Virtual Reality to Support Modelling

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VIRTUAL REALITY TO SUPPORT MODELLING: WHY & WHAT IS IT GOOD FOR?

- Why is the TSC /M&V investigating VR?
  - Independent fresh look at current and new Visualisation technologies.
  - Gaming industry investing heavily in VR
    - (Facebook $2bn into Oculus)
  - Predictions look good for use of VR across the industries.
  - Computational thresholds surpassed
    - CPU/GPU performance thresholds surpassed
  - Costs dropping significantly
  - New peripherals and ways of interacting with data/simulations would this time make VR more engaging and capable.
VIRTUAL REALITY TO SUPPORT MODELLING: HUMAN FACTORS, USER CENTERED DESIGN PRINCIPLES

- Applying HF & UCD principles to modelling & simulations.
- Decision makers / how to select transport options requires...
  - Understand stakeholders? – Process
  - Understand what moral / political pressures? - Psychology
  - What drives or motivates? - Empathy
  - How to connect with stakeholders/decision makers? – Engagement.
- Experiments / public engagement
- What interaction & interactivity is necessary?
  - Insight / perspective
  - Stakeholder Experimentation / Optioneering
VIRTUAL REALITY TO SUPPORT MODELLING: MULTI SENSORY EXPERIENCE: "IMMERSION"

• "Immersion into virtual reality is a perception of being physically present in a non-physical world. The perception is created by surrounding the user of the VR system in images, sound or other stimuli that provide an engrossing total environment."

• The literature indicates that more sensory involvement = more immersion.

• What we “see” and what we are “willing to believe” are often poles apart.
  • Similarities to Hypnosis
    • Person has to want to be hypnotized,
    • The brain augments the illusion sewn by the Hypnotist.
  • Lutz VR demo – Reports of sensation of motion.
VIRTUAL REALITY TO SUPPORT MODELLING: VR SOFTWARE / PERIPHERALS

- VR is driven by Gaming Engines (Unity / Unreal)
- Head Mounted Displays (Oculus Rift / HTC Vive, GearVR, CB)
- Holographics, hand tracking, and physical interactivity
- 3D spatial sound generation
- Haptics:
  - Gloves / suits
  - Thermal simulation
  - Wind / air movement
  - Olfaction generation
- Not all of these are necessary to create a sense of Immersion.
- More sensory involvement = Increased development costs.
VIRTUAL REALITY TO SUPPORT MODELLING: VISUALISATION TEAM ACTIVITIES TO DATE

Objective: To become the one stop shop for information and assistance to build virtual reality tools.

- Task 1: Build an environment that was familiar and one in which the TSC was actively involved = MK
- Task 2: Identify what peripherals add value to VR interactivity.
- Task 3: Identify the pertinent senses to stimulate to generate immersion.
- Task 4: Improve the levels of Immersion.
- Task 5: Integrate transport models/simulations.
- Task 6: Promote, engage, re-evaluate, enhance, collaborate.
VIRTUAL REALITY TO SUPPORT MODELLING:
PROJECT: PODS & PEDS

Challenge: Can we use VR to run user trials with AVs?

Using MK VR: We are collaborating with a UK Automotive OEM to develop:

- Using MK VR we are creating and testing multiple scenarios
- HMI concept evaluation (internal and external)
- Vehicle behavioral characteristics
- The thresholds for immersion
- Measure physiological and psychological reactions to events.
- Pod occupant reactions (External HMI and vehicle behaviour).
- Pedestrian behavior/reactions towards autonomous vehicles
VIRTUAL REALITY TO SUPPORT MODELLING: PROJECT: VISUALISING AN HLA INTEGRATED MODEL IN UNITY

**Challenge**: Populating 3D environments with activity.

**Using the HATS project**: (linked Ped and Pod simulators via HLA)

- Used the **VR MK** environment to showcase the integrated simulation.
  - Piped in HLA/model’s outputs to Unity as vectors
  - Ability to view simulation from any position and debug.
- Conclusions/next steps: to build a “Matrix” with heightened levels of interaction and immersion.
- Need to work with simulation software vendors to investigate time stamp manipulation and “what if” scenarios / interaction with agents.
VIRTUAL REALITY TO SUPPORT MODELLING:
TO SUPPORT TRANSPORT MODELLING & SIMULATION

**Challenge:** populating 3D environments with agents...

**Station Innovation 2:** Work package 3 (pedestrian tracking)
- Identify ethical and legal constraints to tracking movement.
- Station manager’s user interface requirements
  - What blend of sensors are required to deliver capability?
- Build a user interface to view and interact with the data.
- Tracking data collected made available for research.
- We would like find partners to use the collected data to:
  - To compare actual recorded to simulated ped movements.
  - To look at enhancements to pedestrian simulations.
VIRTUAL REALITY TO SUPPORT MODELLING: TO SUPPORT TRANSPORT MODELLING & SIMULATION

**Challenge:** Creation of large and accurate 3D environments (city scale).

- Through the building of VR MK and Pod based experiments we identified…
  - Insufficient time to simulate all the necessary scenarios to develop and validate Autonomous Control Systems.
- Tools exist that with some modification/system integration could help to generate virtual cities much faster.
  - City Engine, GIS tools, OS data/maps, open street map, Drone aerial surveys, databases of information, new surveying technology.
VIRTUAL REALITY TO SUPPORT MODELLING: HOW CAN/SHOULD WE USE VR?

Conclusions: Barriers to greater adoption/use of VR:

• Building large 3D environments is time consuming / costly.
• Populating /animating agents in VR takes lots of time.
  • Application specific
  • We need use models/simulations to drive larger and more natural interactions in VR?
• Greatest stakeholder engagement is achieved when users feel like they can
  • Move naturally
  • Affect / change proceedings.
VIRTUAL REALITY TO SUPPORT MODELLING: WHERE TO NEXT?

- Further integration of models/simulation with VR peripherals and virtual environments.
- Multi-user interaction within virtual worlds.
- Identify the best HMI for interaction with simulations / VR.
  - HMI Inspiration being drawn from Sci fit – Minority Report / Ironman
  - Agent based simulators are most suited to VR / live interaction.
- “Barriers to building better virtual 3D environments” workshop
  - 02/02/2017
- To request attendance: visualisation@ts.catapult.org.uk
- Watch out for the new Spielberg Film – Ready Player One