VisMe Remote

An Overview of the Design and Evaluation of a Remote Collaborative AR System for Educational Use

Preface

- BWSIP
  - UIUC Blue Waters intern 2015-16
- Who are we?
  - Max Collins
    - Phd candidate at UCI
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  - Dr. Alan B. Craig
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Goals of this work

- Exploring AR for education
- Leverage AR for remote collaboration
- Instill the feeling of handing objects through the screen between participants
- Build a tool that would be useful for instructors and student working in a remote model
- Understand how to increase feelings of collaboration, communication, and shared objects (shared object vs. our own copies of an object)

Why?

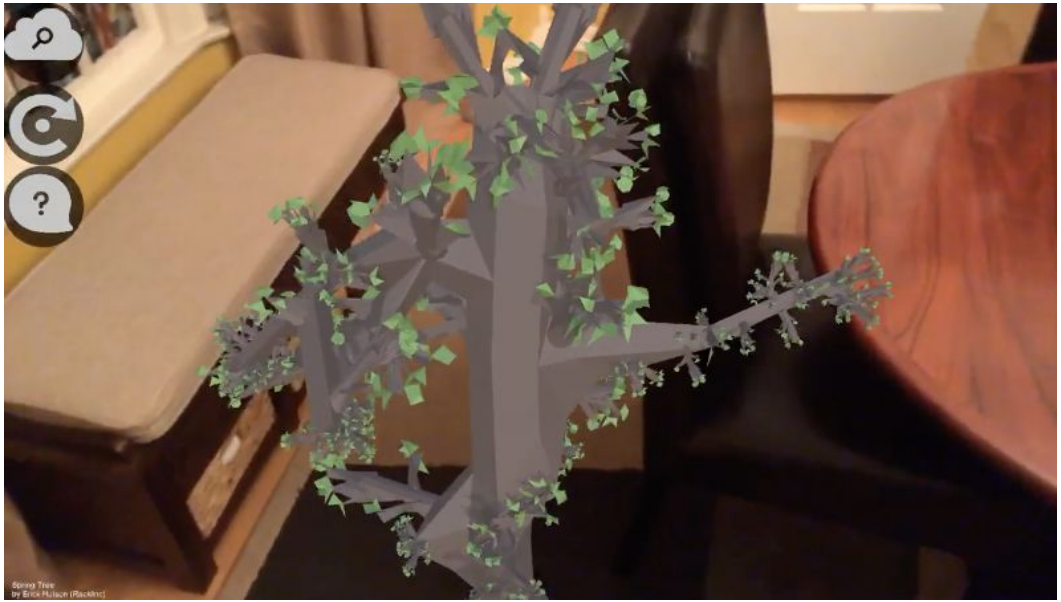
- Collaboration
- Bodily engagement (proprioception)
- Engagement
- Accessibility
- Reach

