Using Virtual Reality for Knowledge Transfer and Teaching Empathetic Design

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About the speaker

Jess Purcell

As the Design Technology Manager, Jess leads the development and implementation of new technologies and work flows for design, delivery, and collaboration at Shepley Bulfinch. She has expertise in computational design, VR and visualizations, data analytics, and process automation. Jess holds a Masters of Architecture from Arizona State University and is an active contributor and speaker in the AEC technology community.

@jessiepurcey

Leaders in design innovation since 1874

Offices in **Boston, Hartford, Houston**, and **Phoenix**

200 Bulfinches

Primarily **Healthcare** and **Education**

Who’s in the room?

Visualizations Convey Design Intent

Rendering and Animations

Quick, but lack dimension

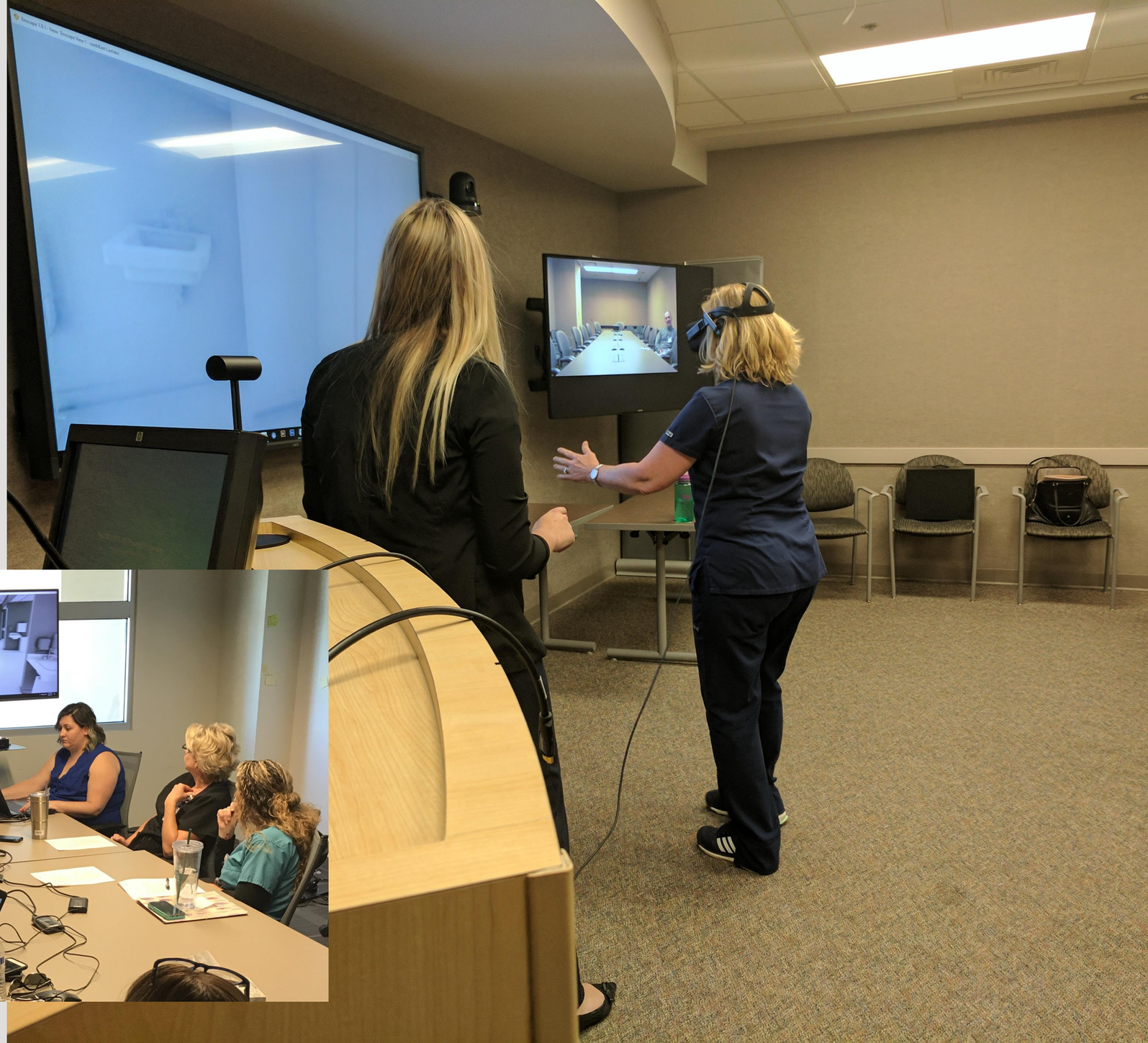
Quick Mockups

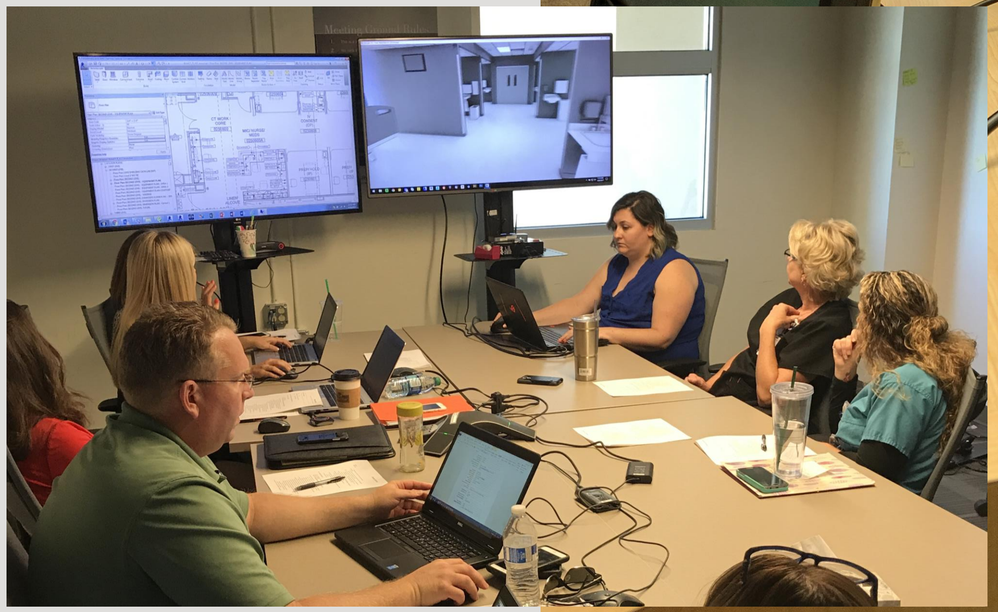
Faster simulation, when the decisions are being made

Immersive simulation allows our clients to experience and test proposed designs before they get built

