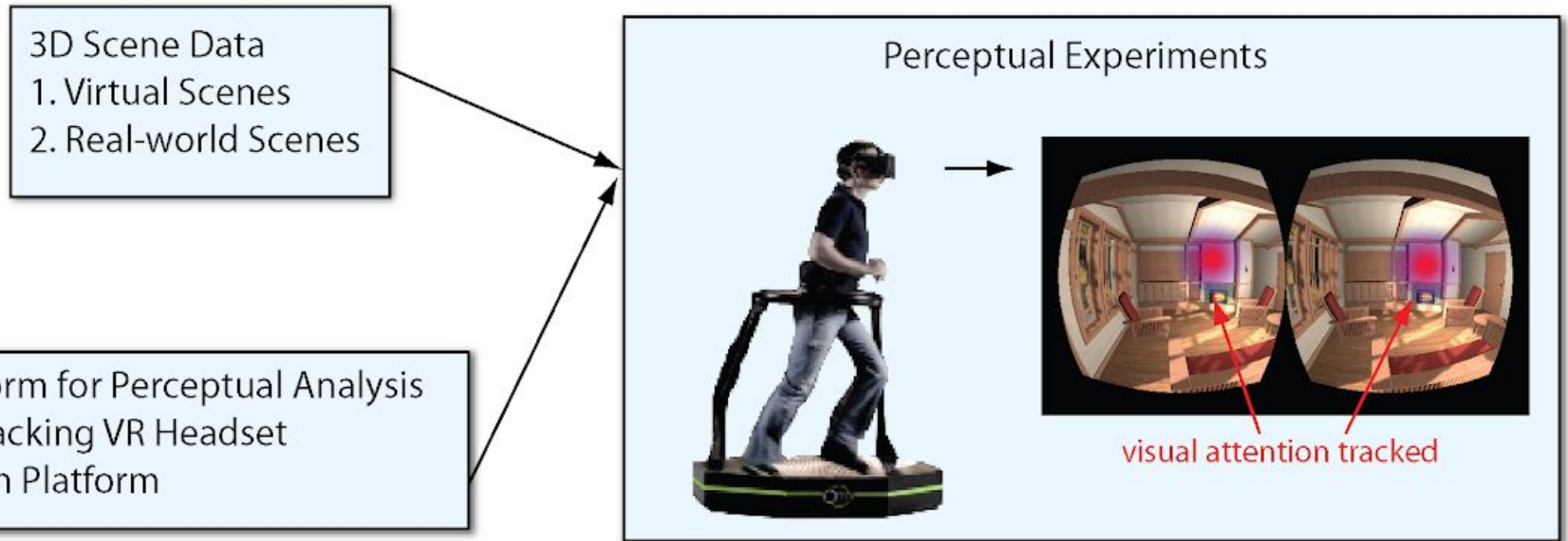


Creating Novel VR Tools for Spatial Design Training via Learning from Human Perceptions and Behaviors in Virtual Simulated Workplaces

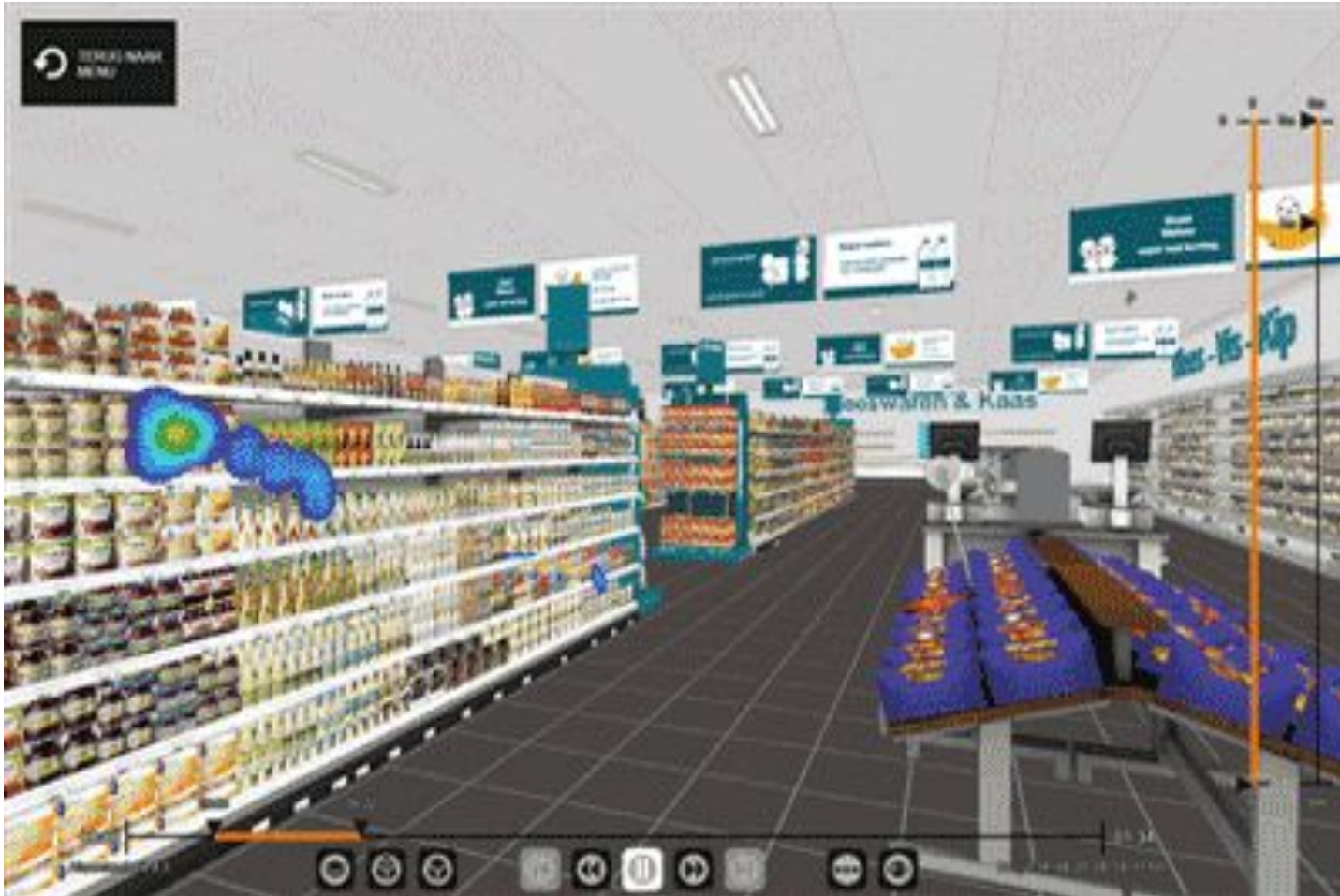
Lap-Fai (Craig) Yu, George Mason University
Tomer Weiss, UCLA / Wayfair Research
Christos Mousas, Purdue University

