



Virtual Reality at Nuthatch Hollow


An Emerging Tool for Sustainable Design in High Performance Buildings

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Course Description

Recent developments in virtual reality (VR) technology allow for the visualization of unbuilt information as immersive full-scale occupiable environments. These tools have proven to provide novel insight to designers, clients, and key stake holders during the design process. How might these tools be applied to visualize and predict the quantitative and material aspects of the design process related to sustainability and the communication of environmentally responsible design decisions both to the discipline and the public?

This presentation will highlight the application of VR as a visualization and simulation tool to support the design process and educational outreach of Nuthatch Hollow, a Living Building Challenge and Passive House project designed by Ashley McGraw Architects.

Learning Objectives

Learning Objective 1

Describe how the imperatives of the Living Building Challenge, together with the Passive House Standard contribute to a more sustainable and resilient built environment as effectively integrated in an education and research center..

Learning Objective 2

Recognize how advanced visualization and simulation using emerging tools can help with design decisions, contribute to better indoor environmental quality and reduce financial, material, and time waste caused by miscommunication during the design phase.

Learning Objective 3

Describe how the hands-on demonstration of virtual reality (VR) hybridizes quantitative and qualitative environmental information as an immersive and interactive experience.

Learning Objective 4

Recognize how VR contributes to effective communication of factors related to sustainable design decisions through full-scale spatial and interactive representation of content to both disciplinary and non-disciplinary audiences.