Digital Mockups

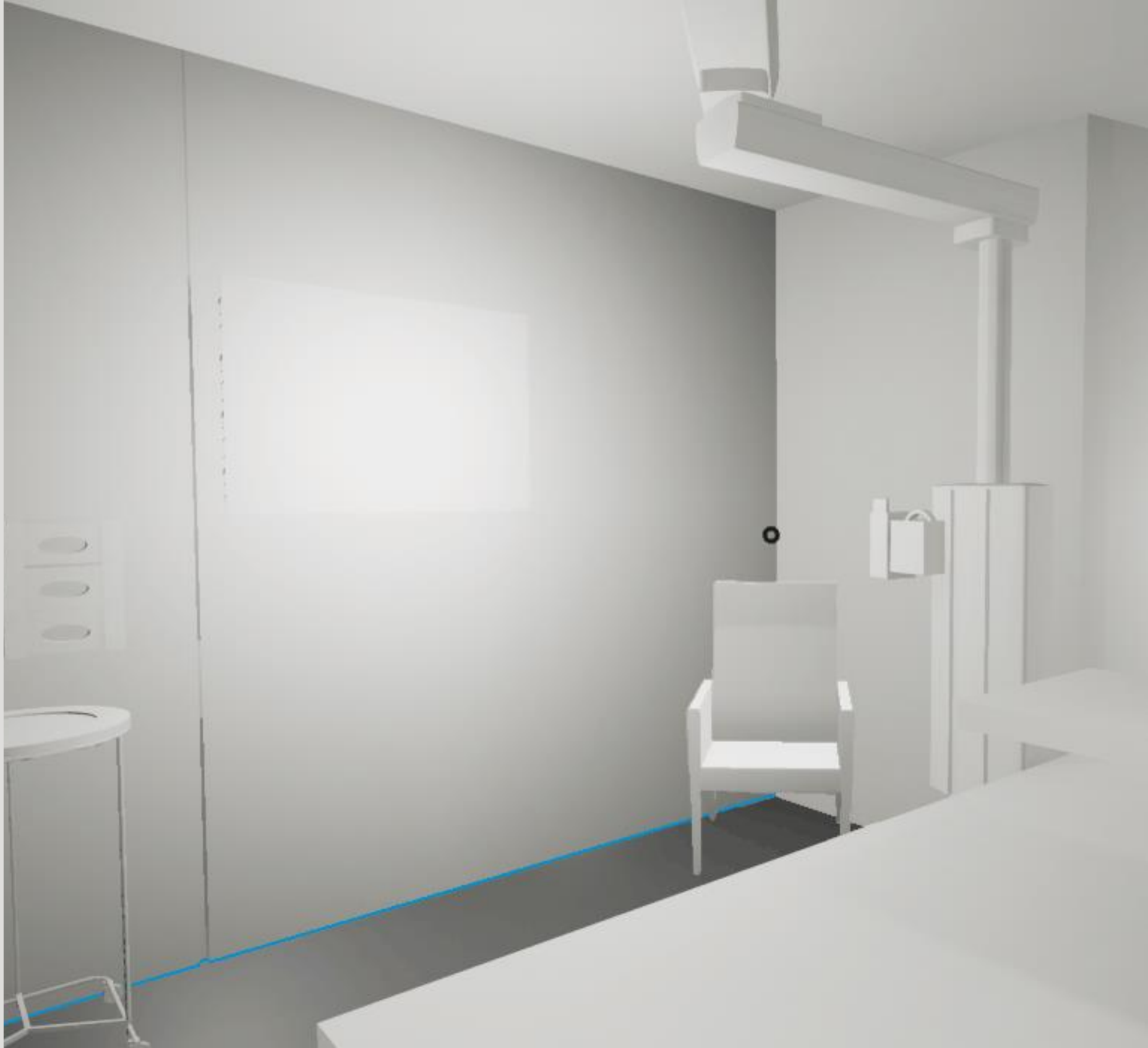
Fast, live demonstrations

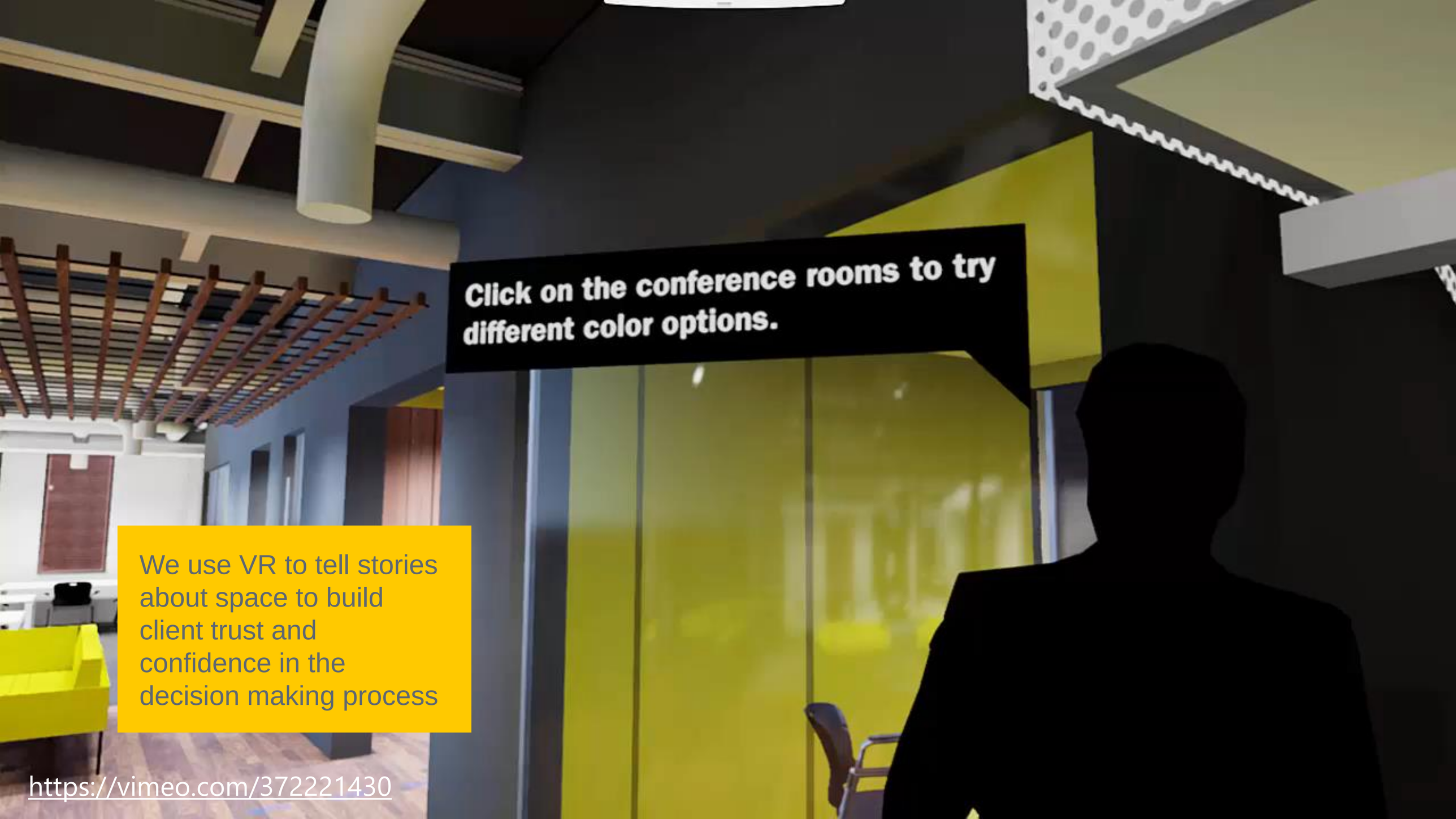




Addressing Specific Concerns

Simplify the experience to focus on what matters





We use VR to tell stories about space to build client trust and confidence in the decision making process

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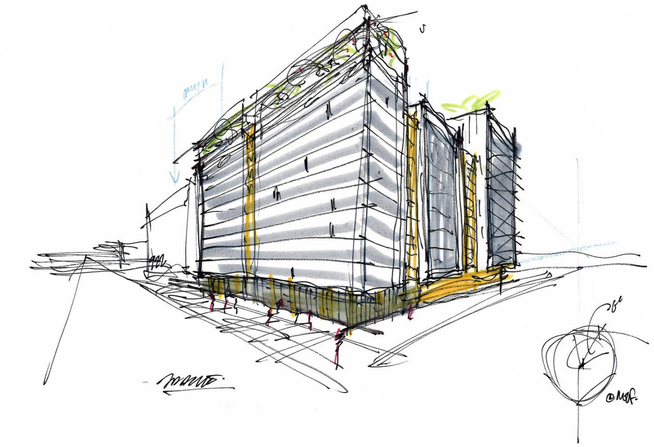
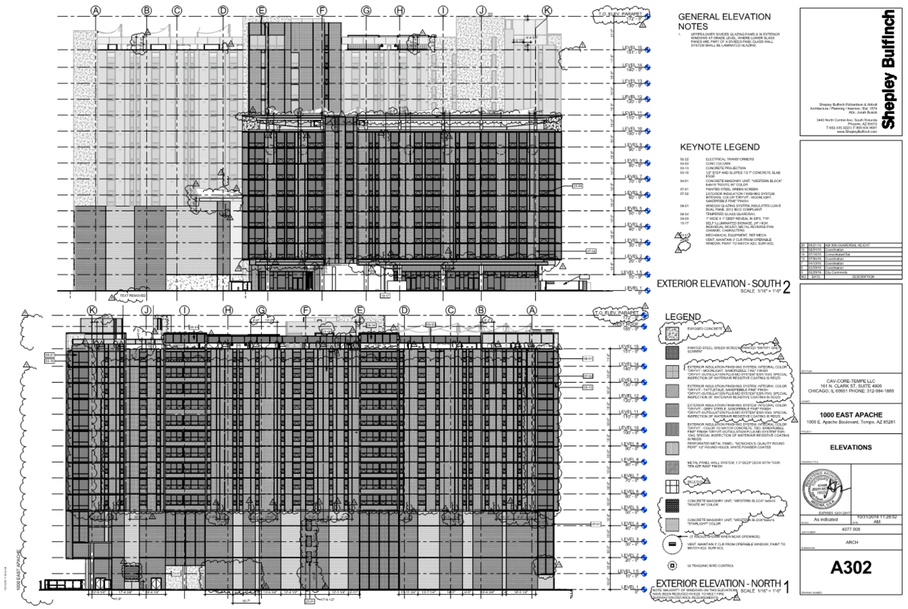




The Problem with 2D Deliverables

Bathrooms are code driven

By the time you get good at designing them, you probably don’t want to do it anymore.

Codes are Analog

604.5.2 Rear Wall. The rear wall grab bar shall be 36 inches (915 mm) long minimum and extend from the centerline of the water closet 12 inches (305 mm) minimum on one side and 24 inches (610 mm) minimum on the other side.

EXCEPTIONS: 1. The rear grab bar shall be permitted to be 24 inches (610 mm) long minimum, centered on the water closet, where wall *space* does not permit a length of 36 inches (915 mm) minimum due to the location of a recessed fixture adjacent to the water closet.

2. Where an *administrative authority* requires flush controls for flush valves to be located in a position that conflicts with the location of the rear grab bar, then the rear grab bar shall be permitted to be split or shifted to the open side of the toilet area.

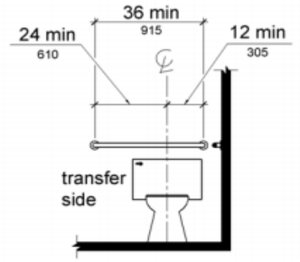


Figure 604.5.2
Rear Wall Grab Bar at Water Closets

604.6 Flush Controls. Flush controls shall be hand operated or automatic. Hand operated flush controls shall comply with 309. Flush controls shall be located on the open side of the water closet except in ambulatory *accessible* compartments complying with 604.8.2.

Advisory 604.6 Flush Controls. If plumbing valves are located directly behind the toilet seat, flush valves and related plumbing can cause injury or imbalance when a person leans back against them. To prevent causing injury or imbalance, the plumbing can be located behind walls or to the side of the toilet; or if approved by the local authority having jurisdiction, provide a toilet seat lid.

309 Operable Parts

309.1 General. *Operable parts* shall comply with 309.

309.2 Clear Floor Space. A clear floor or ground *space* complying with 305 shall be provided.

309.3 Height. *Operable parts* shall be placed within one or more of the reach ranges specified in 308.

309.4 Operation. *Operable parts* shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate *operable parts* shall be 5 pounds (22.2 N) maximum.

EXCEPTION: Gas pump nozzles shall not be required to provide *operable parts* that have an activating force of 5 pounds (22.2 N) maximum.

Why do we need codes?