Perceptual Data-Guided Level Design

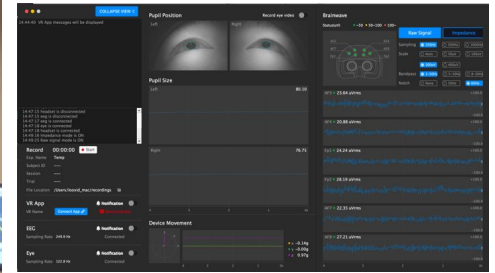
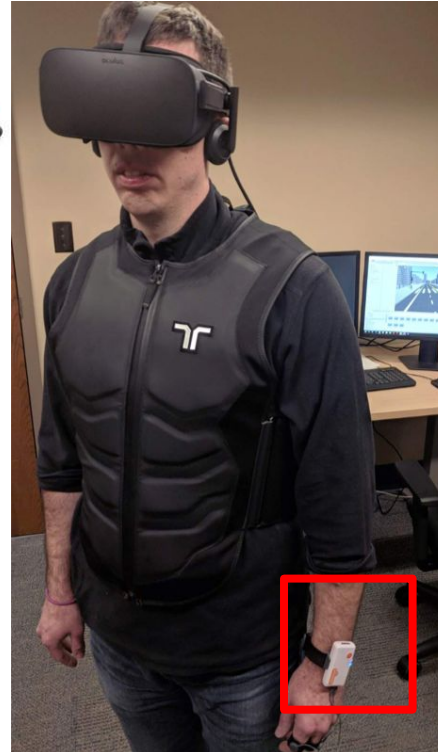
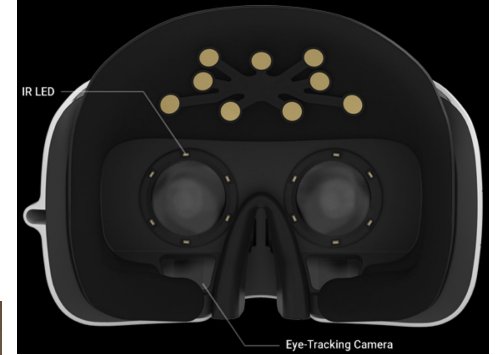