Background: AR

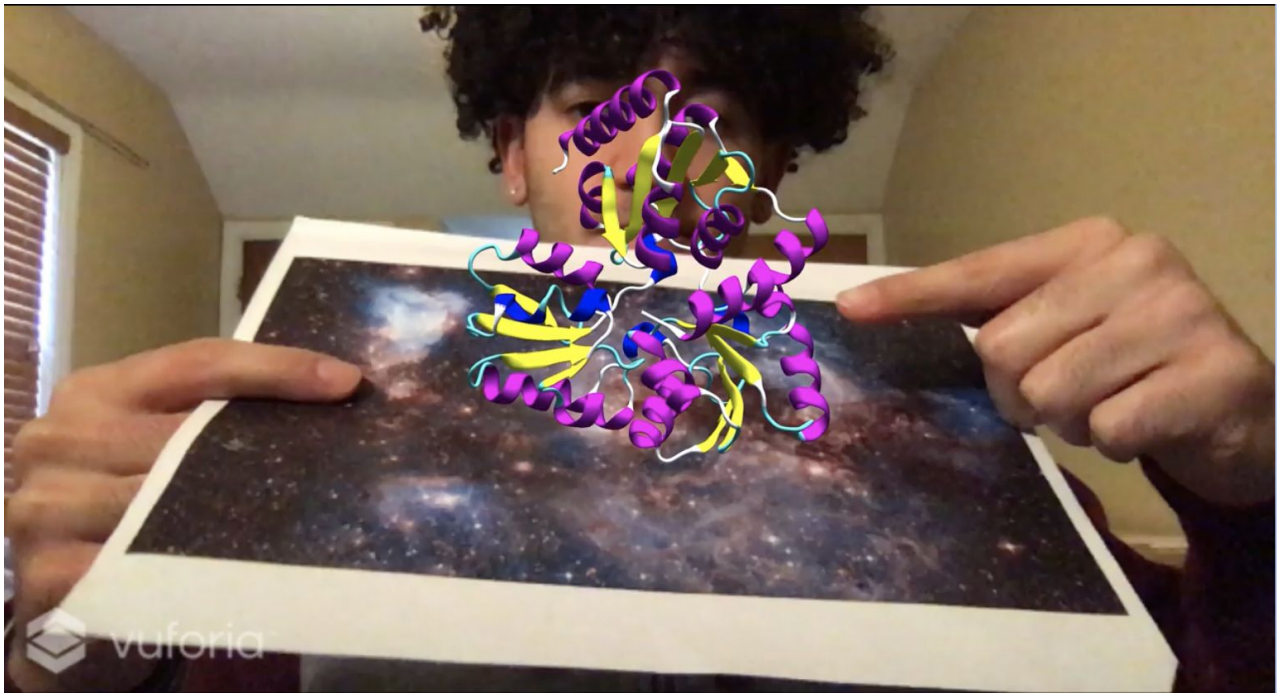
“Augmented Reality: A medium in which digital information is overlaid on the physical world that is in both spatial and temporal registration with the physical world and that is interactive in real time.”