I’d like you to meet some people

Andrea R, Designer,
Code Learner

- 3 years experience
- Working toward licensure
- Has only seen one major project fully built

Steve S, Architect,
Code Expert

- 25+ years of experience
- Doesn’t draft Construction Documents anymore

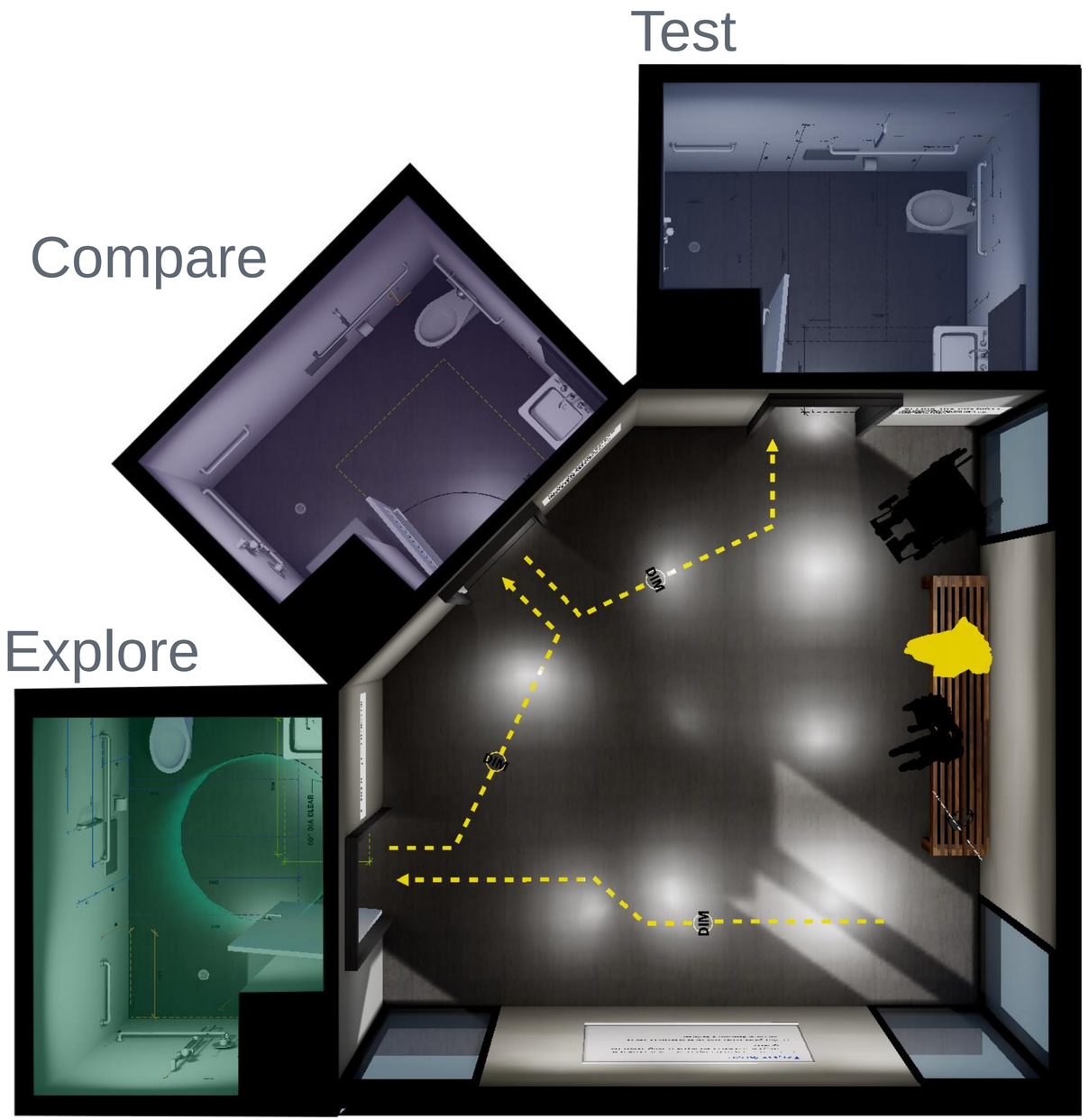
Transferring Knowledge Experientially

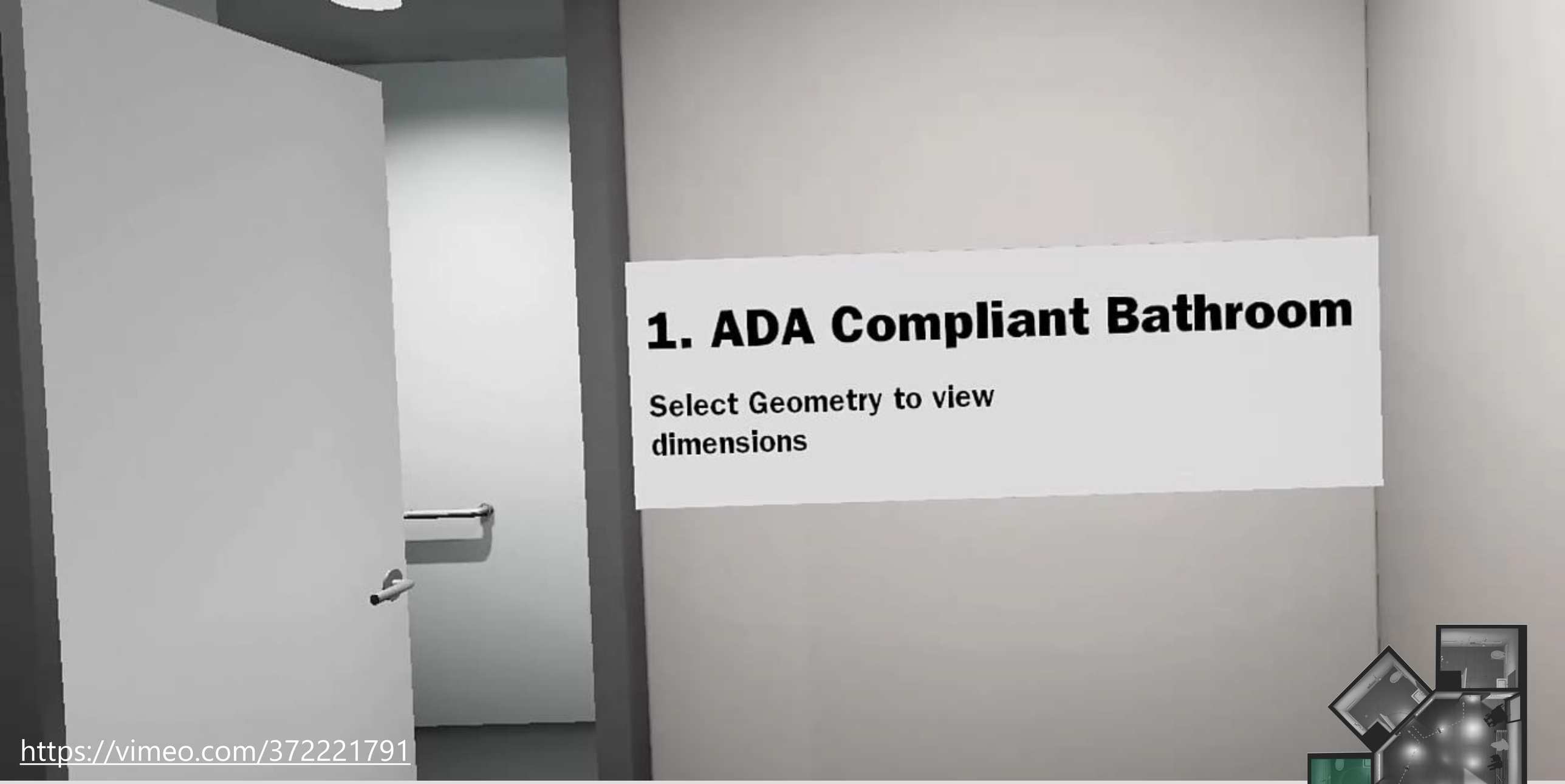
VR as training tool?

Project goals

- Help junior designers in healthcare understand how to correctly document a bathroom

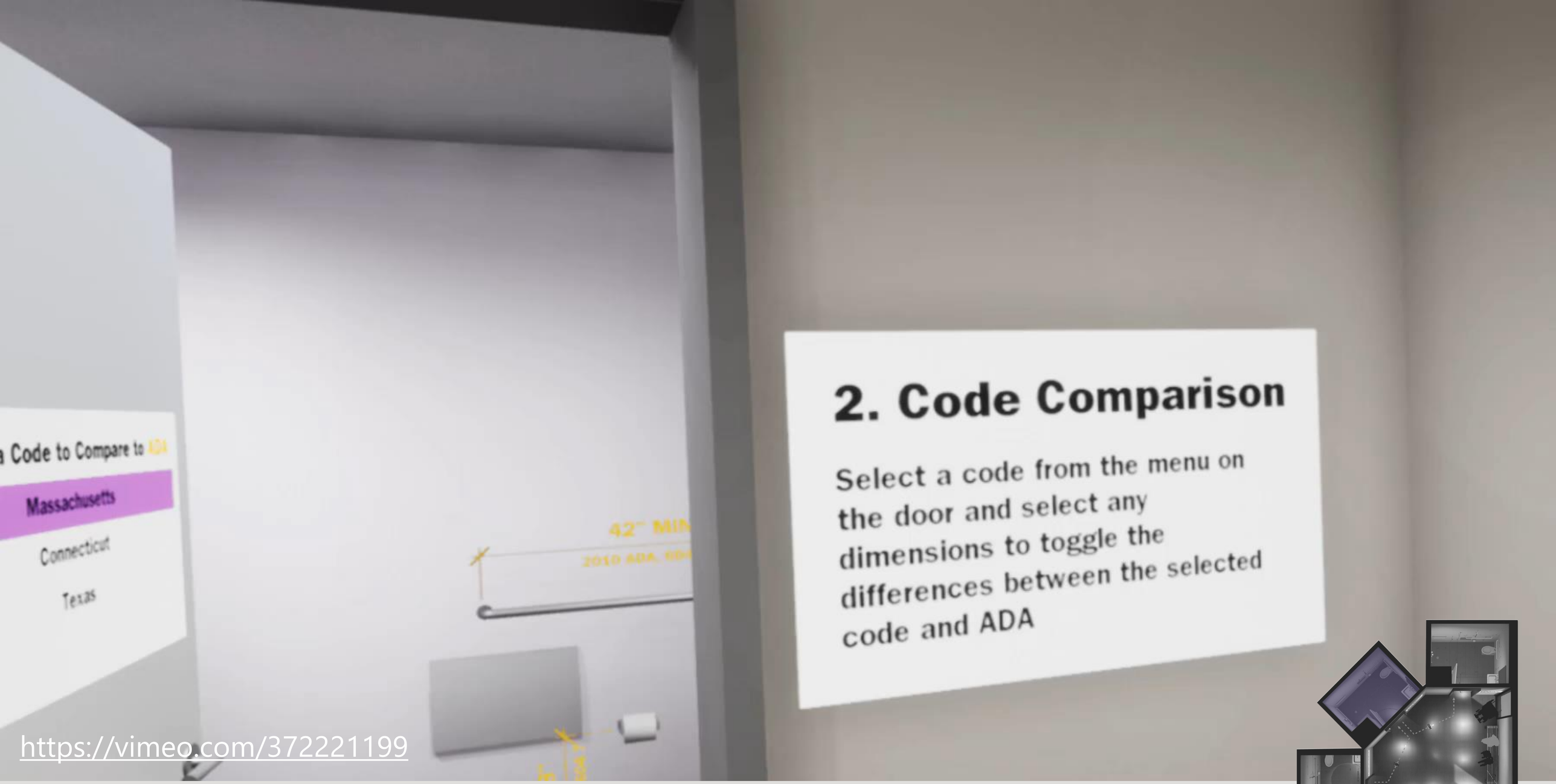
- Educate designers on the differences between the codes we typically encounter in a healthcare setting