Eye-tracking VR headset

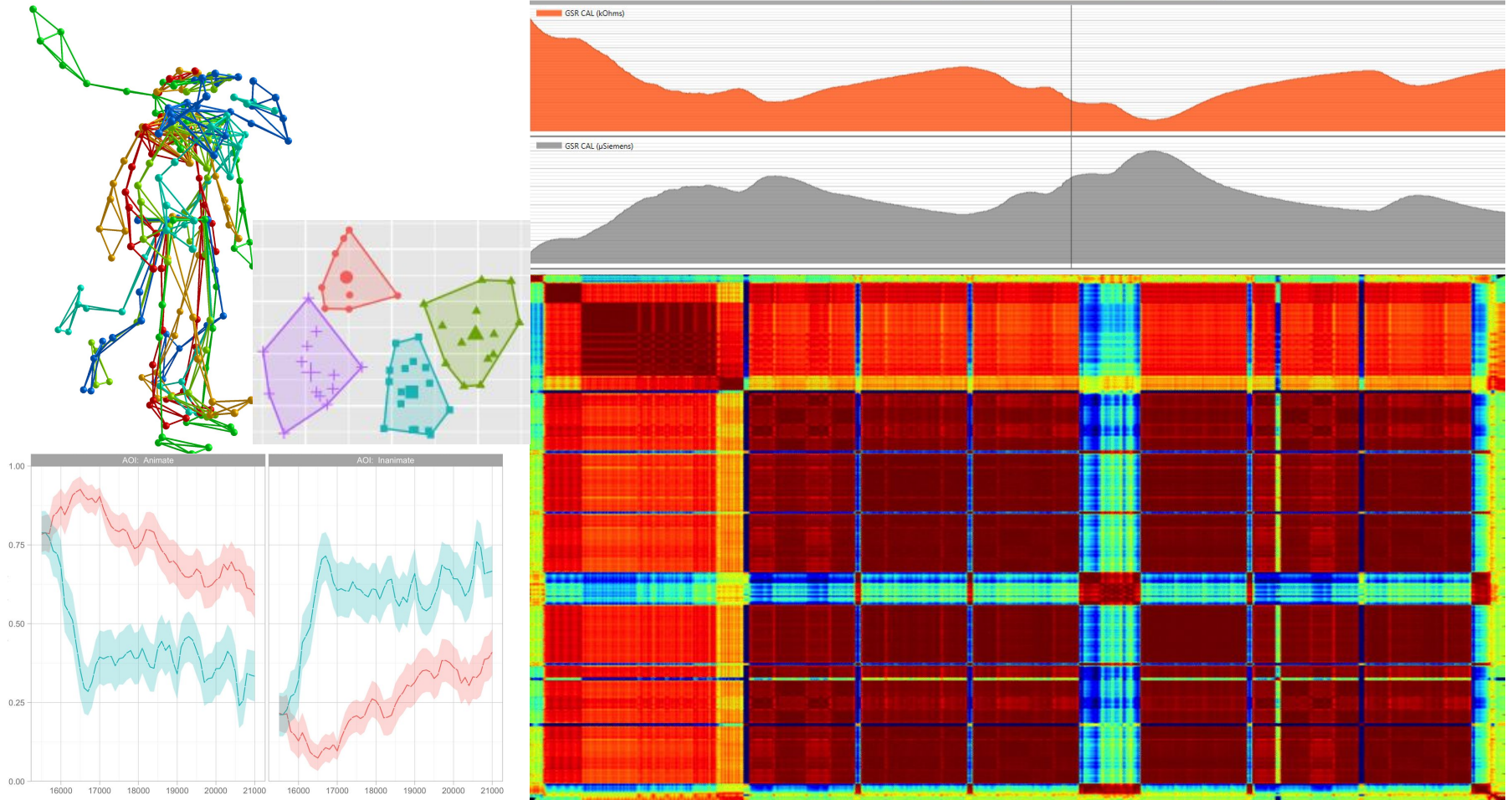
Perceptual Data-Guided Level Design



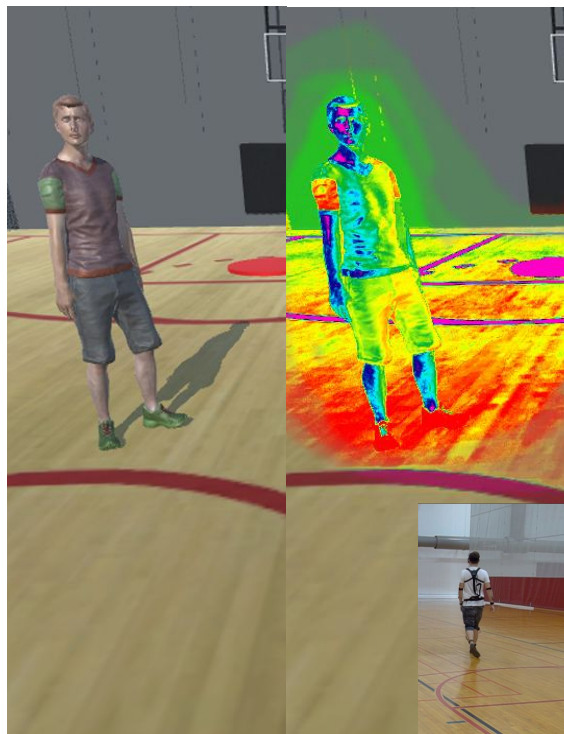
Tracking Devices for VR Interaction



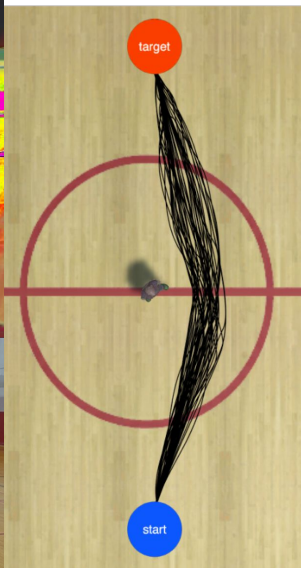
Analysis of Human Behavior & Actions



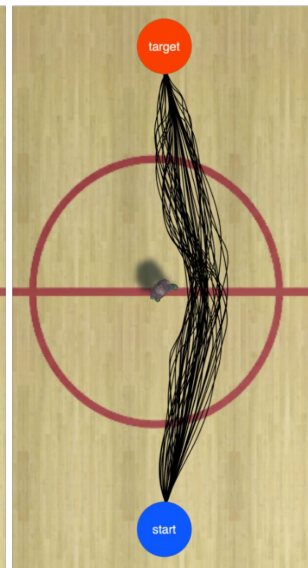
Priors of Human Behavior & Actions



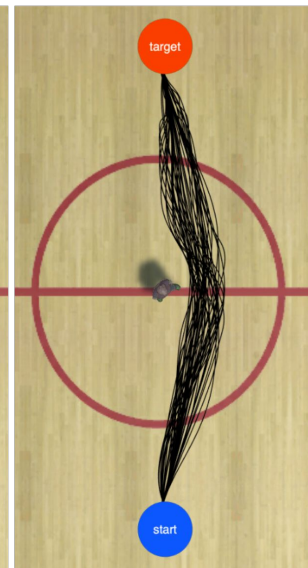
Self-Avatar LookAt



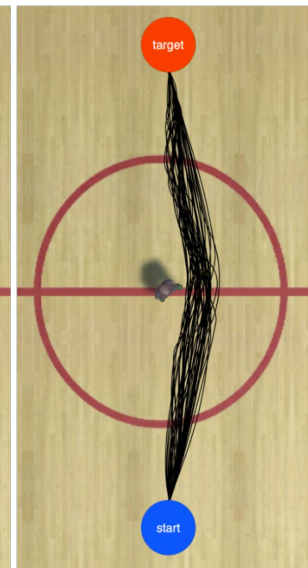
No Self-Avatar LookAt



Self-Avatar No LookAt



No Self-Avatar No LookAt



Length (in cm)