Virtual Reality for Sustainability

Introduce VR

Nuthatch Hollow

Passive House and the Living Building Challenge

IDVL and VR for Sustainability Research

VR in Practice & Education

Passive House VR Studies

Conclusion & Questions

Hands-On Demonstration

NUTHATCH HOLLOW

A Living Building Challenge and Passive House Project



NUTHATCH HOLLOW A Living Building Challenge and Passive House Project

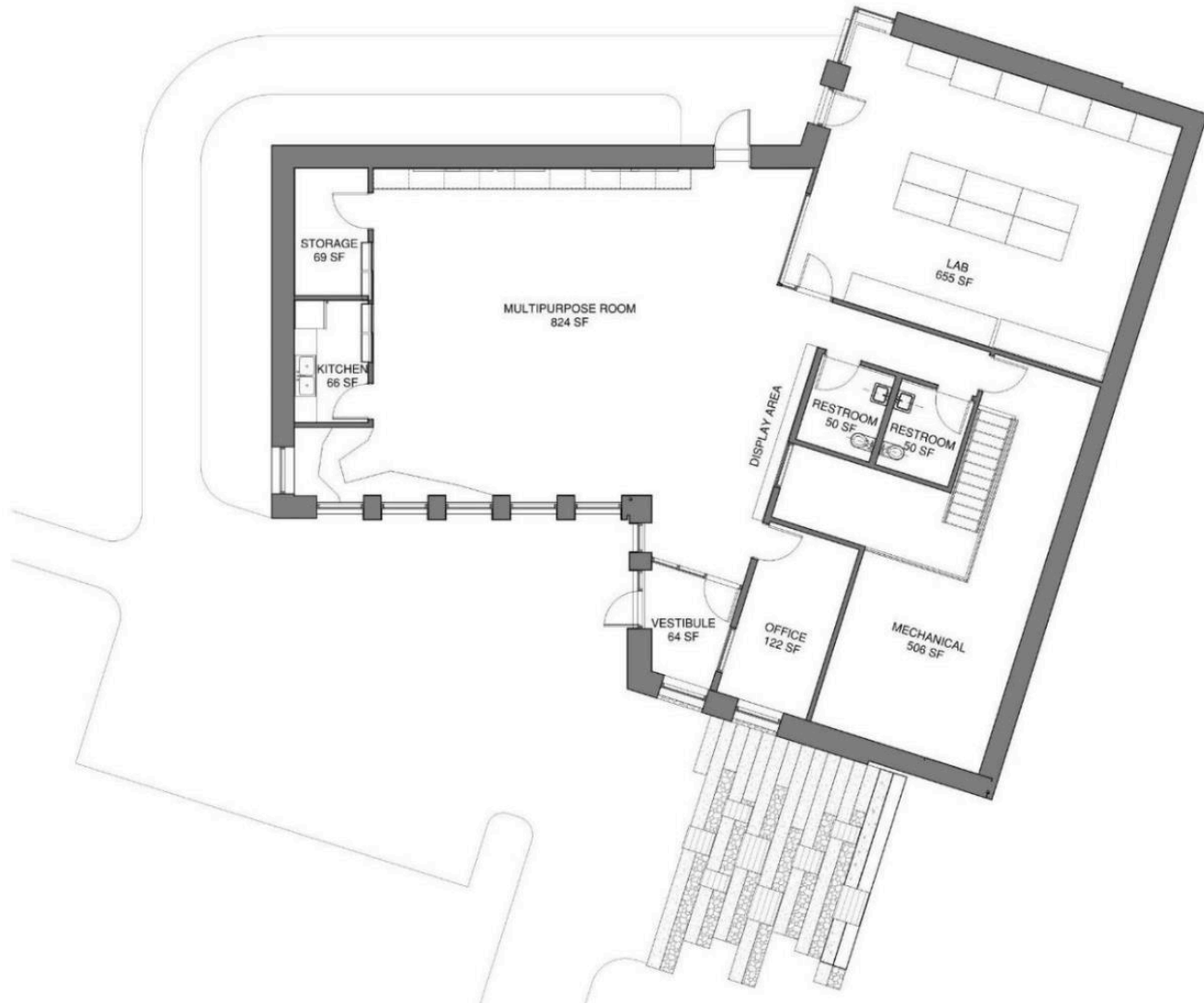


NUTHATCH HOLLOW A Living Building Challenge and Passive House Project

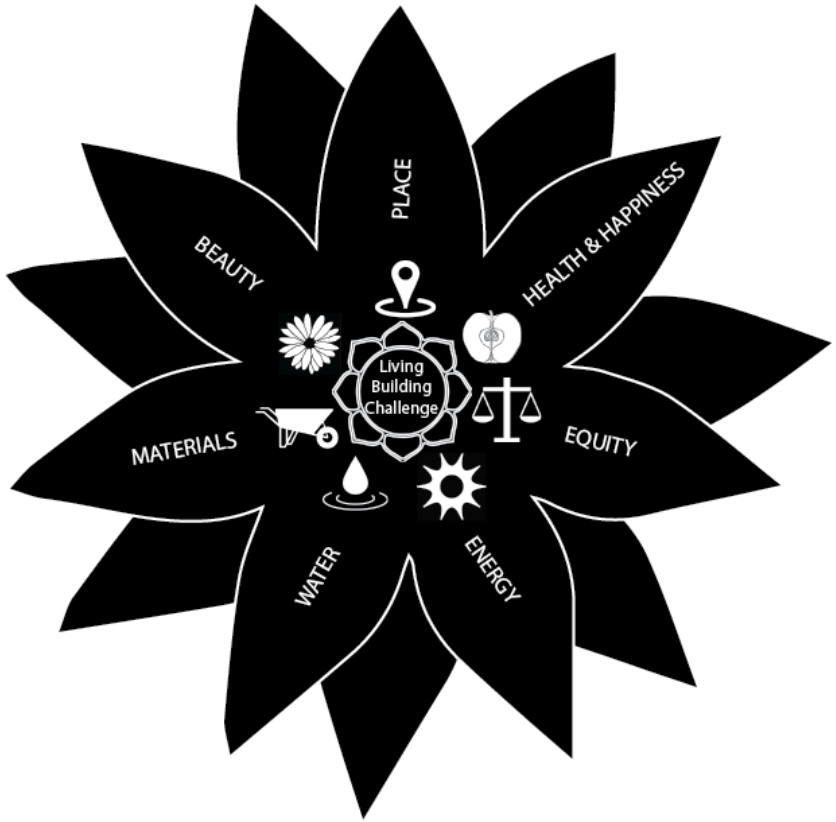
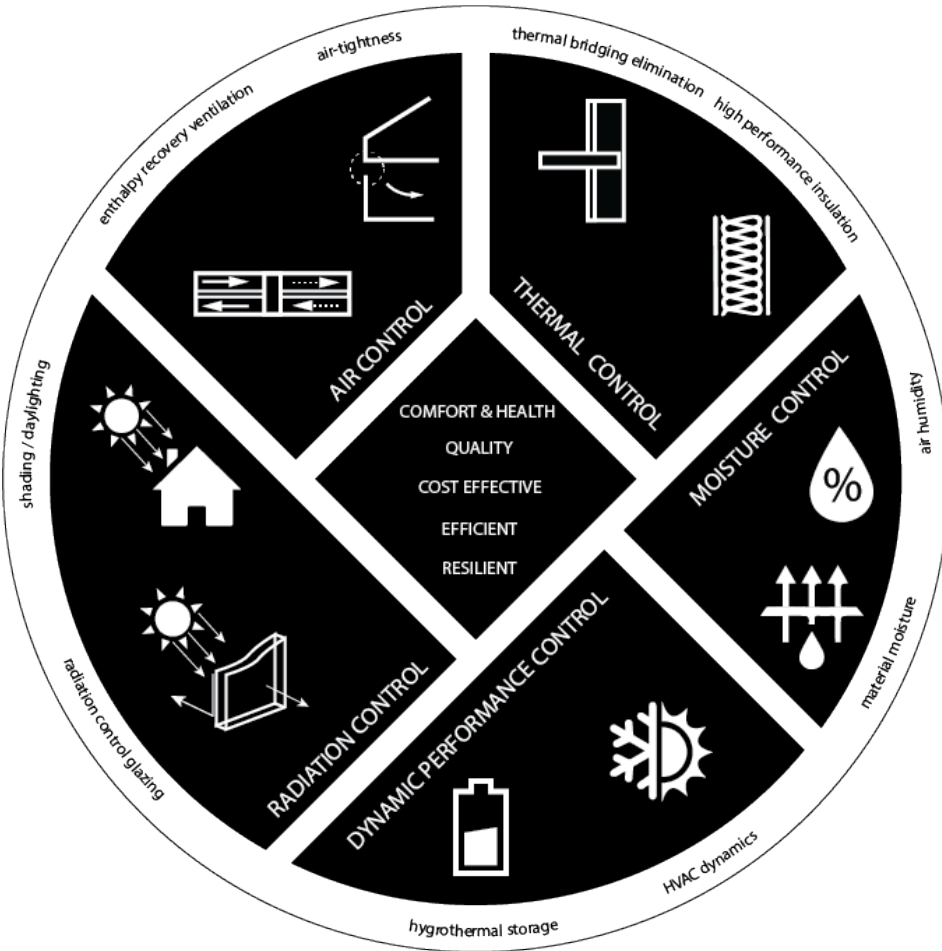


Nuthatch Hollow Floor Plan

Floor
Plan



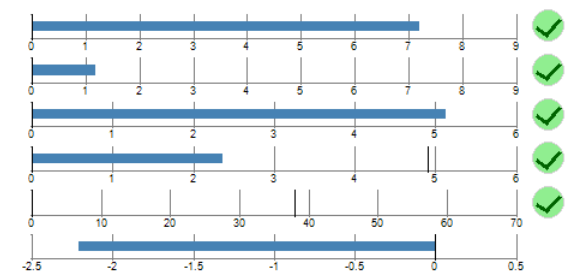
Passive House & Living Building Challenge



Climate Zone 5 climate-specific targets:

Annual heating demand: 9.5 kBtu/sf-iCFA.yr
Annual cooling demand: 9.4 kBtu/sf-iCFA.yr
Peak heating load: 6.7 Btu/sf-iCFA.h
Peak cooling load: 4.9 Btu/sf-iCFA.h
Source Energy (Commercial Building): 34.8 kBtu/sf/yr

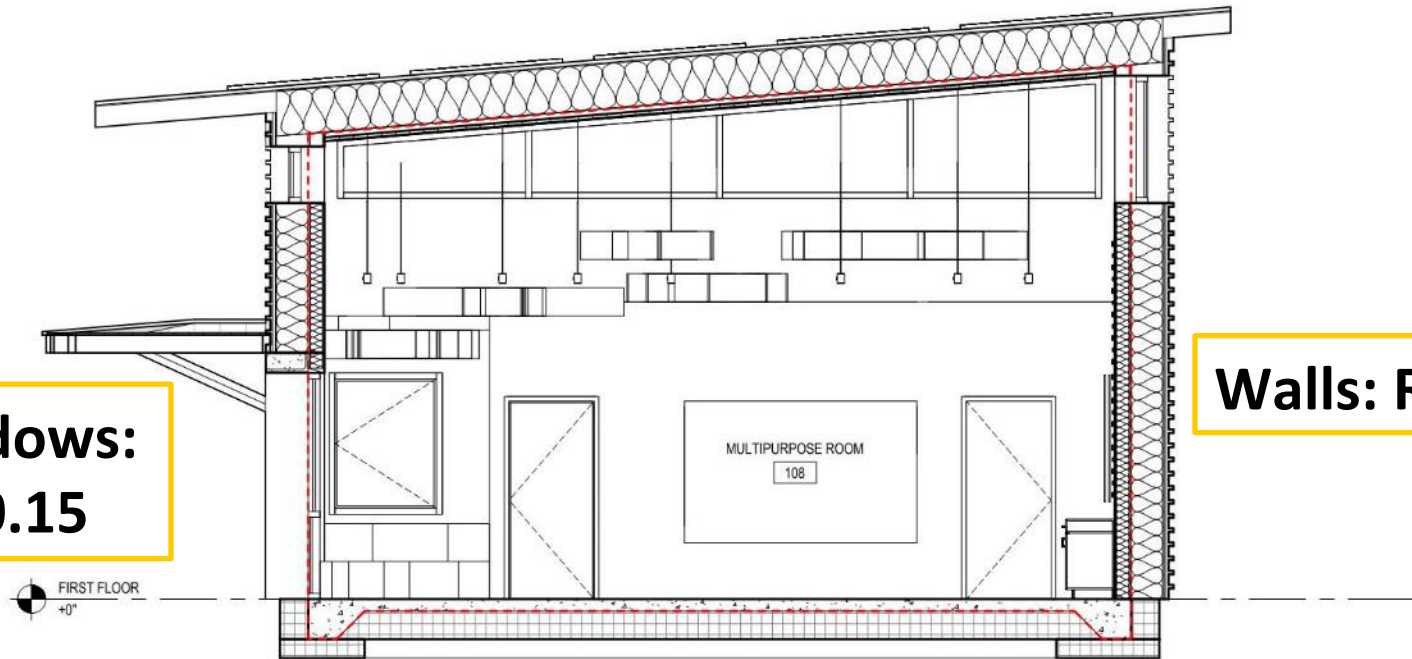
Heating demand: 7.21 kBtu/ft²yr
Cooling demand: 1.17 kBtu/ft²yr
Heating load: 5.12 Btu/hr ft²
Cooling load: 2.36 Btu/hr ft²
Source energy: 0 kBtu/ft²yr
Site energy: -2.21 kBtu/ft²yr