https://vimeo.com/372221791

Explore



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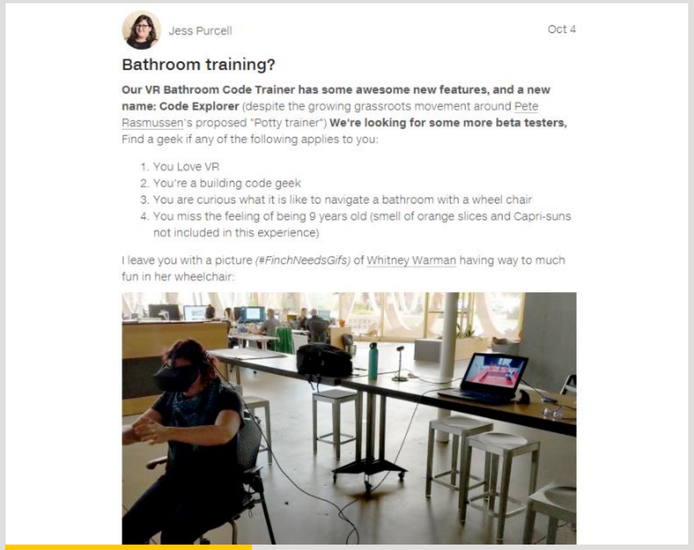
Compare

https://vimeo.com/372221813

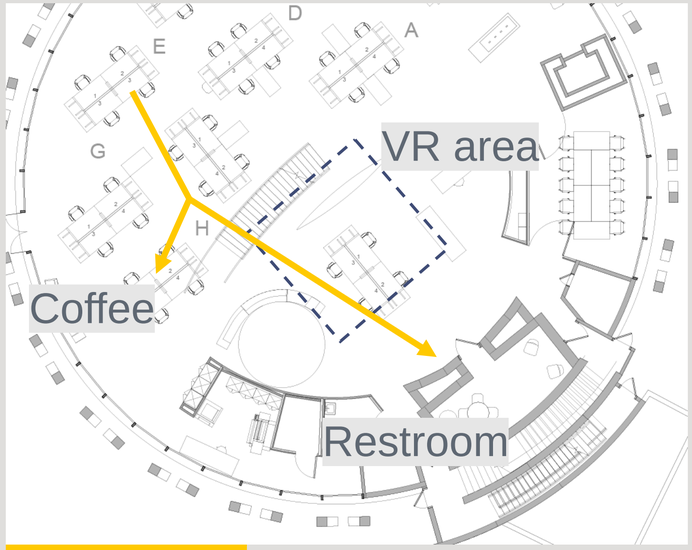
Test

Beta Test: Early and Often



Spread the Word

Widespread all office messages



Grab Passers by

Set up in a visible space, and don't be afraid of wasting people's time

Vary your Audience

Make sure you are getting feedback both from intended users, and those who are content experts

Make the most of your feedback

Record demo sessions:

- Screen and audio capture with headset microphone

Prepare key questions ahead of time:

- How does the experience change your understanding?
- Can you think of a better way to explain the subject?
- What other problems do you think this kind of experience could be applied to?

What we’re hearing

(literally)

VR allows us to experience space before construction

- "In healthcare we design spaces to be jammed into an airplane...there's per minimum, and then what feels good"
  – Ned M, Architect, Code Expert

- "While working on bathrooms, especially in plan, it feels small. But being in it, it feels pretty nice."
  - Anita L, Designer, Code Learner

VR is a useful tool for studying and verifying

- “I actually need this for studying”
  - Alyssa M, Designer, Code Learner

- “I don’t have to flip between 6 pages”
  - Rebecca M, Designer, Code Learner

“I've never actually been in a bathroom that I've drawn dimensions for, and fully understood everything about it.”

- Andrea R, Code Learner

We had an Epiphany

Have you ever felt
uncomfortable in a space…?

A New Goal

- ✓ Help junior designers in healthcare understand how to correctly document a bathroom
- ✓ Educate designers on the differences between the codes we typically encounter in a healthcare setting
- ❑ **Create an empathetic experience in which healthcare designers can better understand the impact of design choices for all users**

Empathy creates an even stronger understanding of dimensions

- "The sink, I knew it was wrong because I looked at the dimensions, but sitting, you can tell it's too high, I can't reach"
  - Pete R, Architect

- “You can really see why you need that floor clearance to turn around”
  - Whitney W, Architect

Empathy creates compassionate designers

The brain processes VR experience as real experience, and that memory sticks with you for the rest of your design career

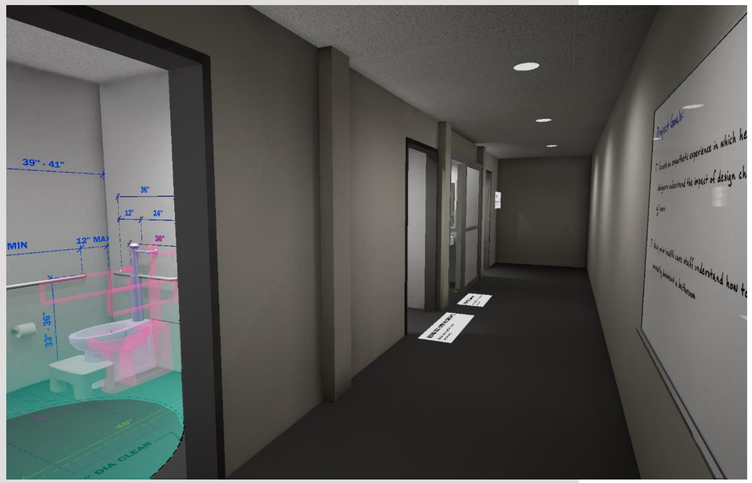
Codes are lists of what to do, VR shows you why

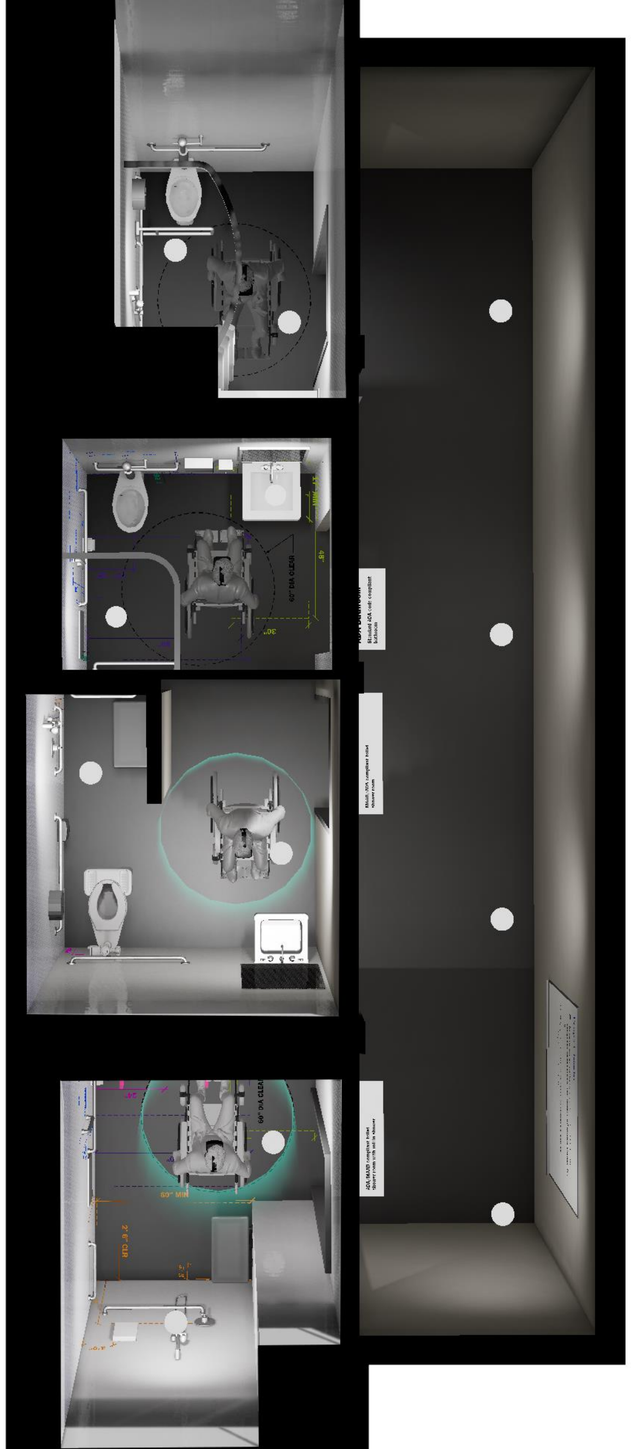
Experience Programing?