Duration (in sec)



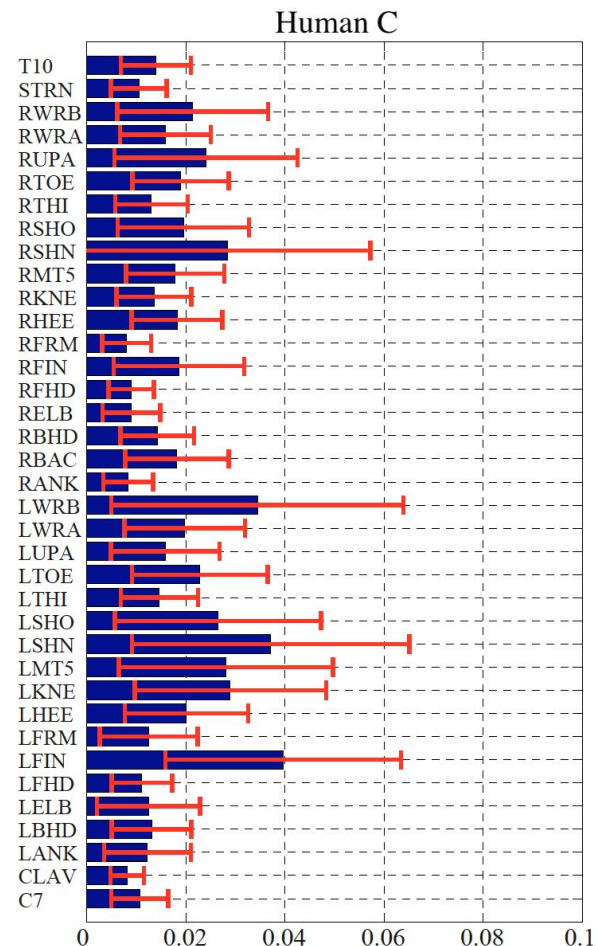
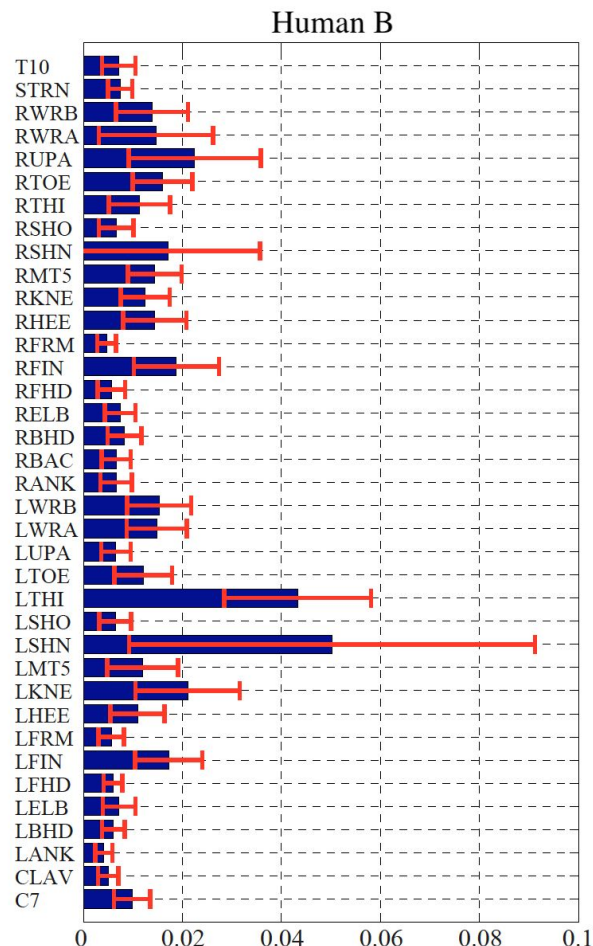
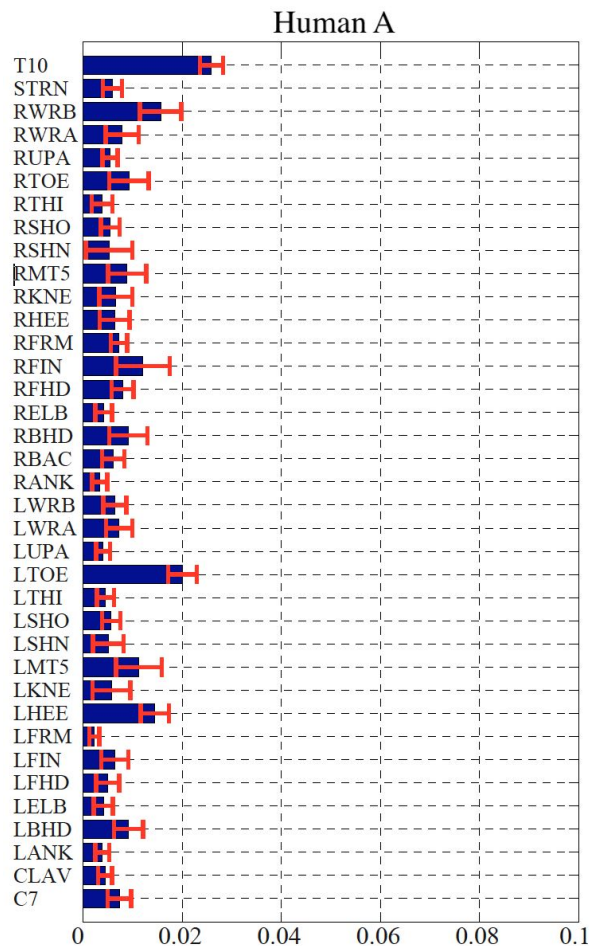
Speed (in cm/sec)



