The United States Army continues to develop new and effective ways to use simulation for training. One example is the Non-Rated Crew Member Manned Module (NCM3), a simulator designed to train helicopter crewmembers in critical, high risk tasks such as crew coordination, flight, aerial gunnery, hoist and sling load related tasks. The goal of this study was to evaluate visual modalities' effect on performance in mixed reality aerial door gunnery.

There is a strong belief in the United States Army that the greater the degree of immersion in a virtual simulation, the more effective that simulation is. However, little scientific research exists that supports this notion. In fact, the true goal of training simulation is to optimize the degree of transfer to the trainee - not to create the most immersive experience possible. As a result, the Army Program Manager frequently faces trade-off dilemmas during the simulation design phase, balancing user desires with cost and schedule constraints. One of those trade-off predicaments, and the unscientific manner in which it was resolved, served as the motivation for this research.

A review of the literature was conducted in order to investigate the benefits of simulation for training. The taxonomy of reality, as well as the training efficacy of virtual and mixed reality simulation, were examined. Major concepts, applications and components of virtual and mixed reality simulation training were studied. Prior visual modality research was reviewed and discussed.

Two discrete groups of subjects, expert (n = 20) and novice (n = 76), were employed in this study. Participants were randomly assigned to one of two visual modality treatments (Liquid Crystal Display (LCD) flat panel screen or Head-Mounted Display (HMD)) and executed three aerial door gunnery training scenarios in the NCM3. Independent variables were visual modality, trial, immersive tendency and simulator sickness questionnaire scores. Dependent variables included performance, presence and simulator sickness change scores.

The results of the study indicate no main effect of visual modality on performance for the expert population while a main effect of visual modality on performance was discovered for the novice population. Both visual treatment groups experienced the same degree of presence and simulator sickness. No relationship between an individual's immersive tendency and their performance and level of presence was found. Results of this study's primary objective are conflicting, by expertise group, and thus both support and challenge the commonly held notion that higher immersive simulation leads to better performance.
Approved for distribution by Peter Kincaid, Committee Chair, on April 21, 2014.

The public is welcome to attend.