Image compression is a technique to reduce overall data size, but its effects on human perception have not been clearly established. The purpose of this effort was to determine the most effective psychophysical method for subjective image quality assessment, and to apply those findings to an objective algorithm. This algorithm was used to identify the minimum level of texture compression noticeable to the human, in order to determine whether compression-induced texture distortion impacted game-play outcomes. Four experiments tested several hypotheses. The first hypothesis evaluated which of three magnitude estimation (ME) methods (absolute ME, absolute ME plus, or ME with a standard) for image quality assessment was the most reliable. The just noticeable difference (JND) point for textures compression against the Feature Similarity Index for color was determined. The second hypothesis tested whether human participants perceived the same amount of distortion differently when textures were presented in three ways: when textures were displayed as flat images; when textures were wrapped around a model; and when textures were wrapped around models and in a virtual environment. The last set of hypotheses examined whether compression affected both subjective (immersion, technology acceptance, usability) and objective (performance) gameplay outcomes. The results were: the absolute magnitude estimation method was the most reliable; no difference was observed in the JND threshold between flat textures and textures placed on models, but textured embedded within the virtual environment were more noticeable than in the other two presentation formats. There were no differences in subjective gameplay outcomes when textures were compressed to below the JND thresholds; and those who played a game with uncompressed textures performed better on in-game tasks than those with the textures compressed, but only on the first in-game day. Practitioners and researchers can use these findings to guide their approaches to texture compression and experimental design.

Major: Modeling and Simulation

Educational Career:
Bachelor's of Psychology, BS, 2003, University of Central Florida
Master's of Modeling & Simulation, MS, 2010, University of Central Florida

Committee in Charge:
James Szalma, Chair, Psychology
Cali Michael Fidopiastis, Institute for Simulation & Training
Florian Jentsch, Psychology
Mubarak Shah, Computer Science

Approved for distribution by James Szalma, Committee Chair, on June 14, 2018.

The public is welcome to attend.