Roof: R-85/88

**Windows:
Uw 0.15**

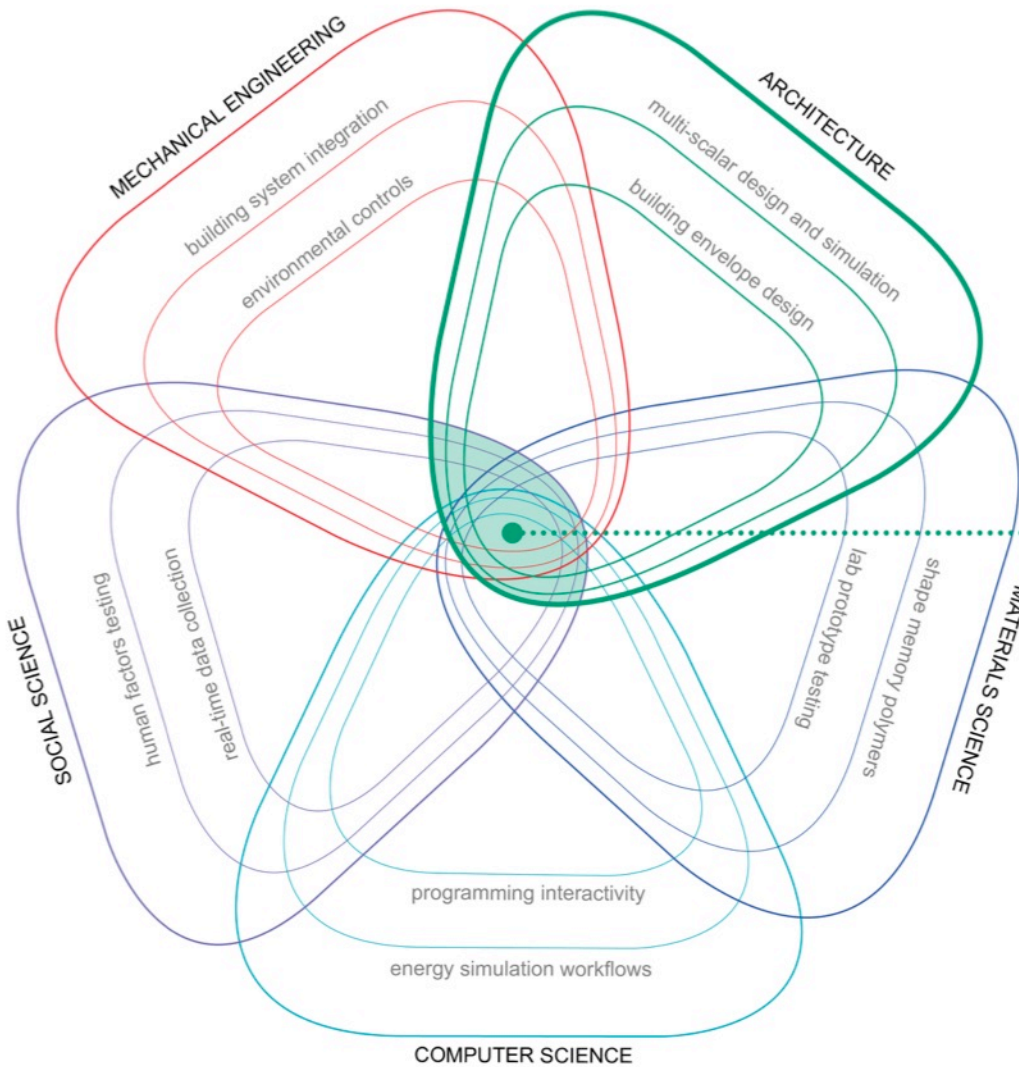
Walls: R-42/61



Slab: R-32

**Below Grade
Walls: R-34**





Design Research Questions

How can we perceive and experience our built environment in new ways to better understand the energetic relationships between our bodies, buildings, and cities?

Hybrid-Reality Design Frameworks for bioresponsive building systems and cities

How can design and visualization environments empower a wider audience with knowledge and opportunities for engagement in design decision-making processes?