Deviation (in cm)



Priors of Human Behavior & Actions



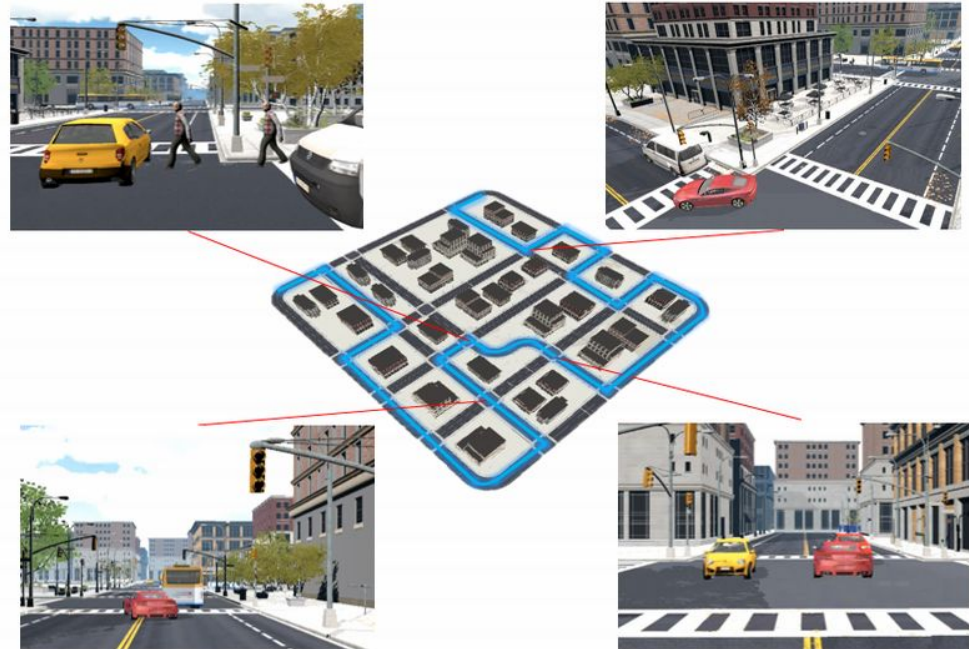
Procedural Generation of Virtual Environments



Generated scenes

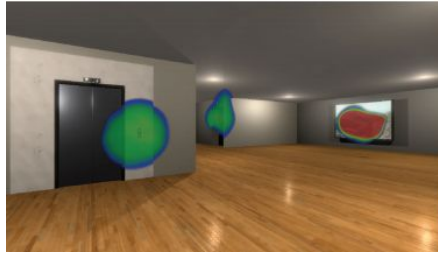
Make-it-Home: Automatic Optimization of Furniture Arrangement, SIGGRAPH 2011

Procedural Generation of Personalized VR Training

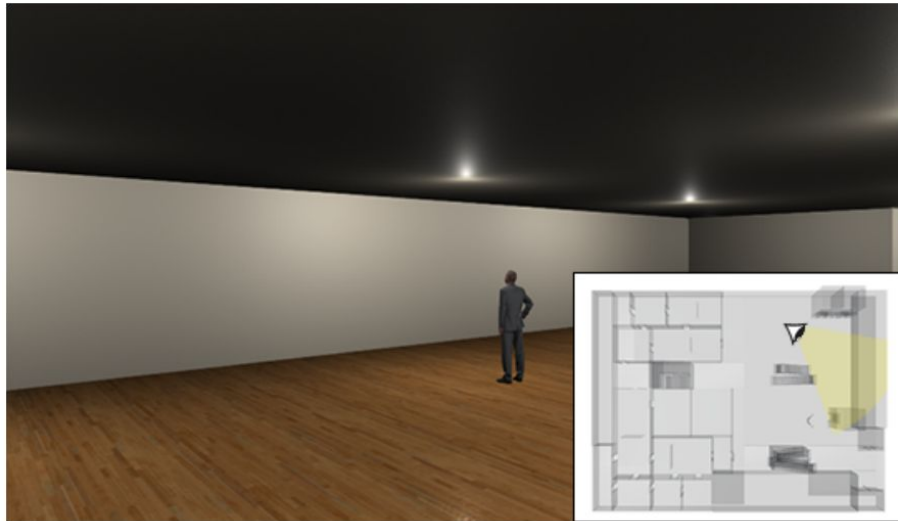


Synthesizing Personalized Training Programs for Improving Driving Habits via Virtual Reality. IEEE VR 2018

Perceptual Data-Guided Spatial Design



VR Eye-tracking Data



Optimizing Visual Element Placement via Visual Attention Analysis. IEEE VR 2018

Functional Workspace Optimization



Functional Workspace Optimization via Learning Personal Preferences from Virtual Experiences. IEEE VR 2018

