3D user interface technologies have the potential to make games more immersive & engaging and thus potentially provide a better user experience to the gamers. Although 3D user interface technologies are available for games, it is still unclear how their usage affects game play and if there are any user performance benefits. A systematic study of these technologies in game environment is required to understand how the game play is affected and how could we optimize the usage in order to achieve better game play experience.

This dissertation seeks to improve the gaming experience by using several 3DUI technologies. In this work, we focused on stereoscopic 3D viewing (to improve viewing experience) coupled with motion based control, head tracking (to make games more engaging), and faster gesture based menu selection (to reduce cognitive burden associated with menu interaction while playing). We first studied each of these technologies in isolation to understand their benefits for games. Based on these findings, we custom designed an air-combat game prototype which simultaneously uses stereoscopic 3D, head tracking, and finger-count shortcuts to prove that these technologies could be useful for games if the game is designed with these technologies in mind. Additionally, to enhance depth discrimination and minimize visual discomfort, the game dynamically optimizes stereoscopic 3D parameters (convergence and separation) based on the user's look direction. We conducted a within subjects experiment where we examined performance data and self-reported data on users perception of the game. Our results indicate that participants performed significantly better when all the 3DUI technologies (stereoscopic 3D, head-tracking and finger-count gestures) were available simultaneously with head tracking as a dominant factor. We explore the individual contribution of each of these technologies to the overall gaming experience and discuss the reasons behind our findings.