←----- SCALE ----->

BUILDING
ENVELOPE

SCALE
BUILDING

URBAN
DESIGN

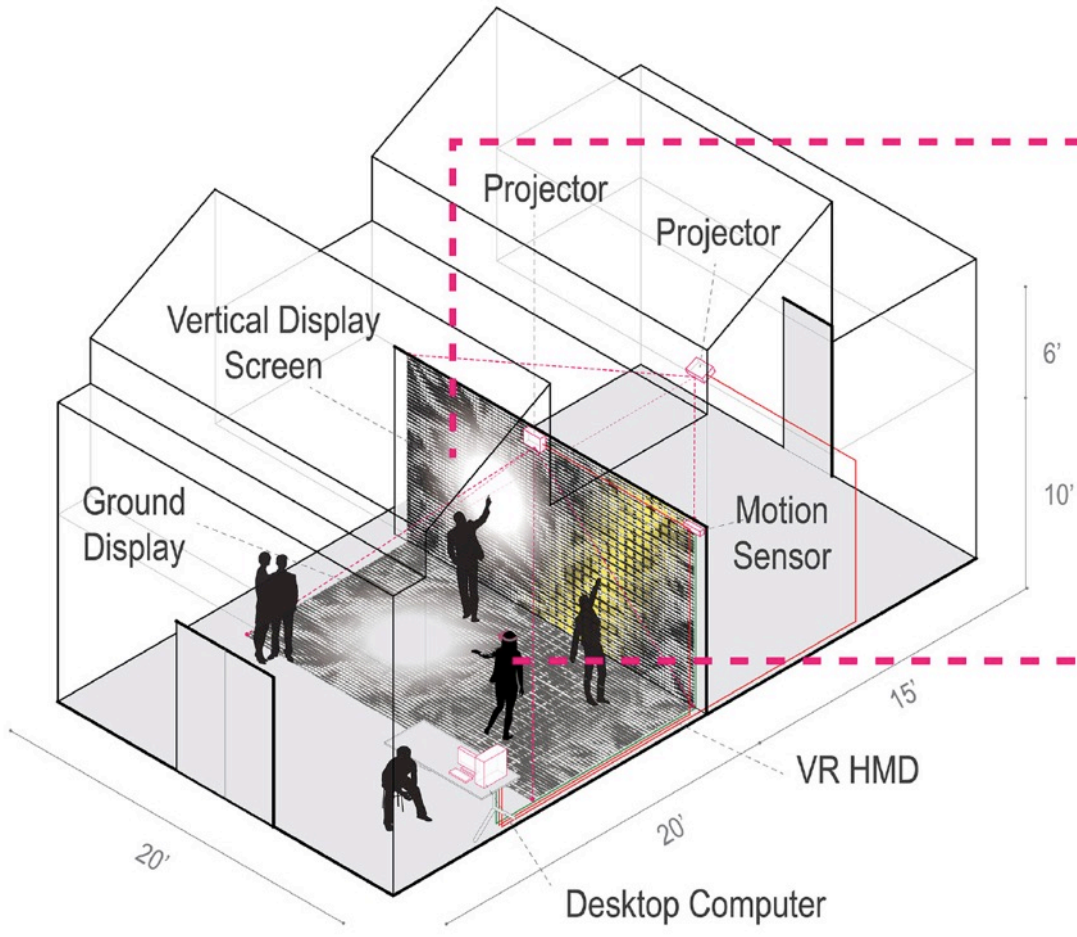


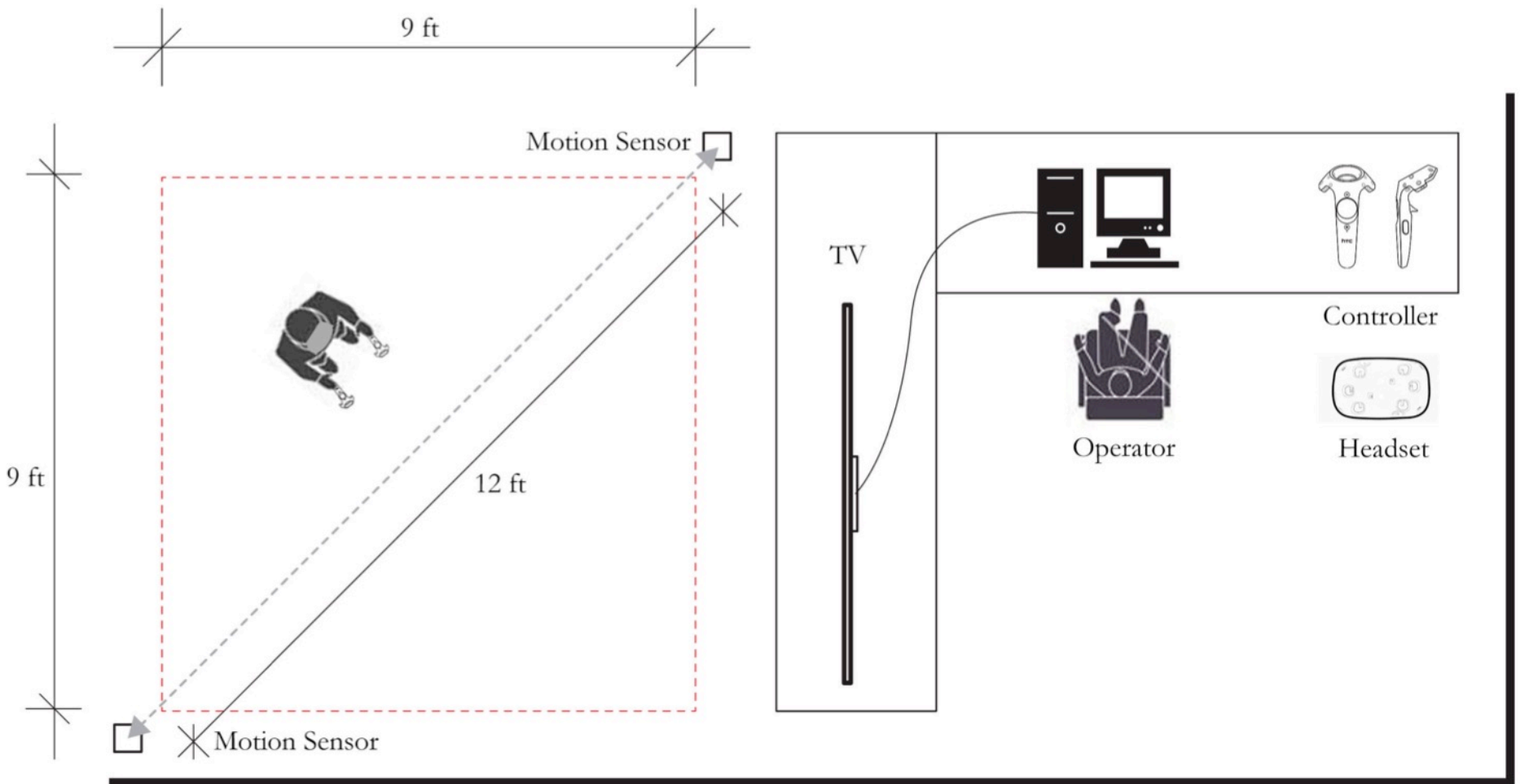
←----- REALITY ----->

PHYSICAL
REALITY

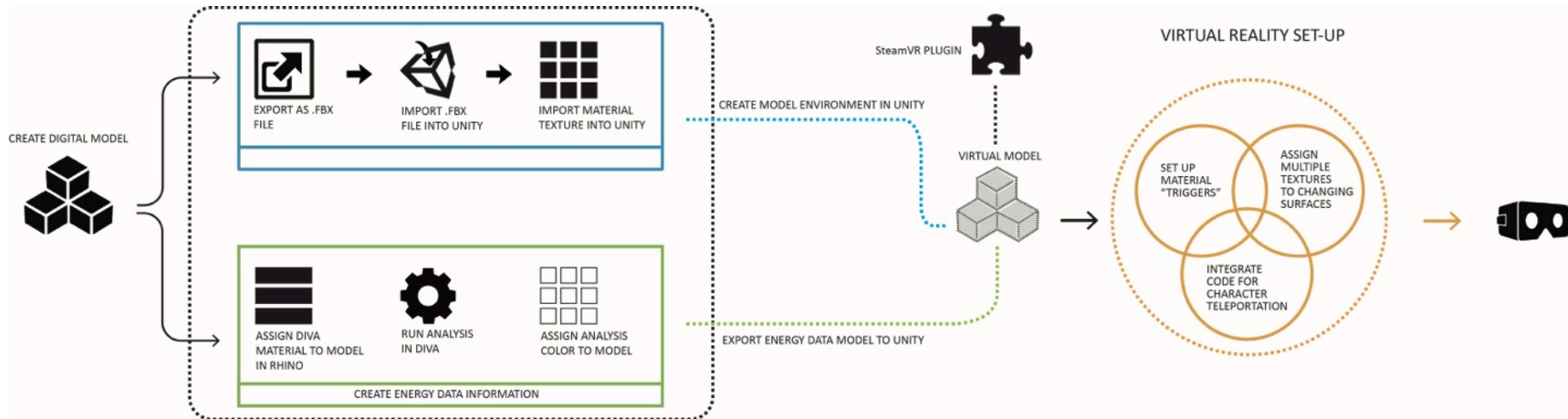
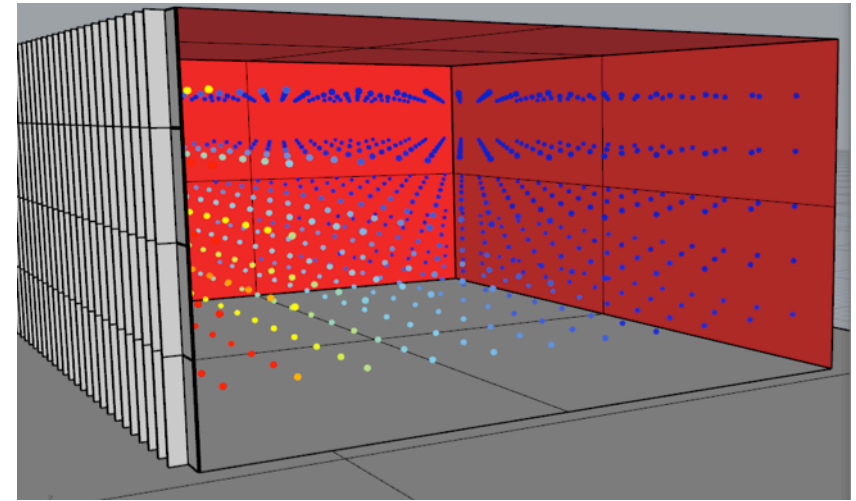
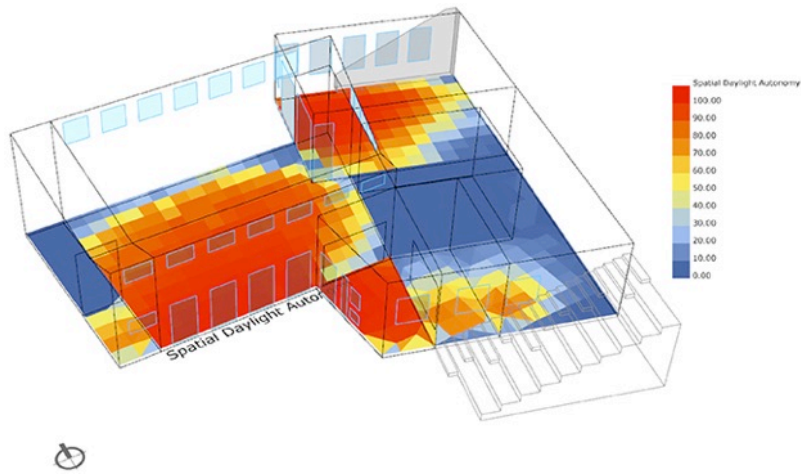
REALITY
AUGMENTED
REALITY

VIRTUAL
REALITY





VR Environmental Analysis Workflow



Bartosh, A., Krietemeyer, B. "Virtual Environment for Design and Analysis (VEDVA)" *TAD*, Vol.1, Issue 1 (2017)

In collaboration with Fengqi Li

What is VR?



- Immersive
- Full-Scale
- Mobile
- Dynamic
- Interactive



BENEFITS: CLIENTS

- Experience-based design decisions
- More efficient use of their time
- Overall greater satisfaction with final design
- Saves potentially costly change-orders down the road
- Prompts understanding of environmental and spatial conditions

BENEFITS: DESIGNERS

- Faster identification of design opportunities
- Easier collaboration between design professionals
- Quick 360 view rendering
- More fun to do the work!