What did we try?
What did we learn?

Showing Multiple Configurations

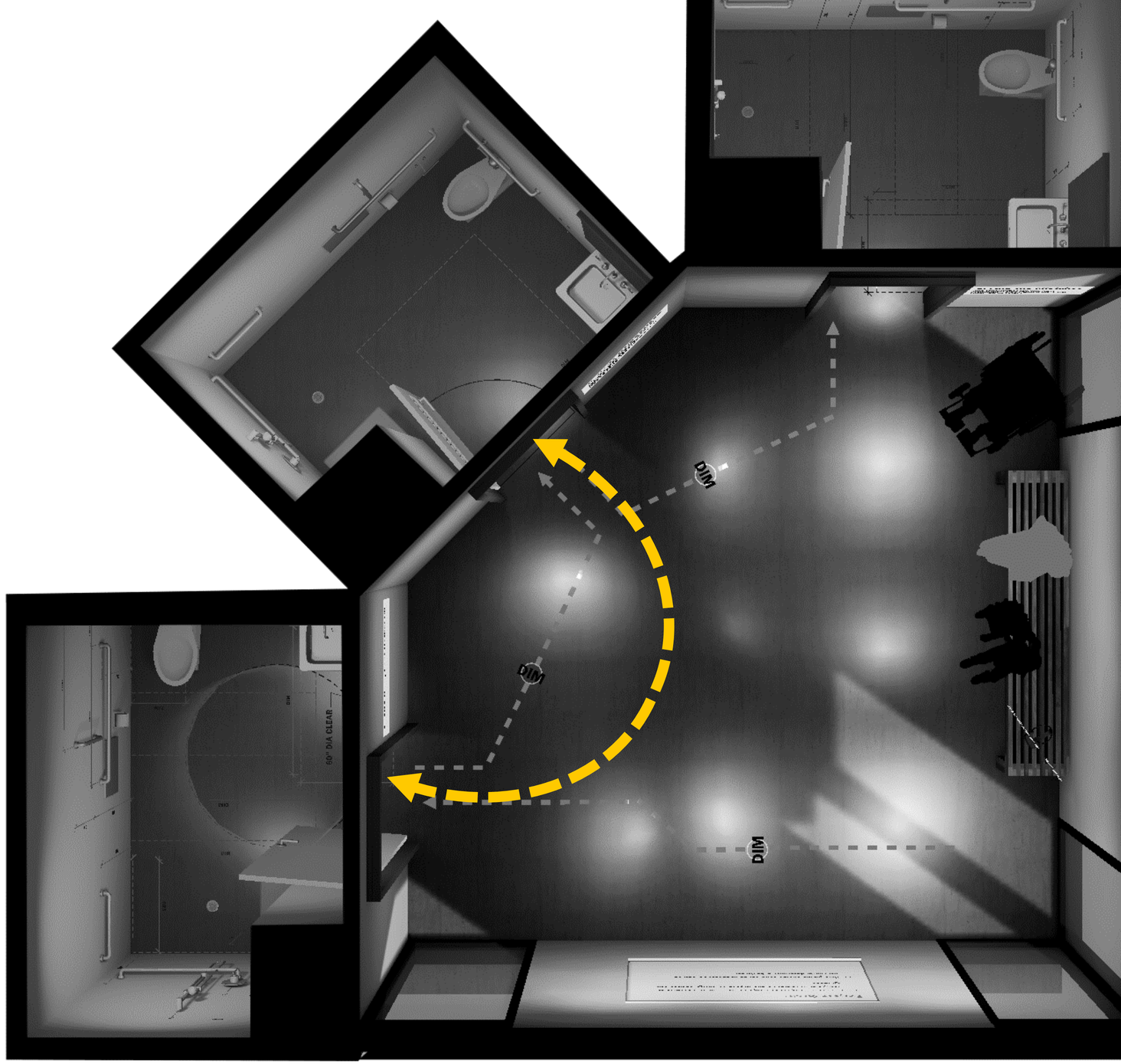
- Goal is not to show design options, but teach constraints that effect design





Showing Multiple Configurations

- Hard to compare



Displaying 2D drawings with 3D objects

- Doesn’t show any relationship with 3D objects
- Designers already know how to draw plans and elevations

Comparing codes within the same view

- Ghosted hologram geometry doesn’t feel real

- Toggling between geometry sets adequately allows you to explore differences

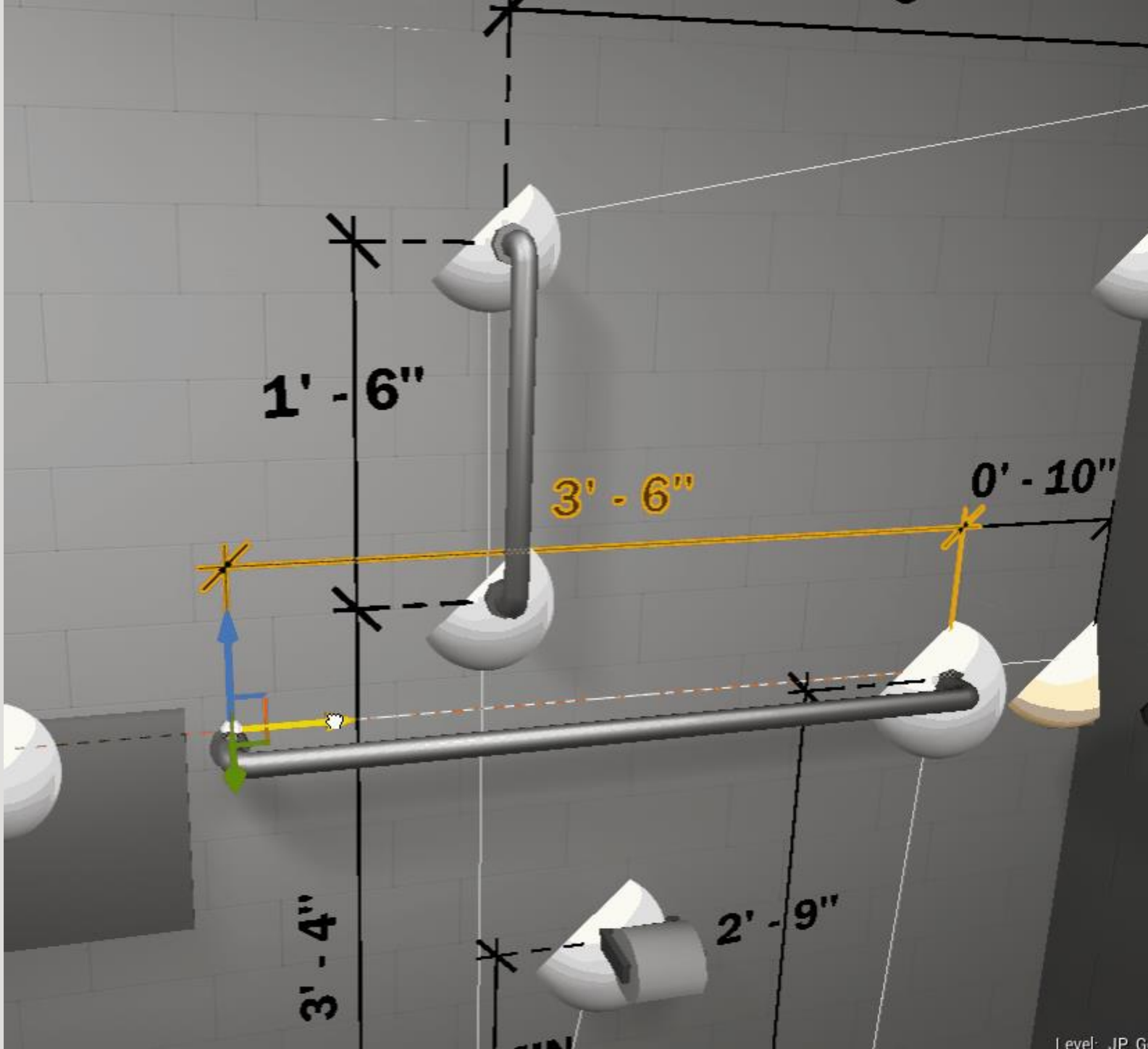
How do we make a 3D representation of 2D drawings?