Computational Design in Industry

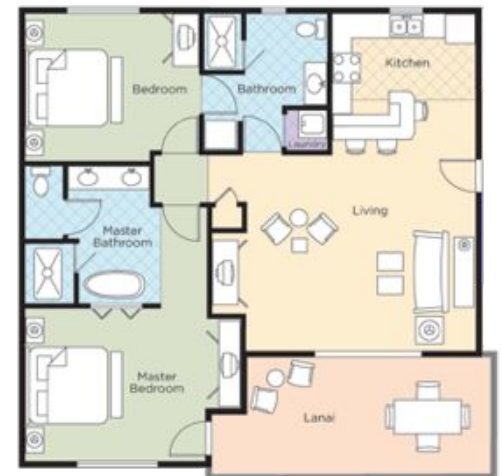


Computational Design

Interior Design



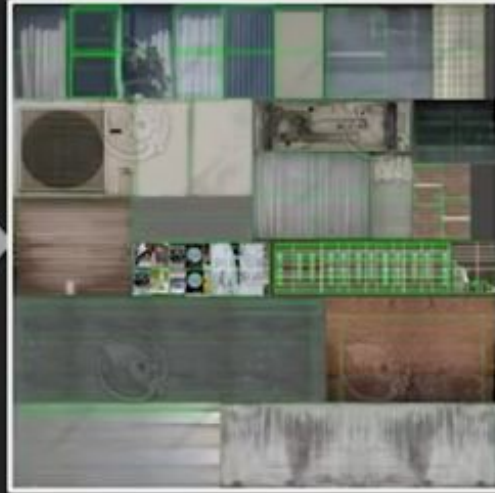
Architectural Design



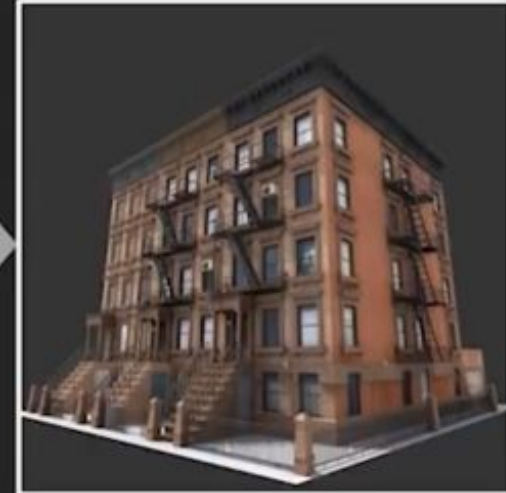
Virtual Assets are Unreasonably Expensive