- Alan B. Craig - Understanding Augmented Reality

Markerless AR



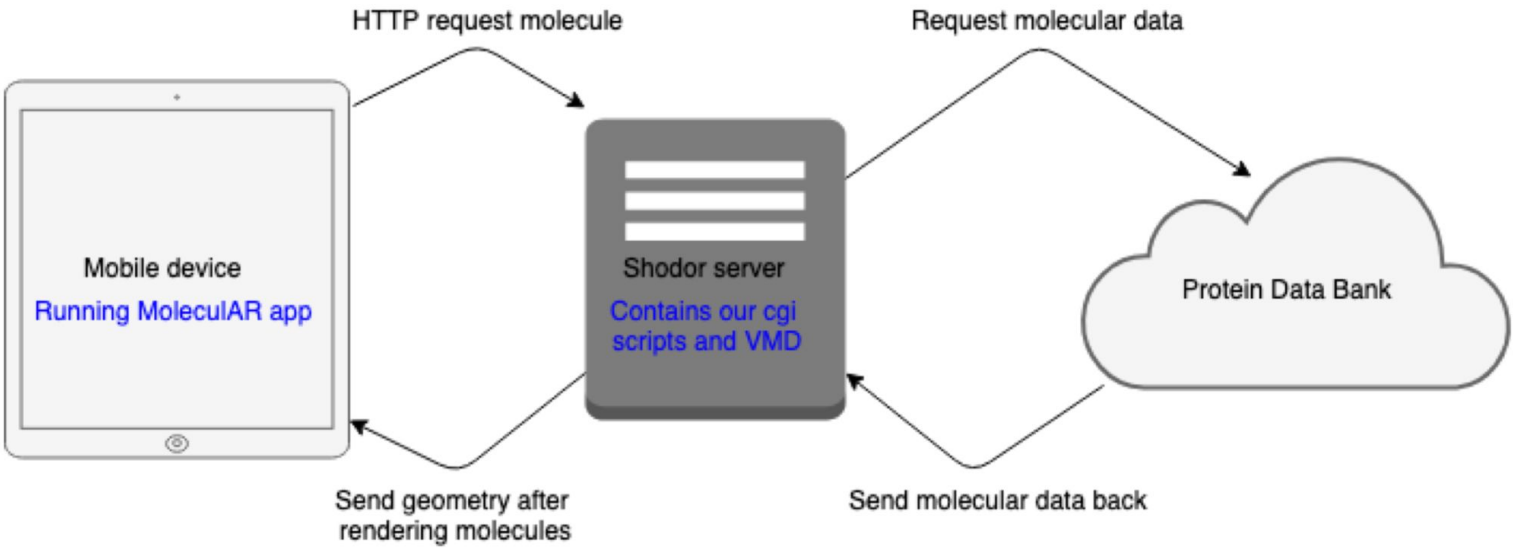
Marker-based AR



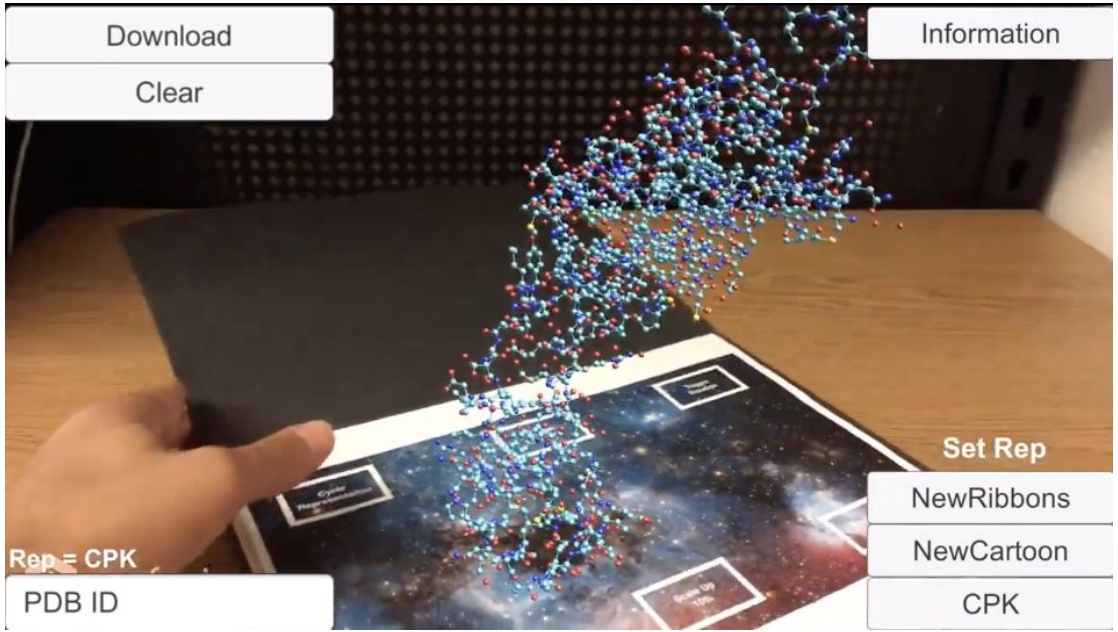
Background: VisMe

- An easy to use application to visualize any PDB (Protein Data Bank) file and other curated scientific data for educational purposes using AR
- Manipulate models in various representation styles
- Import PDB files into a visualization software > visualize in AR
- Explore commonalities in PDB files and how to generally view any PDB file in certain visualization software (as well as any 3D file at application runtime)
- For more technical information look at the June 2019 ECSS Symposium: *The Development of a Mobile Augmented Reality Application for Visualizing the Protein Data Bank*
    - Full paper: http://www.jocse.org/articles/8/1/3/