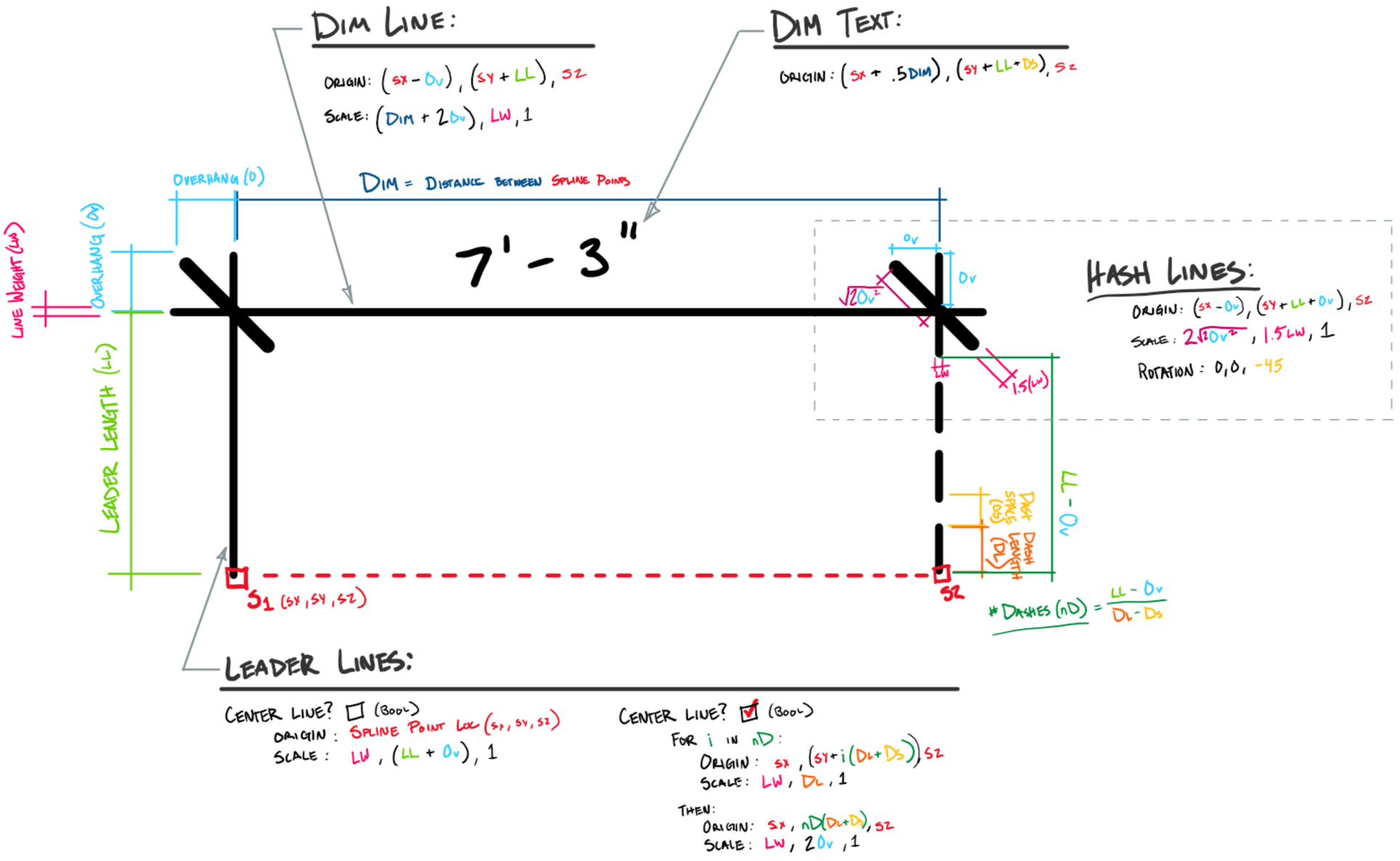
Dimensions in Space

- Floating stickers are quick and easy…
- Unless you have to make any updates

Creating Drafting Tools

- An appreciation for the software developers that build these tools for you

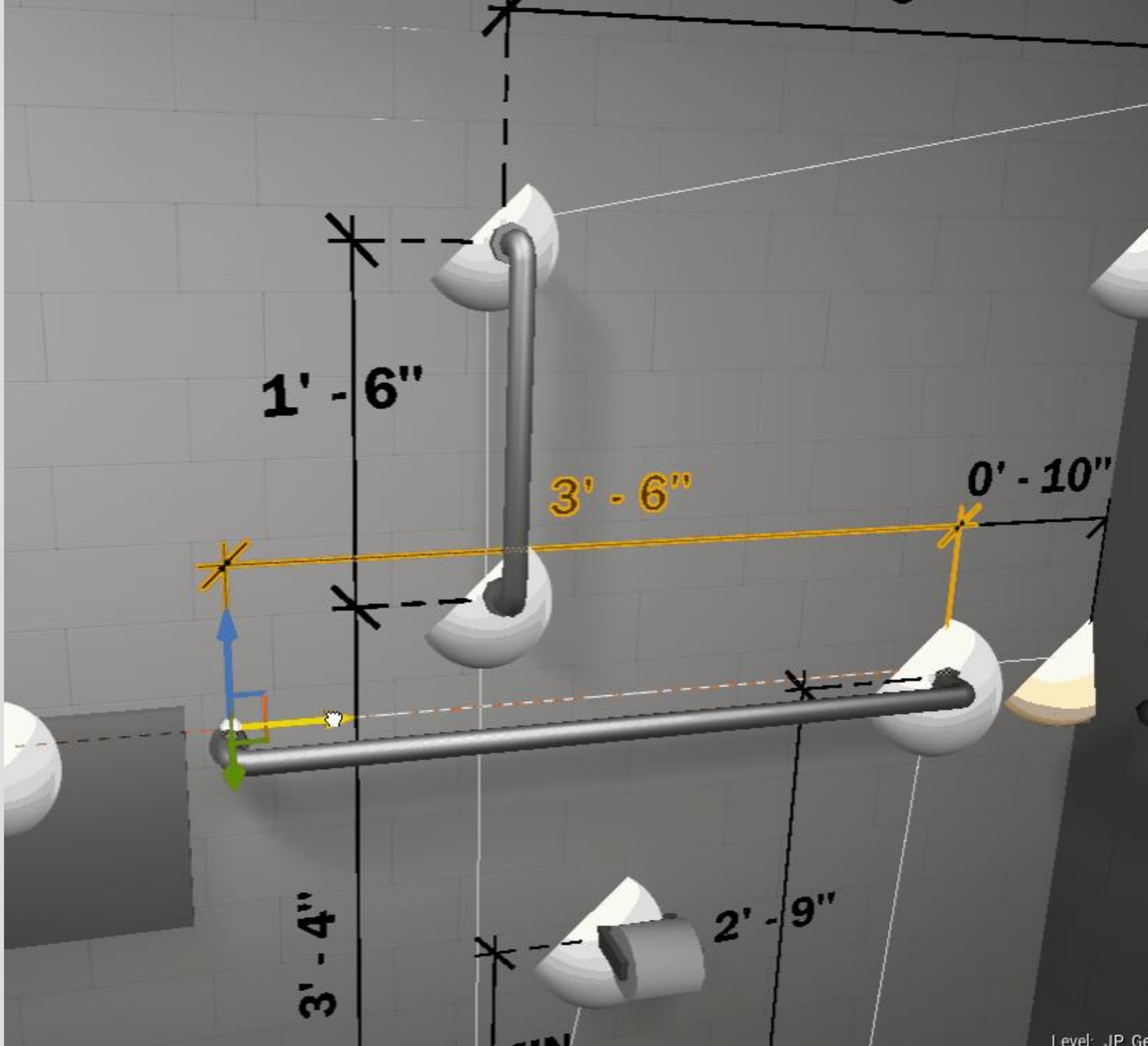




What makes up a dimension annotation?

