**MOVING IN A BOX**
**IMPROVING SPATIAL ORIENTATION IN VR USING SIMULATED REFERENCE FRAMES**

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**MOTIVATION**
When people navigate in an environment, a representation of their physical location and orientation is formed and continuously updated. This representation is referred to as reference frame. To enable more effective locomotion in VR, we proposed using an overlaid wireframe of a 3D rectangular box to simulate frames of reference.

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**METHOD**
Participants: 27 volunteers
Experimental design: within-subjects
Task: Navigating through a virtual environment to find 8 target objects hidden in 16 boxes
Display: HTC Vive HMD
Navigation interface: NaviChair motion cueing stool (Swooper stool mounted on a Nintendo Wii balance board)

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**RESULTS**
Task completion time: Simulated Room helped participants finish the task faster, compared to Simulated CAVE and the condition of No Reference Frame.
Travel distance: Participants significantly traveled a longer path in the condition of No Reference Frame compared to the condition of Simulated Room.

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**CONCLUSION**
Whereas previous studies showed a clear benefit of reference frame in spatial updating tasks [1]–[3], the current study provides first evidence that simply adding visually simulated reference frame consisting only of a wireframe rectangular box can provide significant benefits.

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