VisMe Architecture

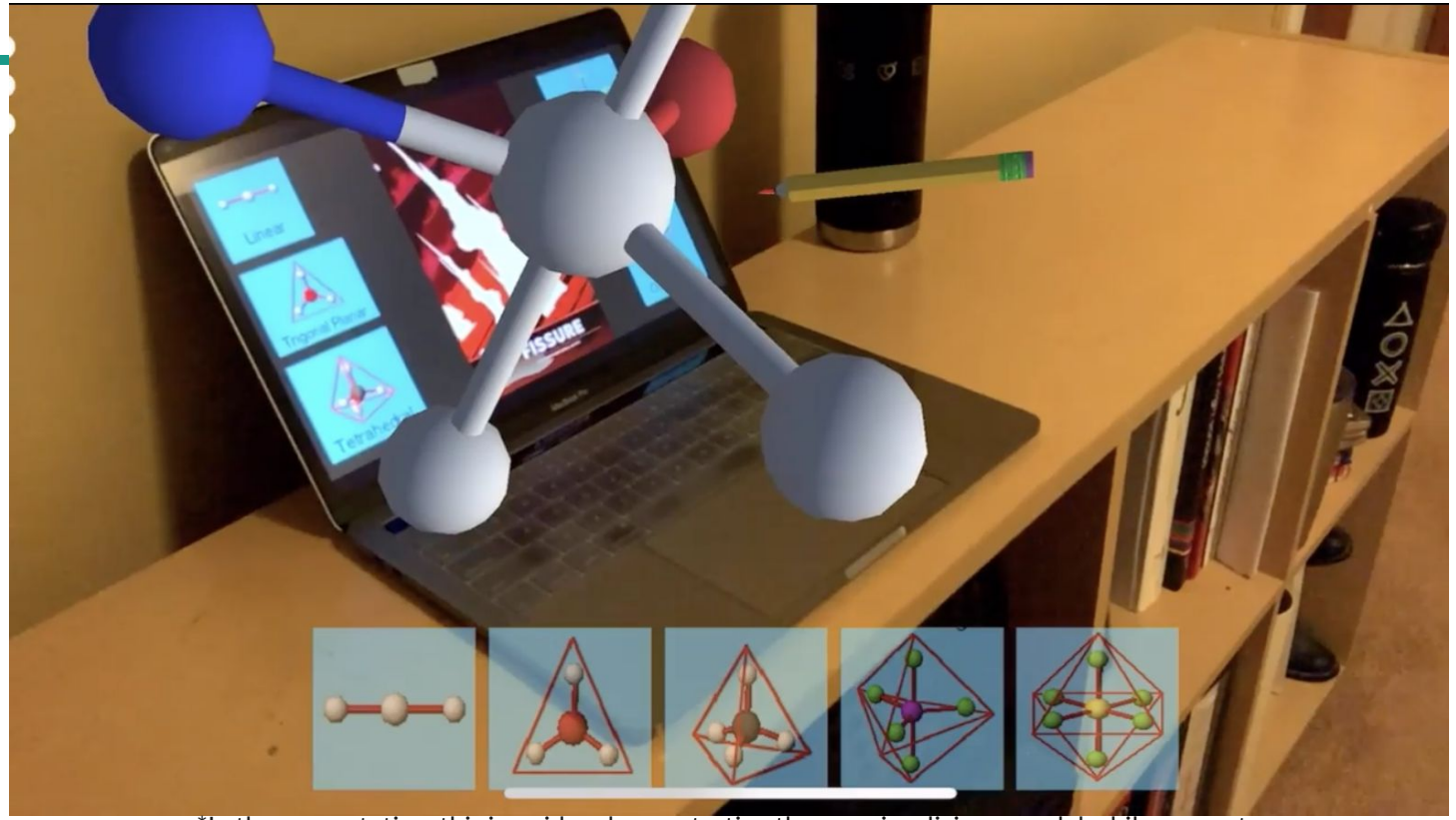


VisMe in action

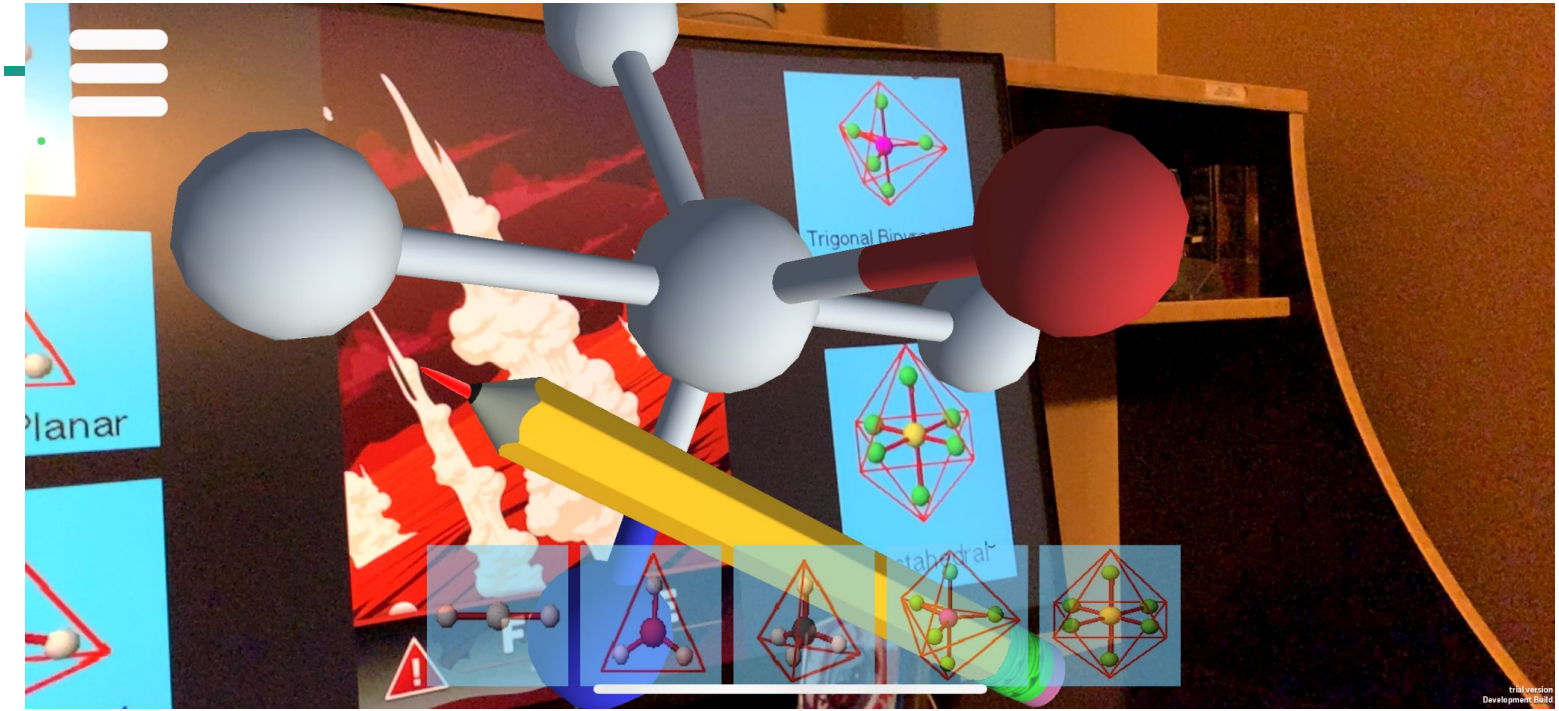


Designing a remote collaborative AR experience

- During the talk on VisMe, we received a question about collaborative experiences using AR
- Given the uptake in remote work, we designed a remote collaborative AR experience around VisMe
- Exploiting capabilities of Zoom (teleconferencing) calls
  - Sharing screen, shared video/audio
- Using target images
  - Unity + Vuforia
  - Target images can be on paper, textbooks, computer screen
- Use case flow:
  - Multiple participants join a Zoom meeting
  - The “driver” of the experience shares their screen to display relevant target images that will rig the desired AR assets
  - Participants of the meeting observe the presentation through the lens of their phone/device to see the AR information overlaid onto the presentation slides
  - Participants can interact with the data (and each other) using the application
    - Object manipulation and remote control
    - Visual representations of remote participants (in this case, a pointer shown as a pencil which is tracked in real time using position and rotation based on the image target marker to display remote participants relative to one another in a scene)



*In the presentation, this is a video demonstrating the app visualizing a model while a remote collaborator is visualized using the pencil, tracking position and rotation in real time


Planar
Trigonal
F
trial version
Development Build

Evaluation

- Research Question: does demonstration leveraging AR enhance sense of copresence between remote pairs collaborating (when compared to traditional teleconferencing)?
- User testing
  - Within subjects, 5 conditions presented in random order to counter-balance carryover effects
    - 1 - AR, touch-screen manipulation
    - 2 - AR, no touch-screen manipulation
    - 3 - AR, touch-screen manipulation, remote demonstration + visual representation of remote partner
    - 4 - No AR, touch-screen manipulation
    - 5 - No AR, touch-screen manipulation, remote demonstration
  - Participants
    - Students/instructors (mostly at graduate level) and researchers

