

**MULTI-USER INTERACTIONS FOR SPATIALLY
AUGMENTED REALITY GAMES**

By

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Augmented reality offers a means of overlaying interactive virtual elements onto real world environments. Motivated by an interest in developing new methods for multi-user interactions in the context of games, this thesis extends an existing spatially augmented reality system to develop a number of engaging game prototypes in both small-scale and human-scale display environments. Primarily, it discusses the details of *ARmy*, a two-player military strategy game that demonstrates the concept of combining physical tabletop games with virtual elements characteristic of modern video games. As players move plastic miniatures through a physical scene, the application moderates and augments play by maintaining a heightfield representation of the scene, which it uses to validate movement paths and perform automatic line-of-sight calculations.

The described applications are built on top of a display system capable of dynamically augmenting the appearance of physical objects. The system uses a mounted camera to track a collection of moveable, white surfaces, and applies virtual textures to these objects using multiple projectors. This thesis includes a high-level overview of the system architecture, and describes some of the specific methods it uses, most notably in regard to the problem of fast 3D registration of surface objects. Finally, it discusses the effectiveness of the applications in their current form, as well as possible areas for future research.