VR in Practice



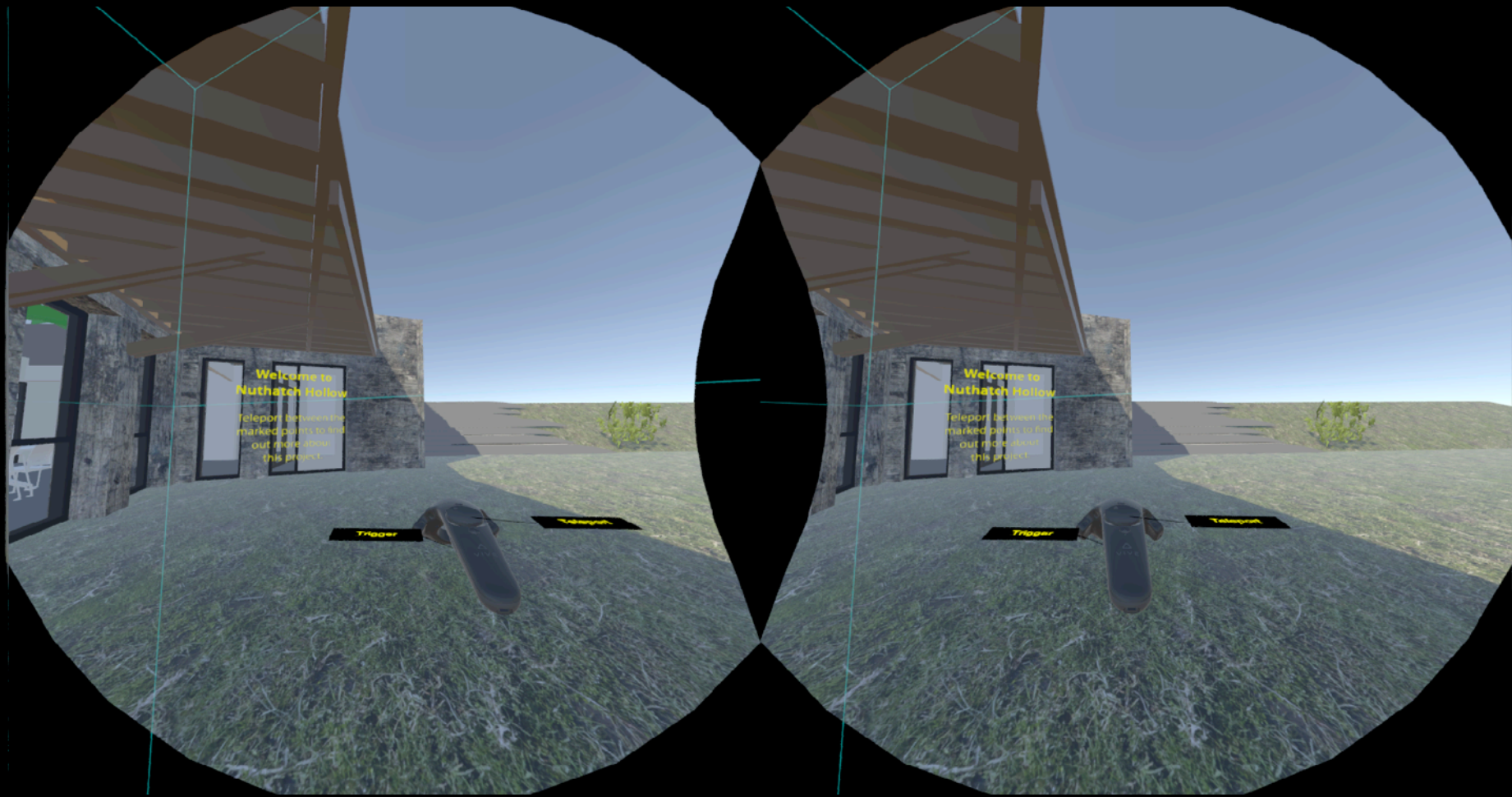
BENEFITS: EDUCATION

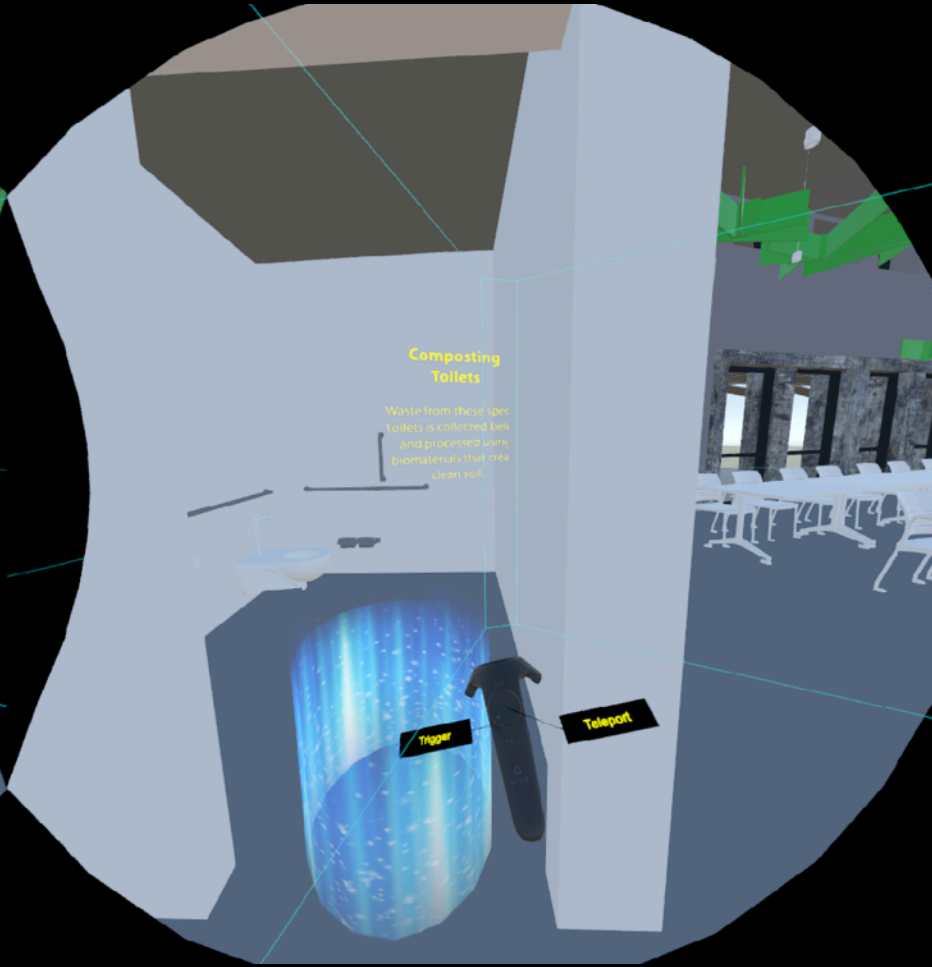
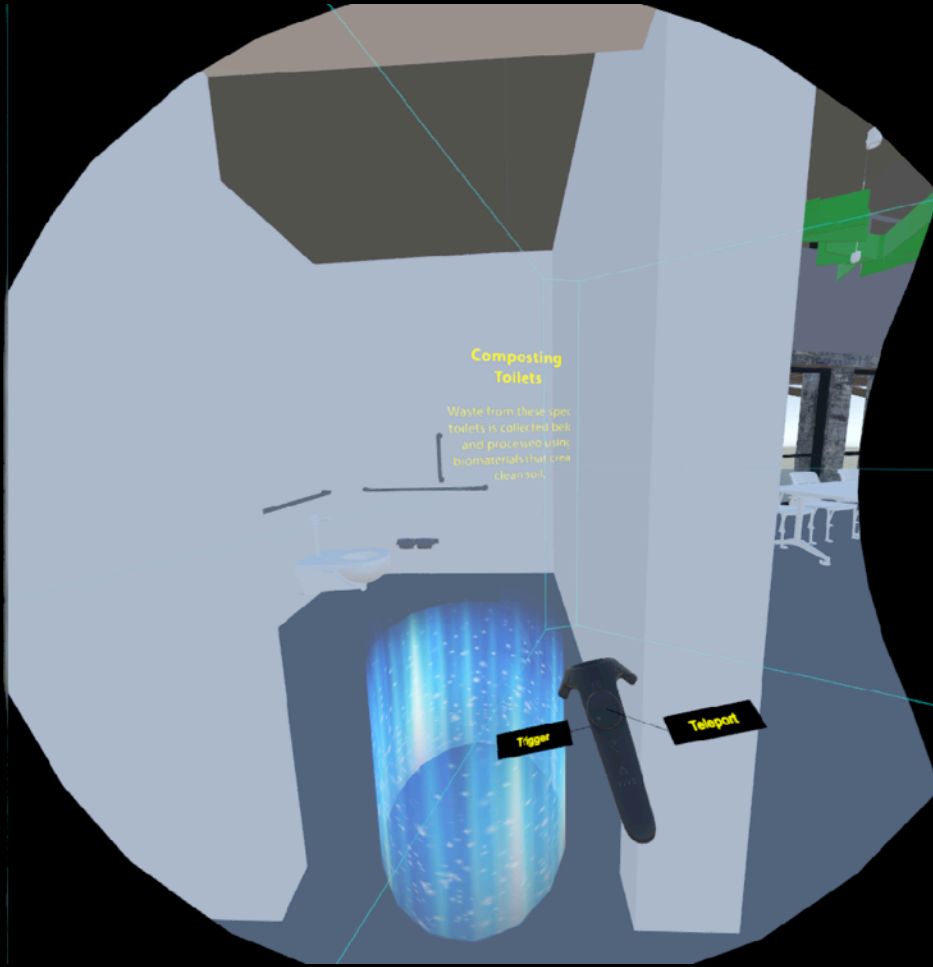
- Headset demands full attention
- Physical participation supports kinesthetic learning
- **Makes complex content more clear and fun!**