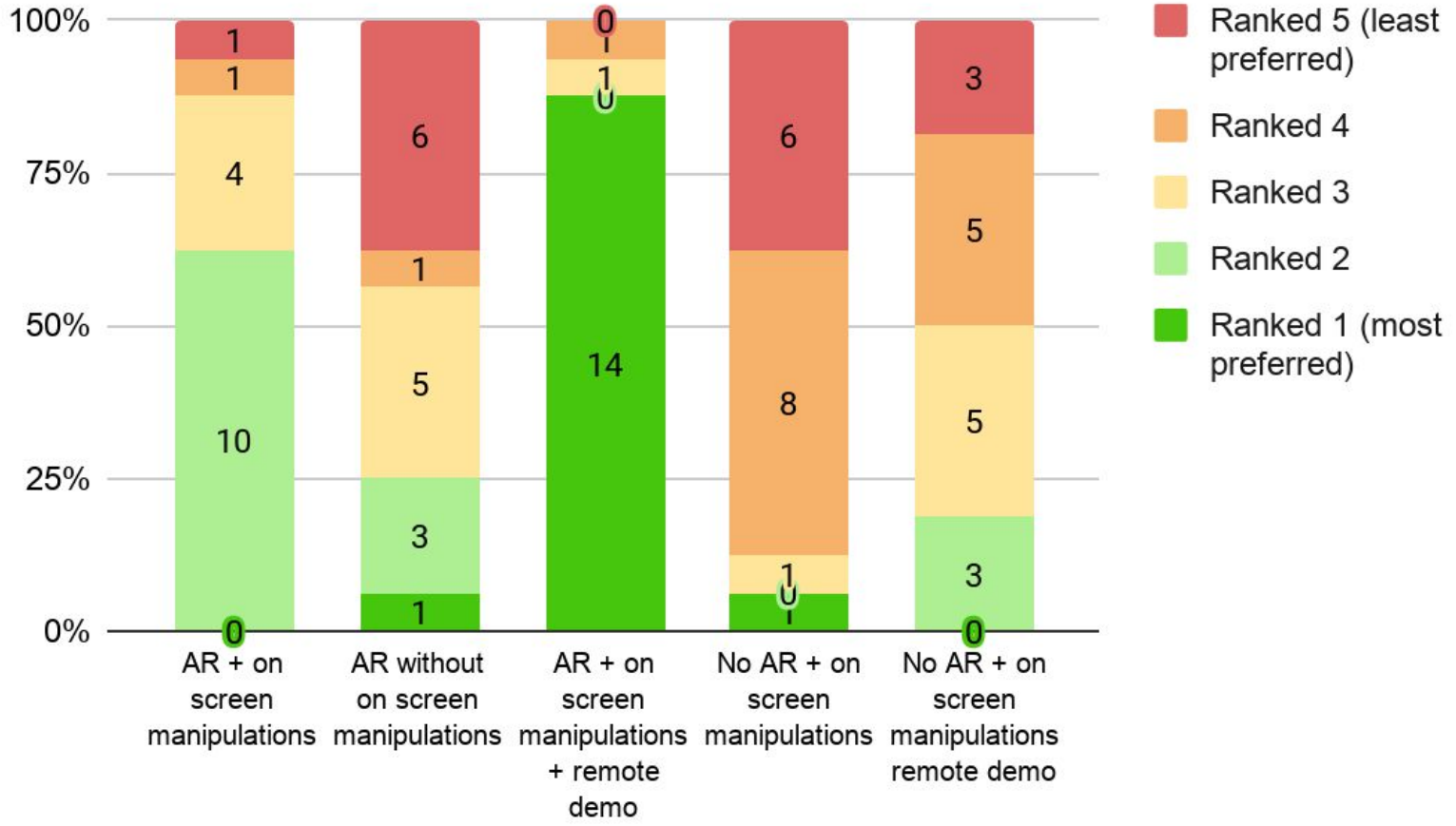
Evaluation cont'd

- Questionnaires, administered after each condition is presented
  - MEC-SPQ
    - "It seemed as though I actually took part in the action of the presentation"
  - NASA TLX
    - "Effort - How hard did you have to work to accomplish your level of performance?"
  - UES
    - "My experience was rewarding"
- Interviews
  - Semi-structured interviews after all conditions
  - "Did you feel that we were sharing the same object, or copies of the same object? Were there different times where you felt differently about this?"
- We are extremely interested in the color that the qualitative data provides as the validated questionnaires are not necessarily designed for AR experiences

Preliminary Findings

- Collaboration
  - *"You know I've had meetings where I have to present something to a collaborator… like a PowerPoint and then, in that case, I can have a cursor and point out something… other people i'm talking to don't have the ability to actually point out something they want me to see right so it's very one sided… being able to see the other person's position was helpful but also you being able to interact with the the model with AR"* --P12, biologist
  - Seeing each other visually represented in our spaces using some type of pointer/avatar
  - Sharing the object, changing the object together
  - Verbal cues aligning with visual cues
- User engagement
  - *"I definitely feel more excited if something like this was to appear in a presentation, as opposed to just sitting through all of these Zoom presentations…it could also be fatigue of the fact that I've been sitting in front of Zoom presentations for a year now. This is the first thing that's actually stood out as being different."* --P14, an instructor/student
  - Interest in AR + novelty of AR
  - Ties up the students' phones and focus
- Proprioception
  - P6 (instructor/student) said that while they are more used to touch screen interactions due to the interaction techniques that our phones commonly afford, changing the view is *"as easy as just, you know, looking over versus getting my finger and like scrolling through thing…seems more natural."*

Condition Rankings Participant Preferences



What's next?

- Finish user testing
- Data analysis (questionnaire + qualitative thematic analysis)
- Add features based on user testing
  - Annotation
  - Customization tools/options
    - Visual representations
    - Pointers
- Consider and compare collaboration methods
  - Remote/near
  - Synchronous/asynchronous
- Consider topic areas/domains
  - Architecture
  - Biology
  - Chemistry
  - Art/3D modeling
  - Gaming
  - Entertainment