Modelling: 12 hours



Texturing: 10 hours



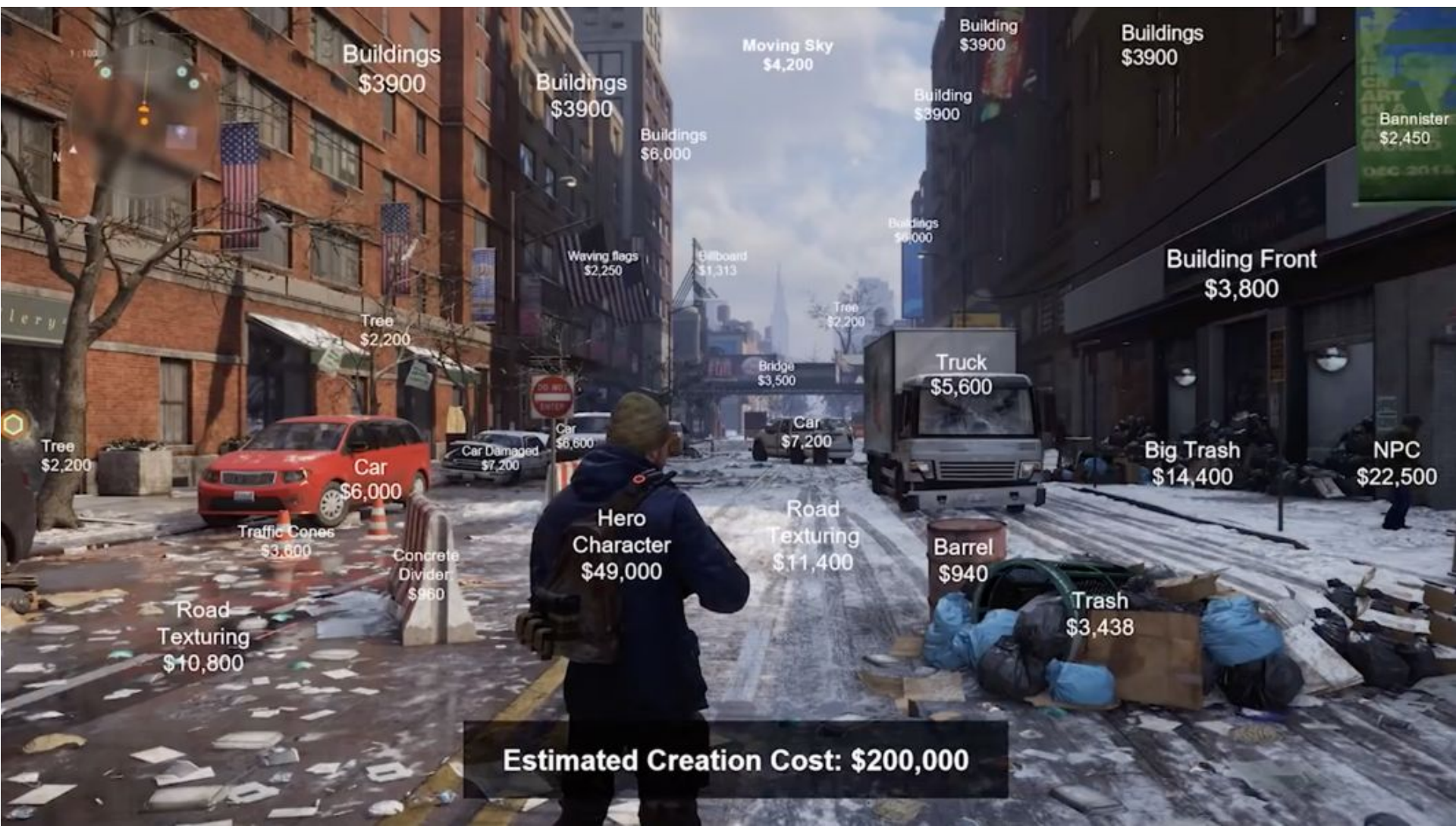
First pass total: 22 hours

Revisions: x2-4

Total of 66 Hours @ \$60/hr

\$3900

Typical \$ of Creating Scene Assets



Virtual Asset Creators: 3D Artists



Virtual Asset Creators: Stylists and Interior Designers



Virtual Asset Creators: Architects



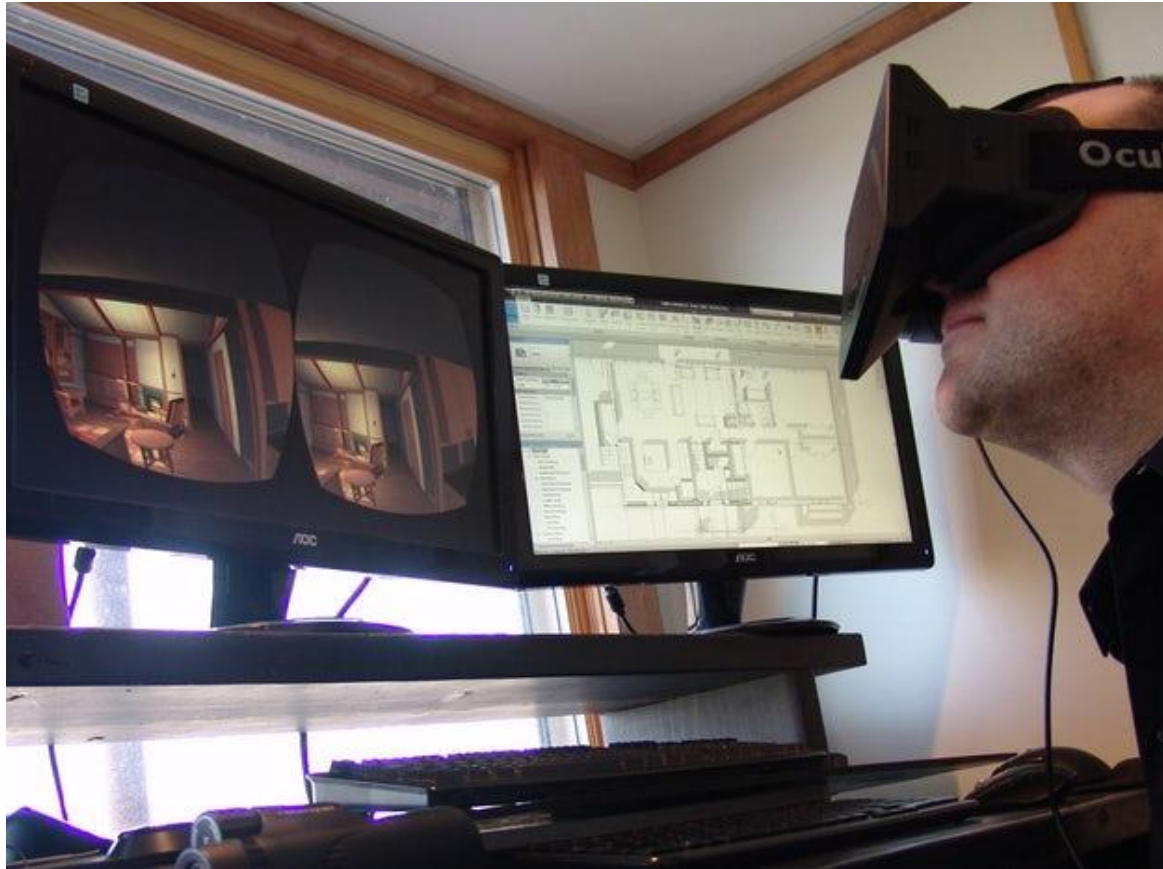
Interior Design with AR/VR



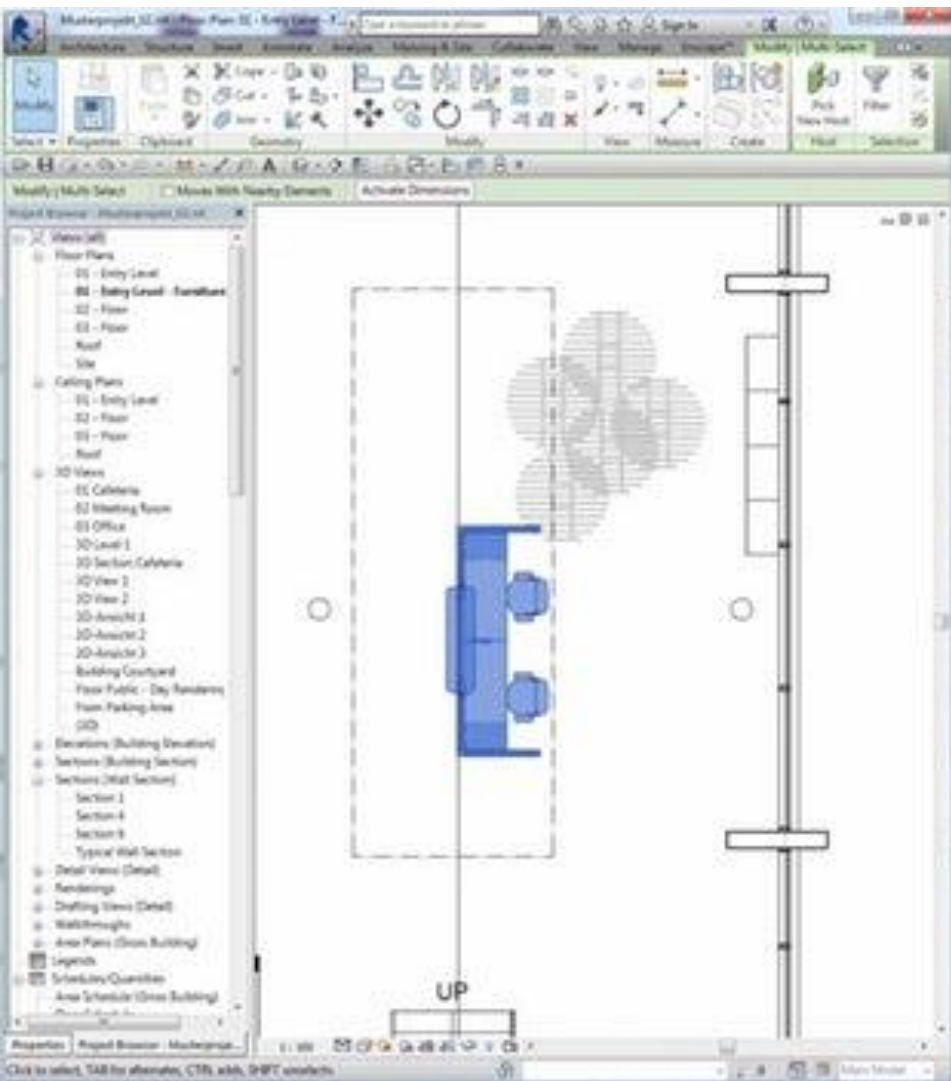
Shortcutting the Design Process with AR/VR @ Wayfair



