generation of 3D geometry
CityEngine to Oculus Rift Workflow

- Terrain / Imagery
- Buildings
- Streets
- Trees
- Operational Layers
- CityEngine

FBX

Static Assets
- Character Controls
- Skybox Rendering
- Dynamic Assets

Platform Specific

Game Build
- Unity

Unity
- Oculus Rift
- Oculus Dev. Settings

Camera Settings
Export each layer separately for the layering in Unity

Baked Model - Control file size in memory allocation in CityEngine FBX exporter

- **Terrain / Imagery needs to be tiled for highest resolution**
  - Keep X,Y, Z center the same on export
  - 1024 X 1024 with 4000dpi max in Unity

- **Trees**
  - Adjust location if originating from GPS
  - Tree leaf card transparency set inside Unity or upon export from CityEngine

- **Buildings**
  - Collision mesh on in order to jump on top of buildings
  - Create doorways in CGA Rule in order to walk inside
  - Create duplicate objects in CityEngine to information (i.e. land use) overlay.

- **Streets**
  - Keep collision mesh off
  - Offset from terrain to reduce shape clashing
CityEngine RPK Inside Unity
Parametric – Adjustable model within the game

- SDK to enable 3rd party developers
- From a standalone application -> to plugins for commercial 3D tools
- CityEngine is needed to author the procedural modeling rules
- Each SDK deployment requires a CityEngine license (basic or advanced)
- Middleware licensing will be on a case-by-case basis
- CityEngine 2014 release of Unity and Maya example plugins

- The CityEngine SDK is available here: https://github.com/Esri/esri-cityengine-sdk
Where is this Game Engine technology going in terms of use for geospatial systems in the next several years?

• Game Engines are App Builders
  Game engines and immersive hardware will continue to add value to the work currently being done in 3D GIS offering more rendered realism.
  We are seeing that this enhanced 3D is giving everyday 2D GIS operations increasingly more public exposure and in effect more public interest and oversight in the planning procedures that continue to shape our real places.
  Support future immersive hardware.
Further Integration

- Oculus Rift
- Unity
- 3D Runtime
Opportunities Between Gaming Technology and Geospatial Technology

- **Gaming Industry**
  - GIS offers an amazing set of spatial data for efficiently modeling a real location.
  - What games need real locations? Racing, Historical Strategy
  - Spatial data is data centric and can help to drive the modeling process with procedural rules.
    (i.e. point feature with species as an attribute = accurate 3D tree model)

- **Geospatial Industry**
  - Architectural applications
  - Military Simulations – Training within environments before you arrive.
  - 3D GIS effectively communicates with the public audience where we can’t assume everyone is a cartographer.
What are the Key Features/Distinguishers for Geospatial Users?

• Growing opportunity to create geographically accurate environments
• Increasing value of game engines and immersive hardware within urban planning and design visualization.
• In terms of GIS this is the symbolized world taking 3D symbology to the next level in realism.
  - For example: Our vegetation library from e-on software contains vegetation symbology that is fully parametric making it easy to switch between the rendered model tree and the analytical symbol of tree canopy width and height.
• With CityEngine and the ArcGIS platform, multiple views of the same data can essentially be parametrically draped over the 3D model.
Training Resources

• Get a Free Trial of CityEngine Advanced: http://www.esri.com/cityengine

• CityEngine Help: http://cehelp.esri.com

Video Tutorials:
• CityEngine Essential Skills: http://bit.ly/1jAz07m
• Basic Shape Grammar: http://bit.ly/1osrvLO
• Façade Modeling: http://bit.ly/1r5jkeC
• Advanced Shape Grammar: http://bit.ly/1rfHeSn
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