Abstract #4017

Calibration of Passability Judgments in Virtual Reality Transfers to Augmented Reality

Holly C. Gagnon[1], Hunter Finney[1], Bobby Bodenheimer[2], Jeanine Stefanucci[1], and Sarah H. Creem-Regehr[1]
[1]University of Utah, Salt Lake City, UT [2]Vanderbilt University, Nashville, TN
Email: holly.gagnon@psych.utah.edu

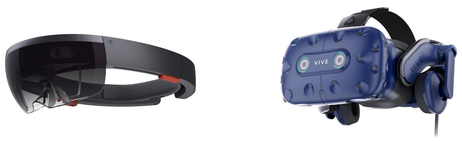
BACKGROUND

- **Virtual reality (VR)** and **augmented reality (AR)** can be used for training
- **Affordances**: Possibilities for action dependent on one's body and capabilities[1].
- Actors typically **overestimate the smallest passable doorway** by a factor of 1.2[2].
- Walking through virtual doorways while **wielding a virtual object** horizontally and receiving feedback about collisions leads to more accurate passability judgments in VR[3].
- Users receive **Action Outcome Feedback** when they perform the afforded action and receive information about the success/failure of their performance.

RESEARCH QUESTIONS

1) Does perceptual-motor action outcome feedback calibrate passability judgments for holding an object at 45 degrees in VR?
2) Will calibration achieved in VR transfer to augmented reality (AR)?

XR Technology



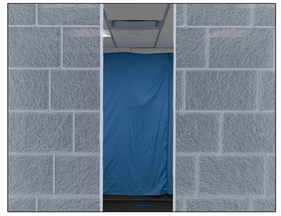
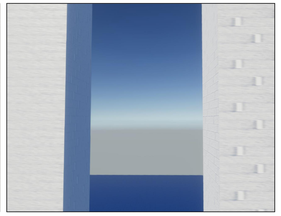
Apertures presented with Microsoft HoloLens 1 & HTC Vive Pro

METHOD

Participants: N = 30, 19 Female, M_{age} = 22.13

Participants completed two types of trials

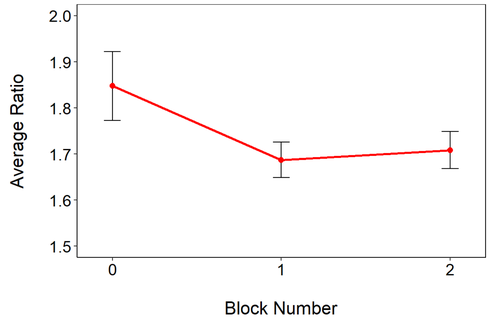
- **Adjustment**: Adjust virtual aperture until perceived to be the smallest aperture that they would be able to pass through while holding pole at 45 degree angle.
- **Feedback**: Ps walked through presented VR aperture. If a collision occurred, the controller corresponding with the wall that was hit vibrated.


Check out a video of the VR trials here!

RESULTS

Feedback calibrates passability judgments in VR, improving accuracy

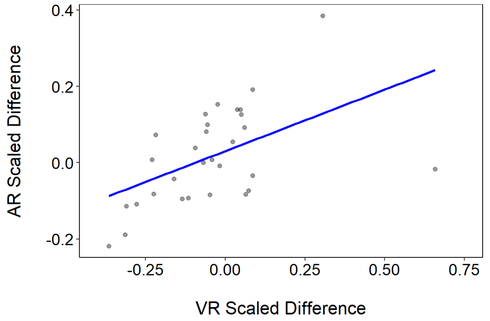


$$\text{Affordance Ratio} = \frac{\text{Adjusted Aperture Width (m)}}{\text{Effective Passable Width (0.86m)}}$$

Multilevel Model: Affordance Ratio = (1|Participant) + BlockNumber

As Block Number increased, affordance ratios decreased, becoming closer to one: $B = -0.07$, $SE = 0.03$, $p < .05$

Calibration transfers from VR to AR



$$\text{AR Scaled Difference} = \frac{\text{AR PostVR} - \text{AR PreVR}}{\text{AR PreVR}}$$

$$\text{VR Scaled Difference} = \frac{\text{VR Block2} - \text{VR Block0}}{\text{VR Block0}}$$

AR Scaled Difference correlated with VR Scaled Difference
$r(28) = 0.51$, $p < .05$

DISCUSSION

Calibration occurred quickly, consistent with prior work[4].

Judgments were still overestimated after calibration.
- Lack of avatar
- Restricted field of view

First study to show calibration transfer from VR to AR.
- Supports utility of training in mixed reality

Future Work
- Different types of feedback
- Other affordances (e.g., reaching)
- Transfer to between different realities (e.g., AR to real world)

REFERENCES

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