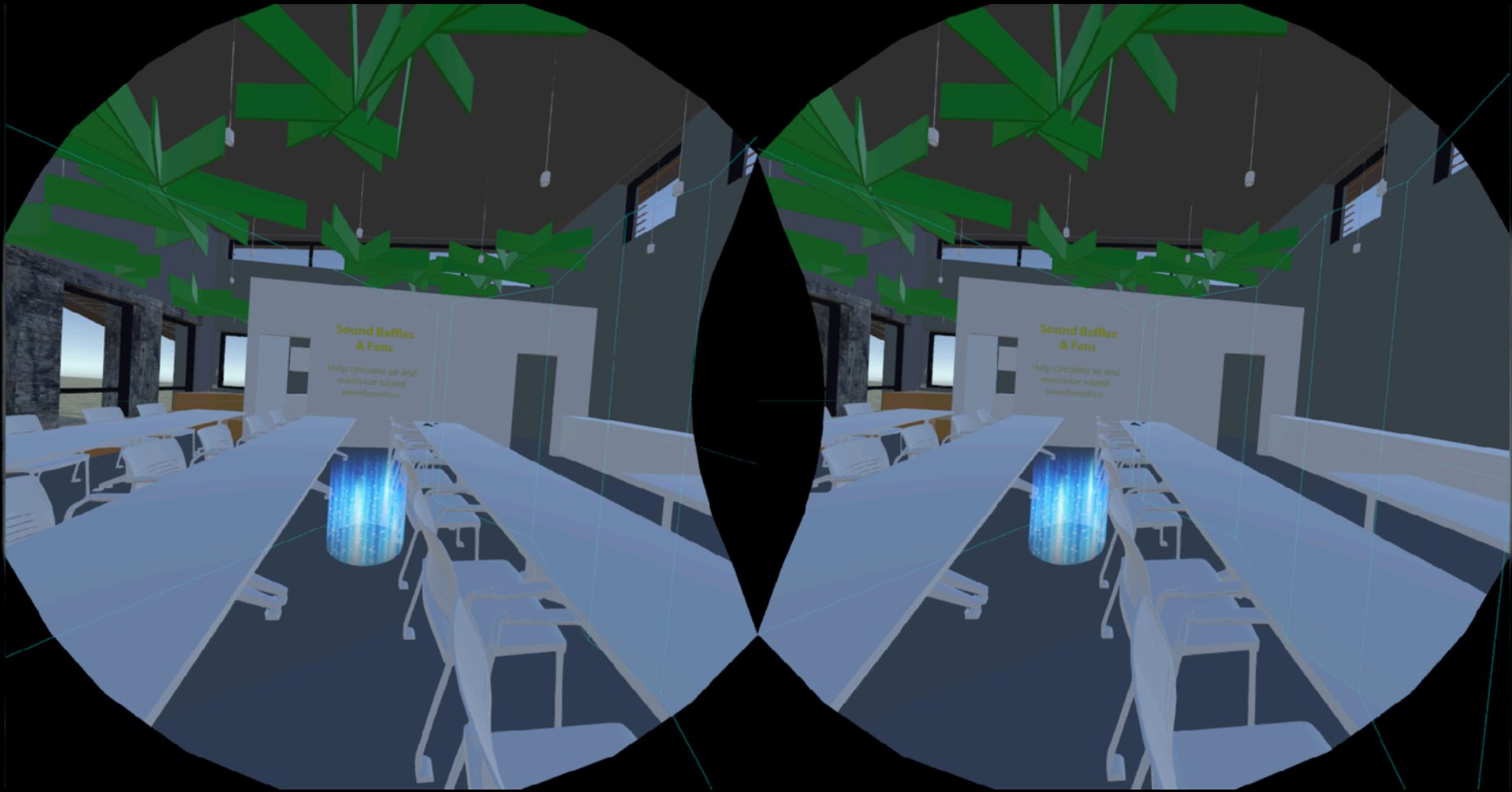


Welcome to Nuthatch Hollow

Teleport between the
marked points to find
out more about
this project.