Benefit of Procedurally Generated Geometry

- Changes are easy to make, and new work can be added quickly



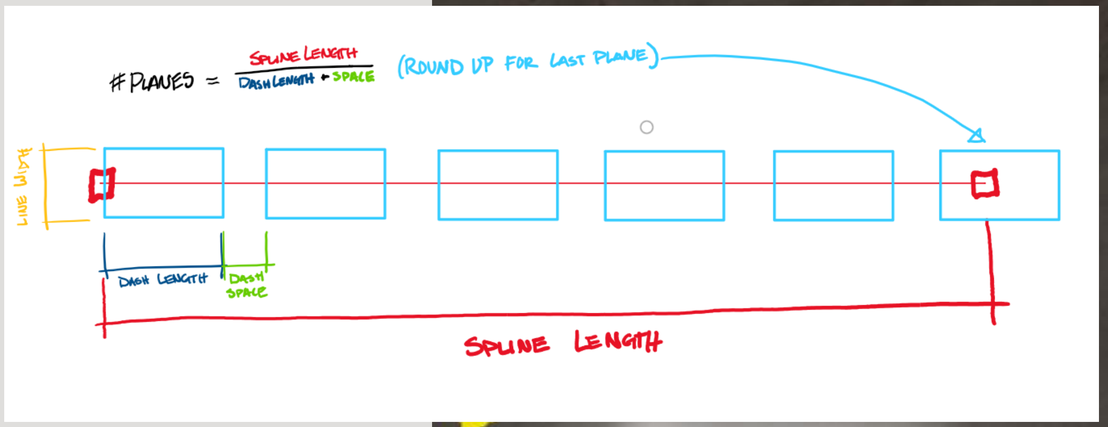
More Procedurally Generated Geometry

- Hand rails based on spline points

More Procedurally Generated Geometry

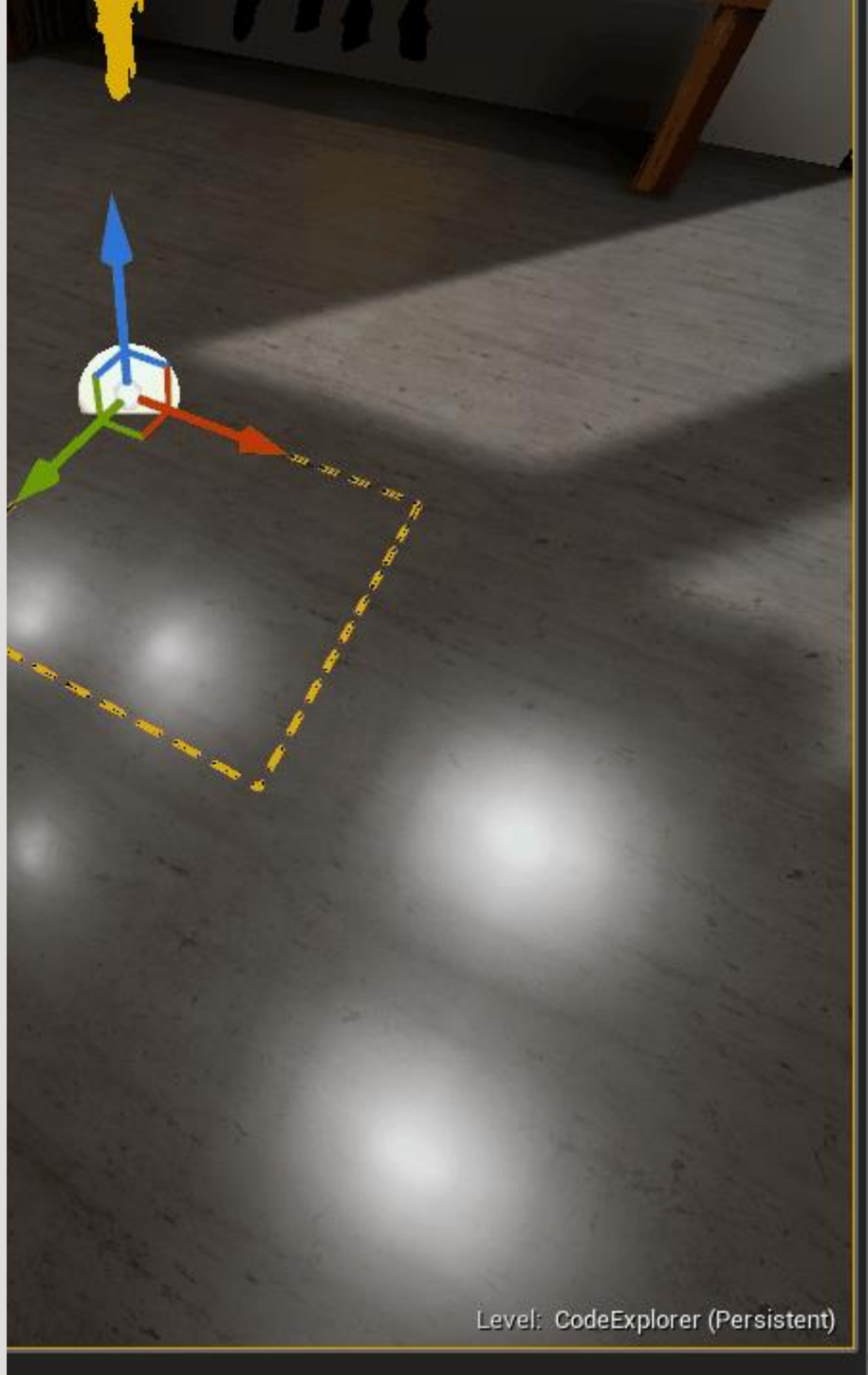
- Hand rails based on spline points

- Dashed lines for directional ques



More Procedurally Generated Geometry

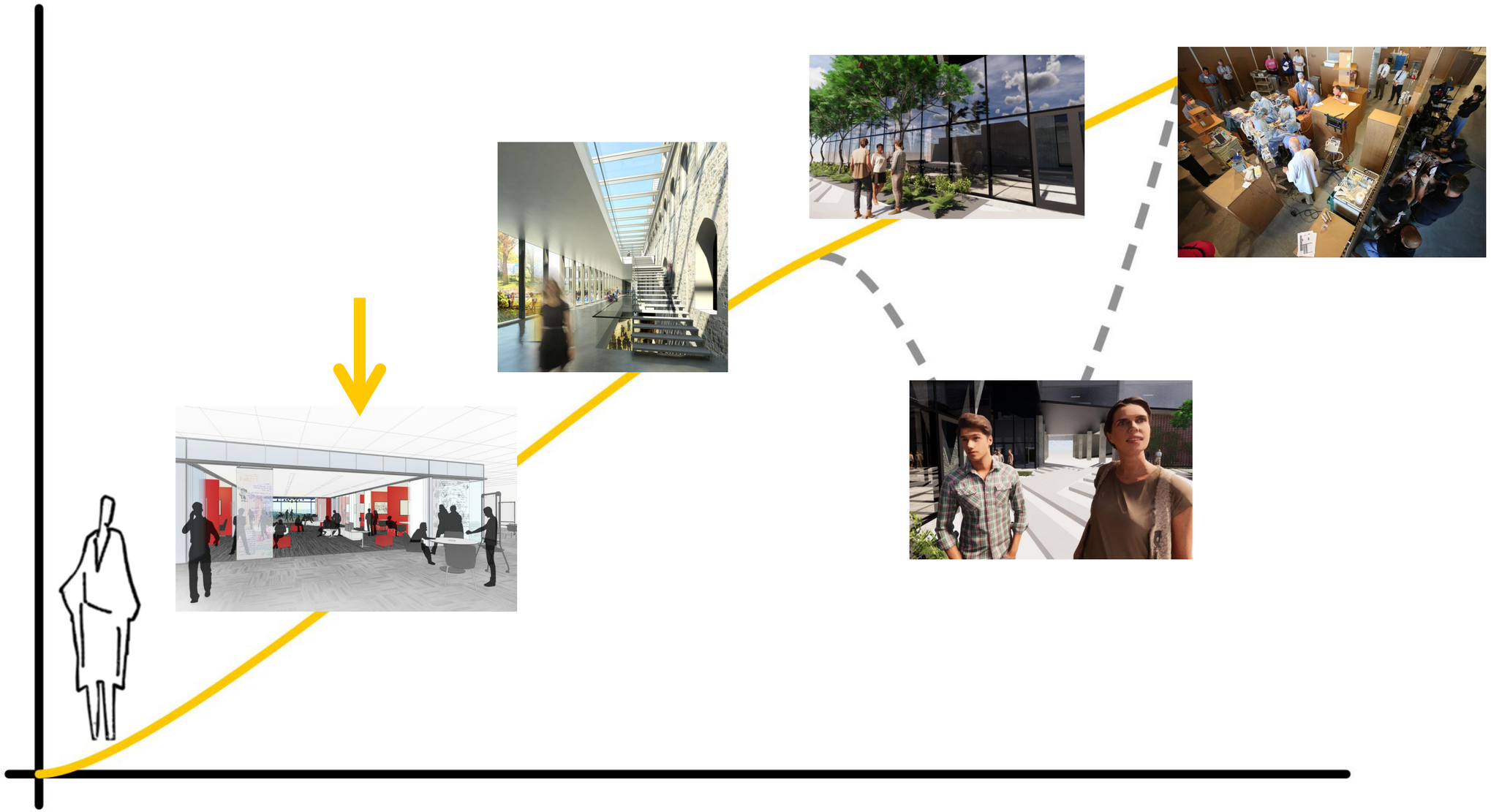
- Hand rails based on spline points
- Dashed lines for directional ques
- Floor clearance boxes that size based on dimensions



Introducing the Human Element

Disembodiment and breaking immersion

- Should you see nothing?
- What if what you see doesn’t match what you feel?



Levels of Detail in Architectural Visualization

3D Silhouettes

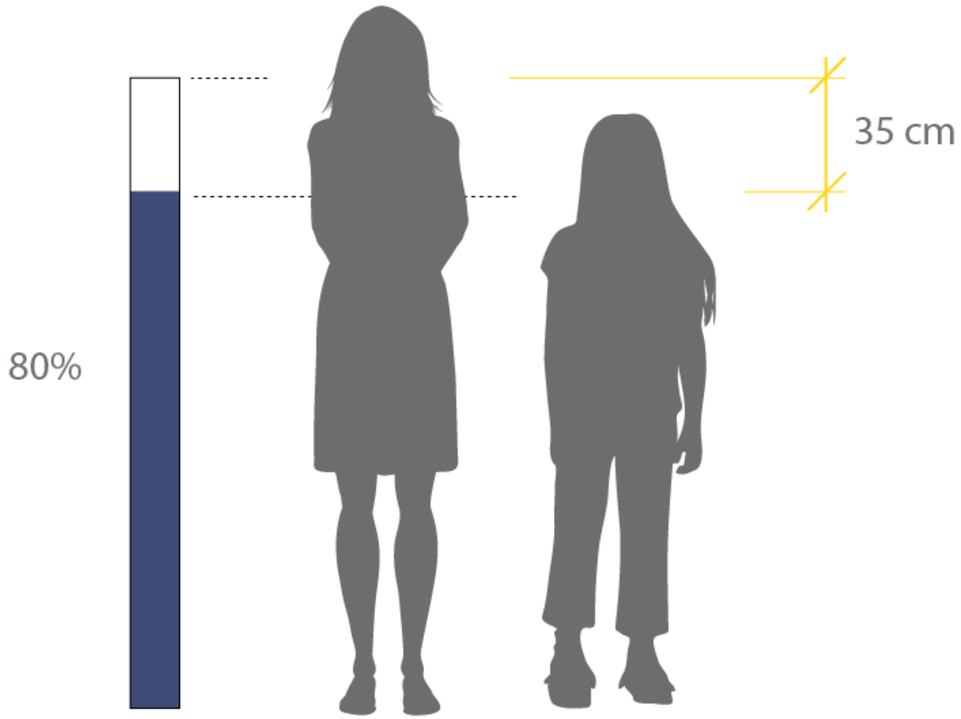
- Not rotating planes
- Low poly 3d figures with unlit materials

