

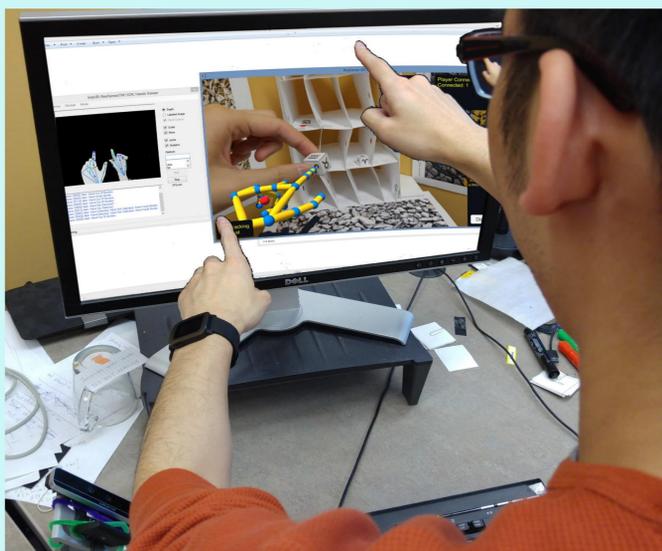
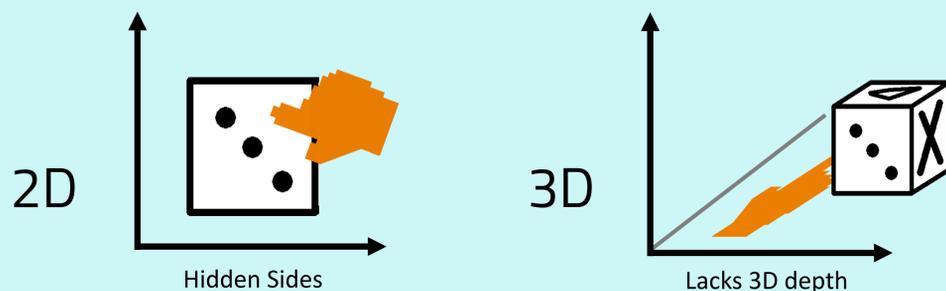
Collaborative 3D-AR Hand Gestures for Video Conferencing

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Problem

Hand gestures are essential human communication tools when **collaborating remotely**. We use gestures to point and disambiguate what we say. However, realistically many tasks involve 3D objects that a 2D workspace cannot fully capture and render. Either there are **hidden sides** or gestures **lack 3D depth**.



Prototype

A prototype system was built to capture a helping partner's **3D hand posture**, and render them into a working partner's **head mounted display (HMD)**. The HMD is **stereoscopic** so that the working user can perceive the hand gestures with depth and use both of their hands. **Augmented reality** was used to stabilize the hands to the workspace so that they are fixed to the real world rather than the camera's movement.



Google Cardboard



Hand Gesture Camera

Pilot Study

A within subjects study, pairs of participants completed tasks on a 3D structure involving **orienting** pieces; determining **subtle location cues**; and making precise hand postures.

Key Findings:

- Rapid and complex gestures not captured
- No perceivable benefit for stereoscopic
- Interaction volume unclear and small

	Shadows Only	Hands + Shadow
2D display	✓	✓
3D stereoscopic	X	✓

N=2	Shadows only	Hands & Shadow	Stereoscopic Hands & Shadows
Time (s)	330	360	247
Preference	0%	0%	100%
Errors (x/8)	0	1	0

Future Work

- Higher fidelity 3D hand capture system to allow helpers utilize **rapid and complex** hand gestures
- A HMD equipped with high resolution **stereo cameras** may give stereoscopic hands more utility in displaying depth cues
- Real world hands and captured hands should have a **one-to-one** mapping to aid helper ease in
- The gesturing **interaction volume** should be revised as to allow enough space for users to comfortably make gestures