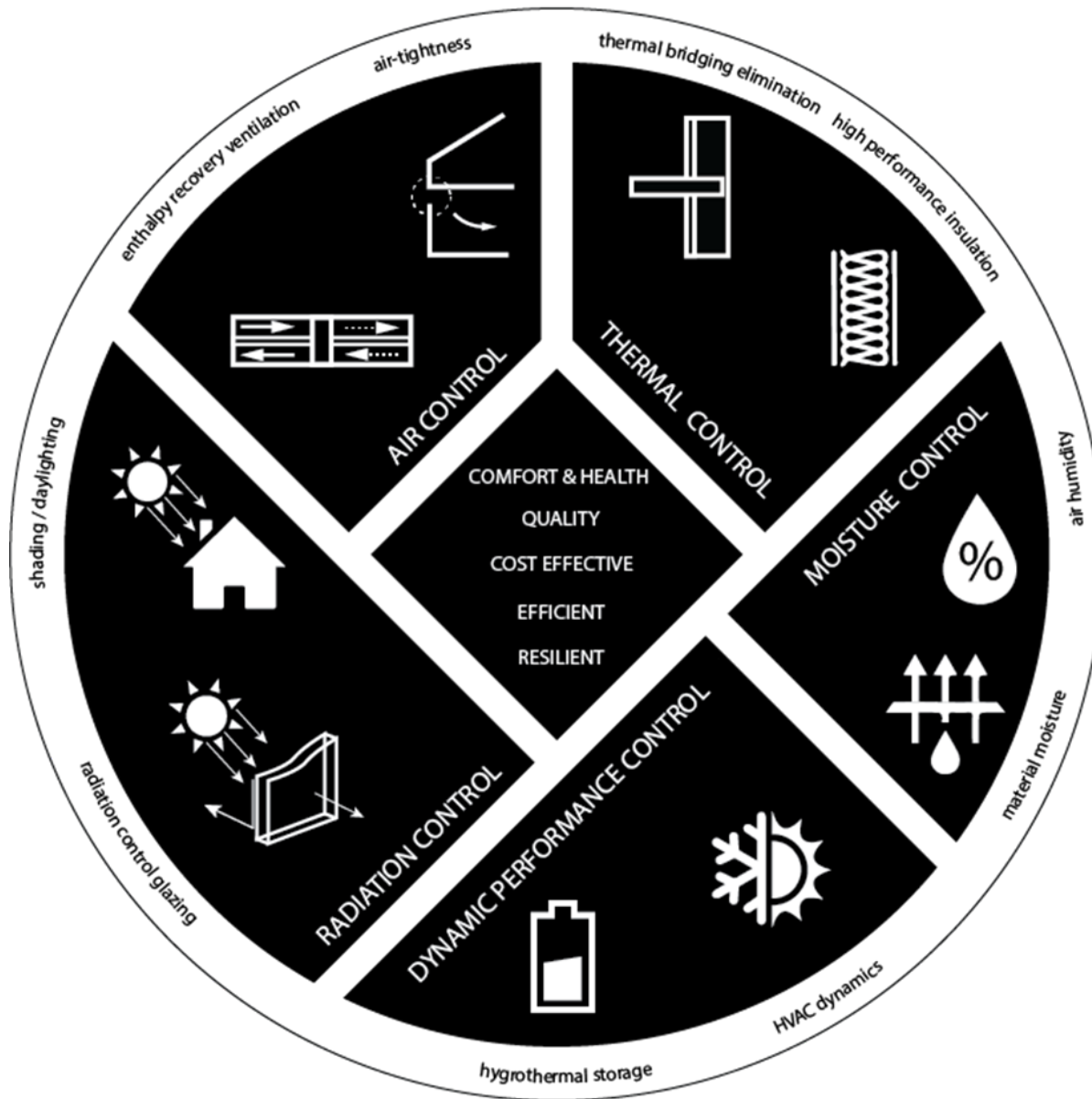


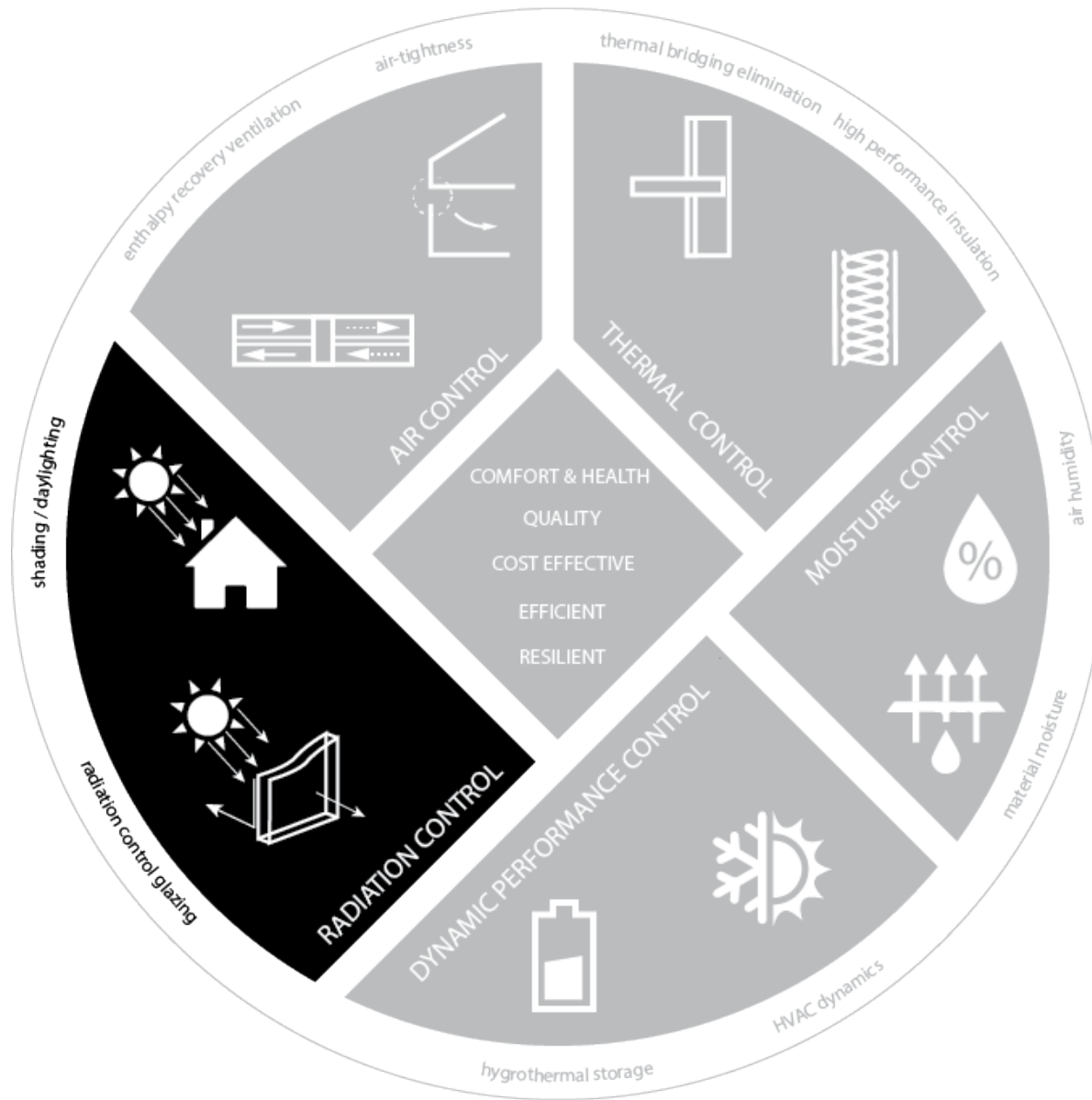
In collaboration with Fengqi Li



Welcome to
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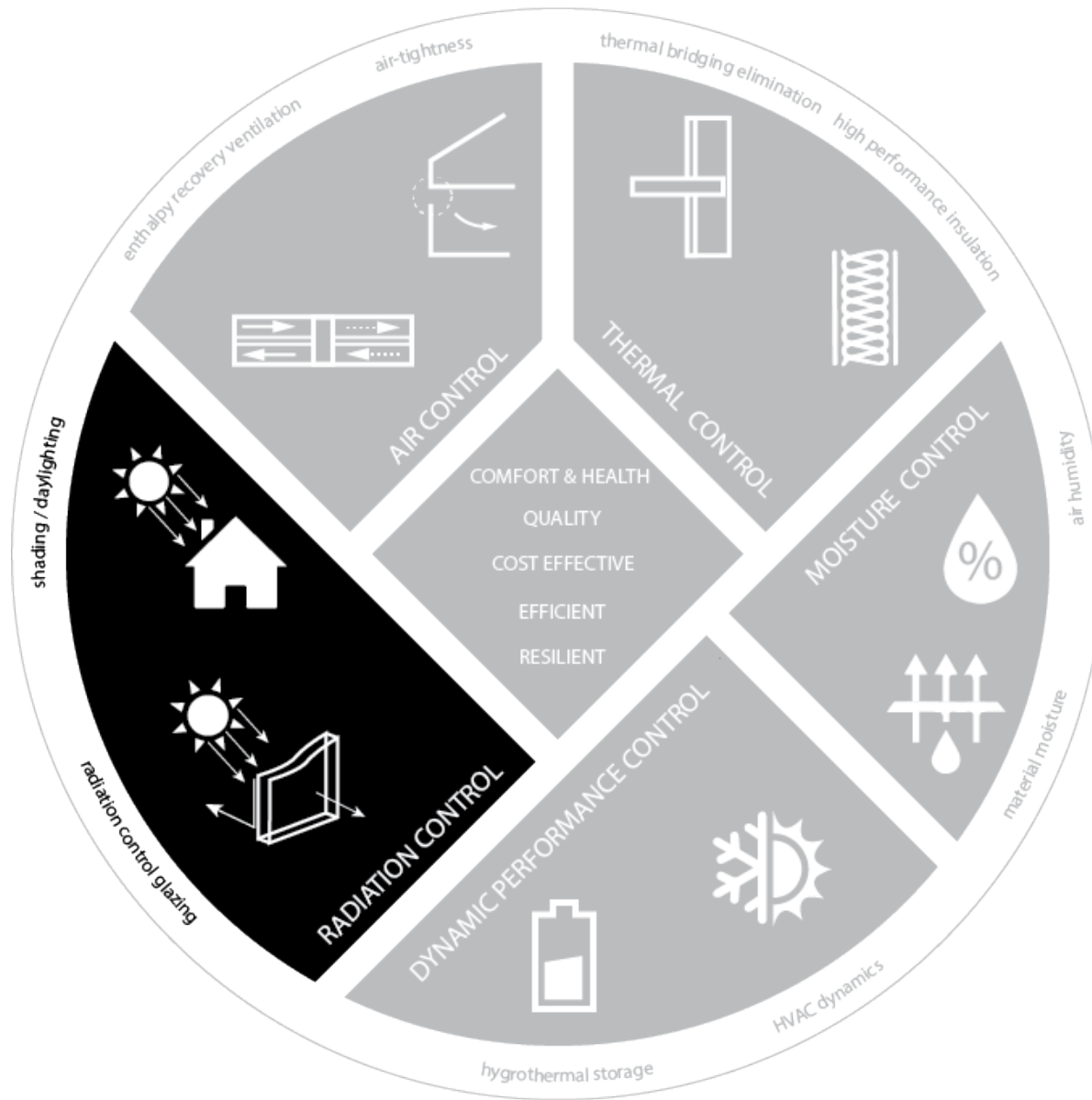