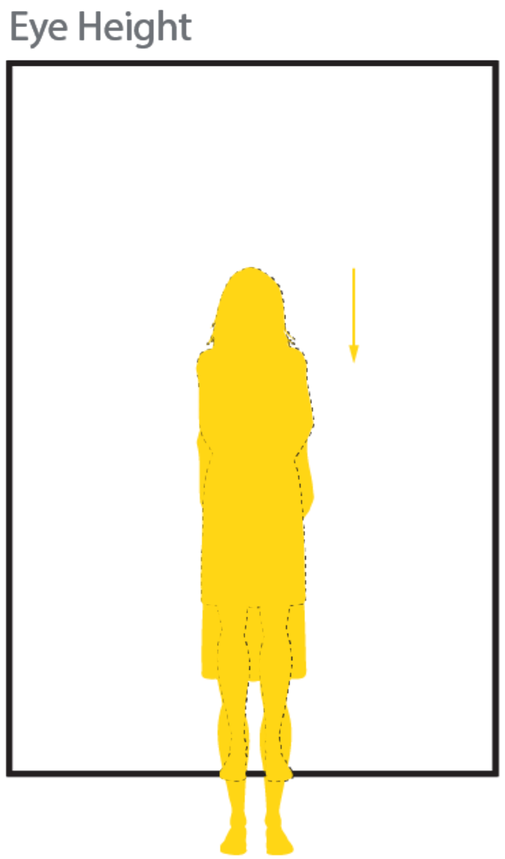
Personal Space

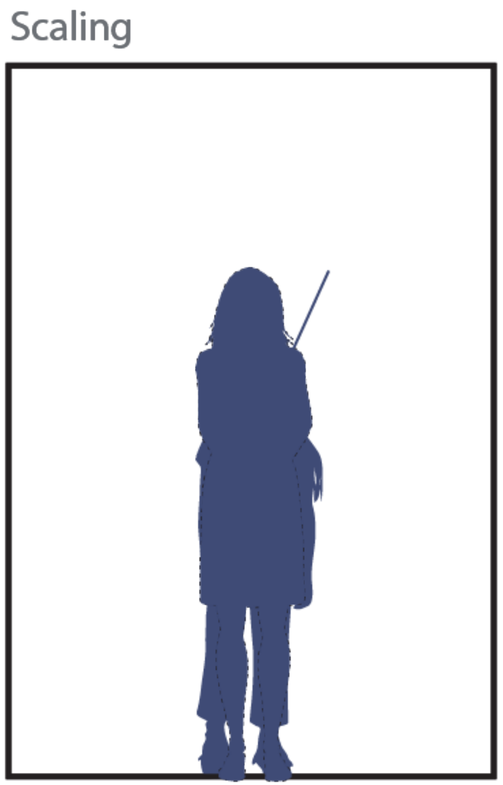
- Material fade based on distance between camera and object

https://vimeo.com/372222882

Interacting with scale figures







What does the world feel like to a child?

Changing your eye height: Brings the floor closer to you, feels unsettling

Scaling the world: The floor stays at the floor, everything is slightly bigger

Interacting with scale figures

Creating an Immersive Wheelchair Experience

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Physical Chair

- Sitting on a physical chair adds a layer of reality.

Creating an Immersive Wheelchair Experience

Physical Chair

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Wheel Chair

- Next layer of reality

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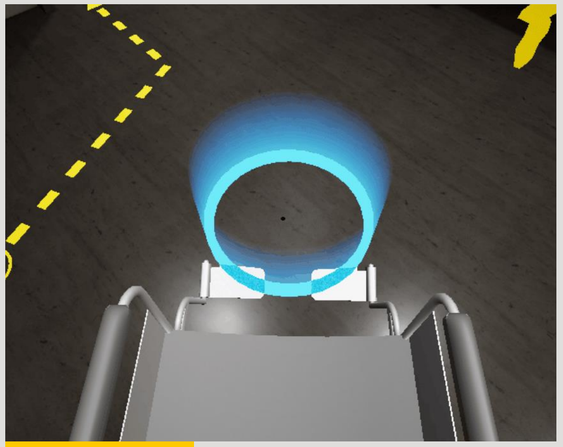
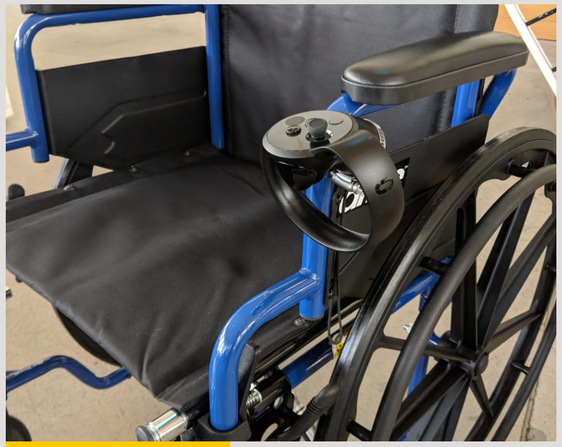


Digital Chair

- Attaching a mesh to the character further builds immersion



Chair as Object

- Attaching a tracker (or unused oculus touch) treats the chair as it’s own object, and not an extension of the character

VR is not always the answer

VR still can’t replace reference material

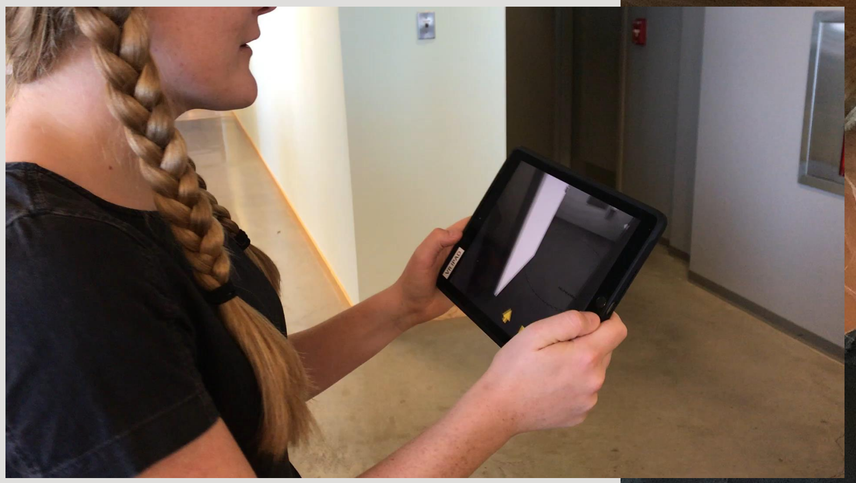
- Bulky, large set up
- Tethered to one machine by cords
- Isolating, no visibility to working document

VR..ish

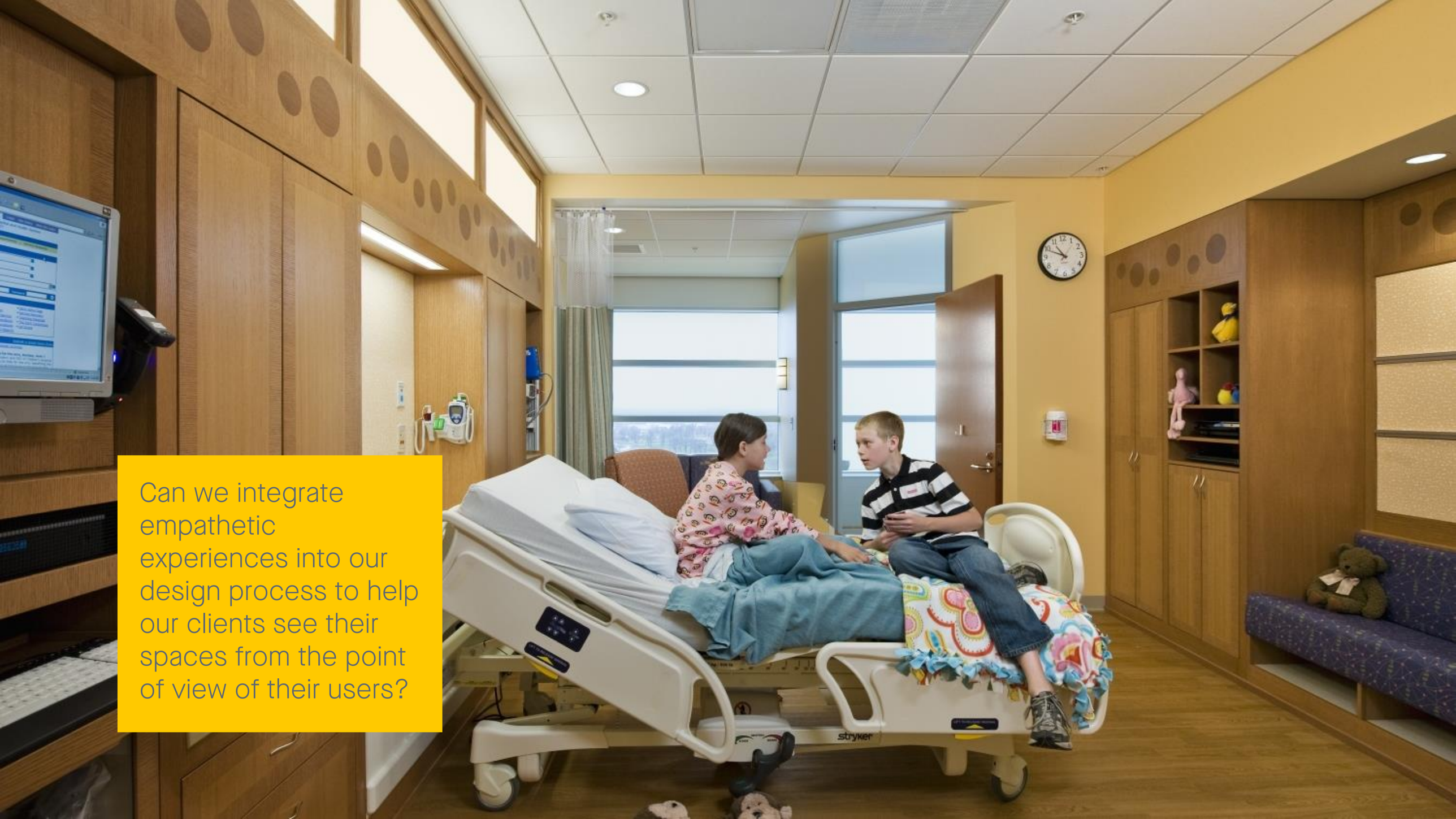
- Portable, small
- Familiar form factor

VR..ish

- Portable, small
- Familiar form factor
- Still walkable



Where Might We Go Next?



Can we integrate empathetic experiences into our design process to help our clients see their spaces from the point of view of their users?

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