Designing Larger Space: Architecture

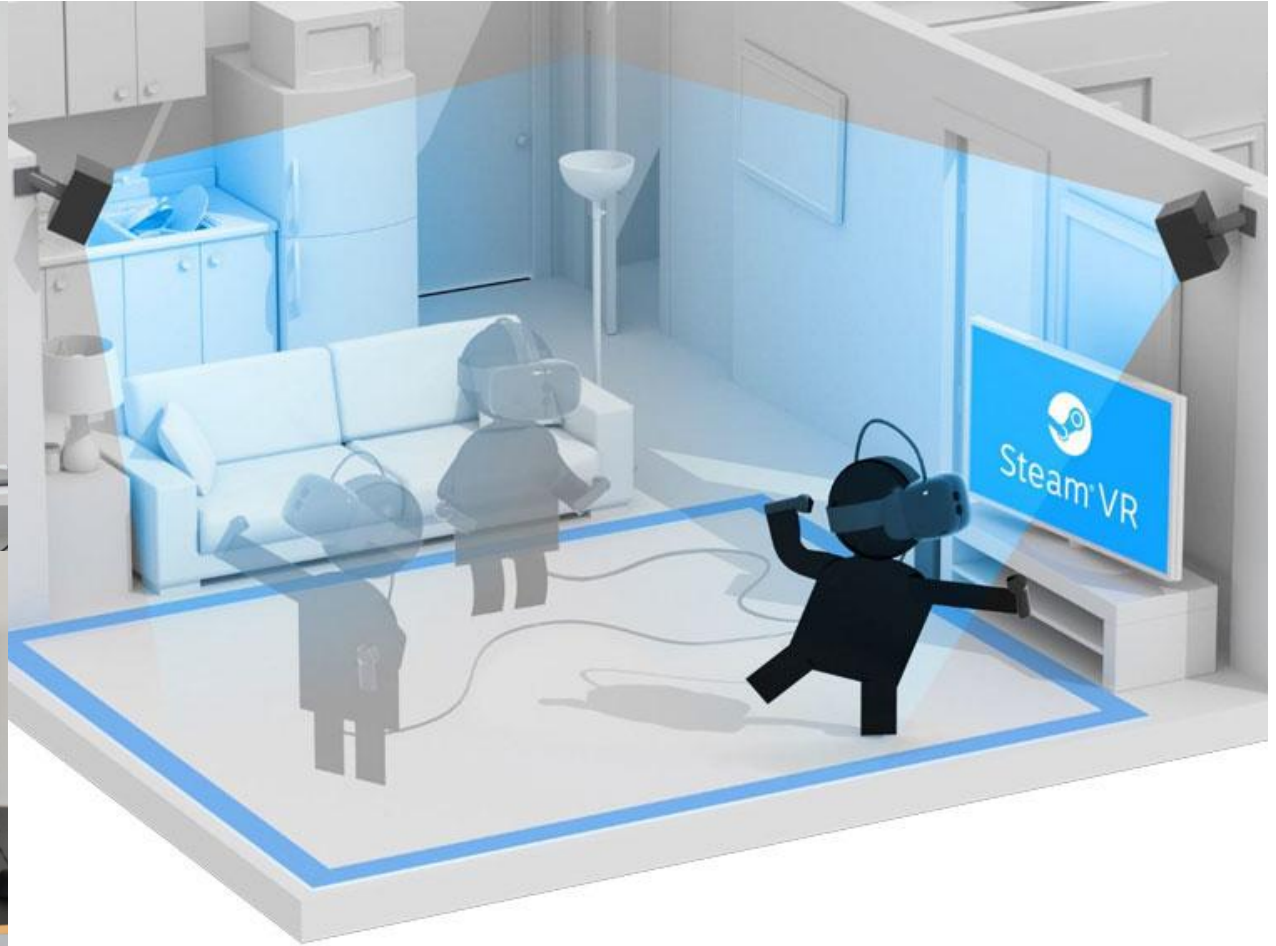


Designing Larger Space: Architecture





Limitations on Behavior Capture & VR Interaction



Closing Remarks

1. Hardware breakthroughs
2. Content creation tools for inexperienced developers
 - a. Teachers, S&M businesses
3. Robust computer vision algorithms for AR-based training

Q&A