VR in Education

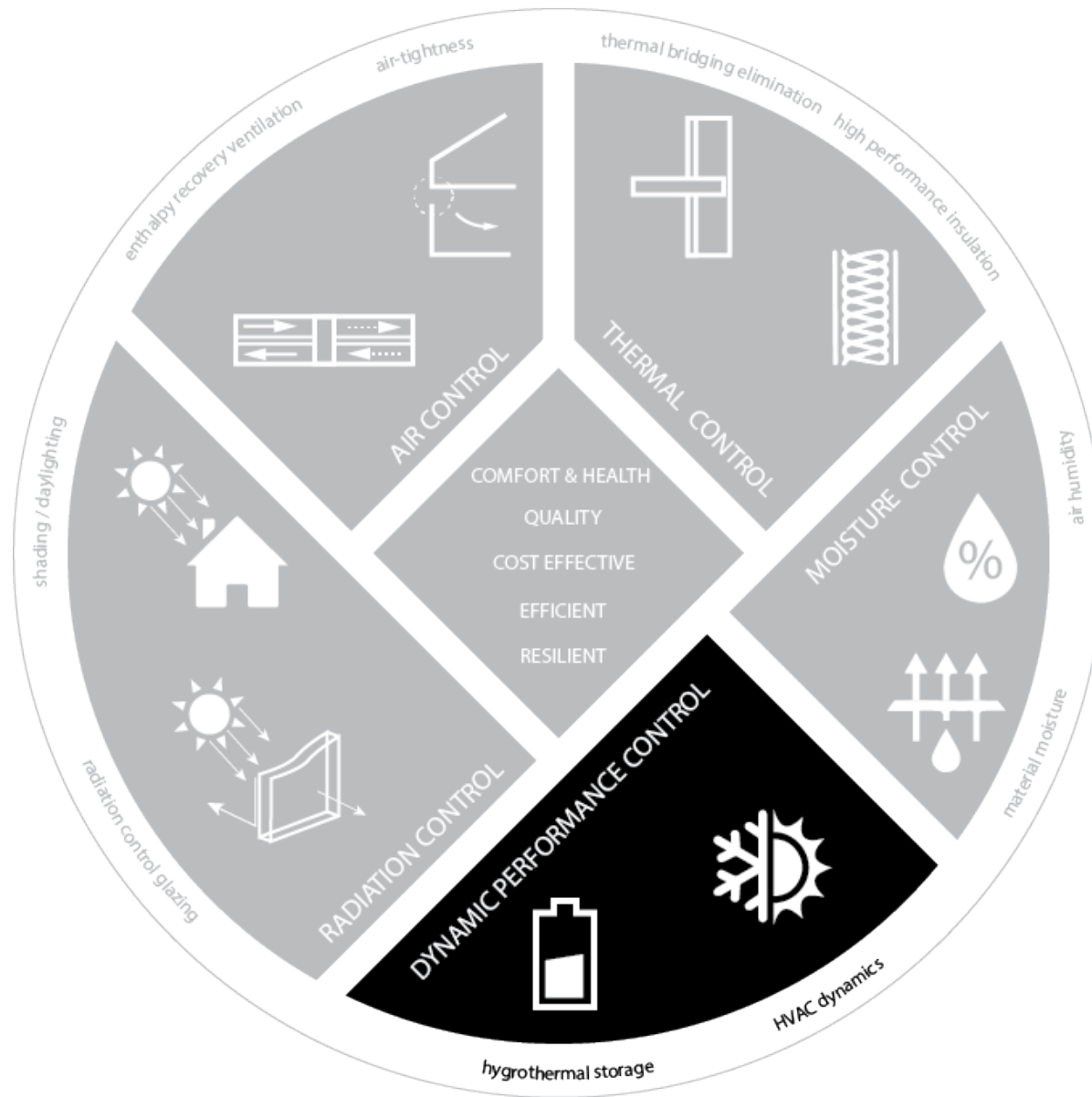


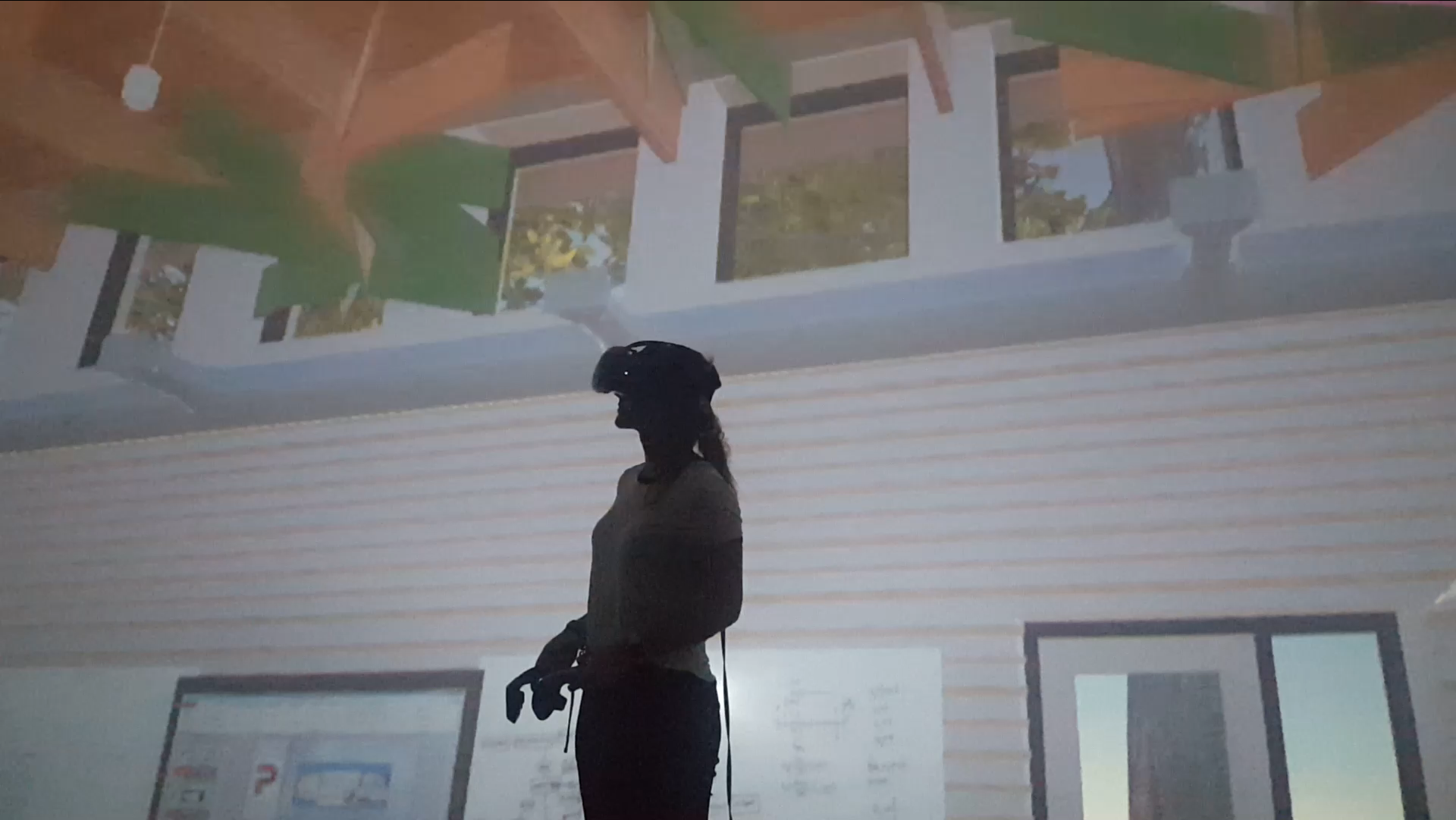












CONCLUSION



- Immersive engagement of the end-user prompts interest and education
- Facilitates non-expert interpretation
- Enhances communication between designers, inter-disciplinary collaborators and stakeholders
- Can convey environmental and sustainable design parameters in a friendly format

CONCLUSION – Looking Forward



- Requires an investment in equipment and skills
- Emphasizes modelling
- Needs to allow for Multi-User Engagement



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