Capture of Virtual Environments for Analysis of Immersive Experiences

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This poster addresses emerging technologies for the capture and reconstruction of participants experiences in immersive virtual environments. These methods might improve communication of participants experiences when solving mathematical problems in three-dimensional contexts.

Keywords: Technology, Virtual-Reality, Mixed-Reality, Geometry

Virtual, mixed and augmented reality technologies provide novel opportunities for undergraduate students to investigate three-dimensional mathematical phenomena. For solid geometry, these immersive dynamic spatial displays support dynamic construction with virtual manipulatives in an immersive space without numeric measurements (Dimmel & Bock, 2017). Recent studies observing students solving mathematical problems use a two-dimensional projection of the first-person perspective in immersive (Lai et al, 2016; Bock & Dimmel, 2017) and augmented environments (Radu et al, 2015). However, these renderings might limit researchers’ ability to analyze student’s experiences in the virtual environment. This poster discusses the research question: How can participant’s experiences solving mathematical problems in immersive three-dimensional mediums be understood through two-dimensional mediums? To address this question, this poster explores mixed-reality video capture, three-dimensional gesture capture, and figure logging provide as partial solutions for the reconstruction of a student’s experience.

**Mixed Reality Video Capture**

Mixed Reality video capture can be used to record and stream live video of the physical participants inside their virtual environment (Figure 1), using both physical and virtual external cameras (Blueprint Reality, 2017). This provides more context about the participant’s environment than a first-person view (Figure 1), while it can still be managed within traditional 2-d mediums.

![Figure 1. First Person (left) and Mixed Reality (right) views of the virtual environment.](image)

**Applications to Future Research**

These data capture methods might improve studies using immersive dynamic spatial displays in addition to the first-person screen captures, when researching small groups of participants or sharing research data between multiple researchers. Immersive renderings of dynamic figures might be relevant for future studies of the teaching and learning of college mathematics in contexts where three-dimensional properties are difficult to render in 2D, including solids of revolution, constructions in solid geometry and gradients of three-dimensional surfaces.
References