PROJECT SUMMARY

Overview:
New technology extends and augments human capabilities. Emerging extended reality technology, including virtual and extended reality, assists the user by expanding visual attentional, perceptual, and cognitive capabilities. There is *a critical need* to identify unforeseen, unintended impacts associated with extended reality technology use, which may introduce new potentials and concerns for the user's cognitive health and safety.

This *research aims* to identify the effects of cognitive augmentation technology – extended reality – on the user's visual functions, including attention, perception, and cognition. By using established theoretical frameworks that describe the multifaceted human visual cognition system, this project aims to systematically and comprehensively 1) examine the effects of extended reality technology on distinct aspects of visual functions; 2) identify human-related, technical, and contextual factors contributing to the effects of extended reality on cognitive functions; and 3) reveal if prolonged use of extended reality technology has potentially permanent effects on human cognition. This research proposes using novel approaches and strategies to examine short-term effects and long-term, possibly permanent, after-effects of human augmentation, using behavioral, eye-tracking, and brain activity measures. This research will focus on older adults and people with cognitive deficits and declines who may benefit most from human augmentation technology.

The proposed project will also integrate research and education to achieve the *educational goals* of facilitating interdisciplinary and STEM education and research and improving diversity and inclusion in STEM disciplines. The core educational aims focus on two key areas: 1) developing a new academic curriculum to improve technology and computing knowledge and skills among behavioral and social science students and 2) initiating an open lab program to provide STEM infrastructure for education and research to underrepresented and underprivileged K-12 students.

Intellectual Merit:

This research will advance our knowledge of the positive as well as potential adverse effects of extended reality technology on visual attention, perception, and cognition while being in extended or virtual environments and permanently after extended use. The findings can lead to a new potential for using extended reality as the training and rehabilitation intervention tools that can help improve the functions of individuals with visual attentional, perceptual, and cognitive deteriorations. In addition, the findings will help develop evidence-based countermeasures that prevent any potential adverse effects of long-term use of extended reality. The expected findings will further advance our understanding of human cognition and brain plasticity related to prolonged interactions with emerging technologies.

Broader Impacts:

The proposed educational activities will improve technology and computing knowledge and skills among behavioral and social science students who might otherwise have no opportunity to train and research technology and expand the accessibility of underrepresented and under-resourced students to STEM education and research infrastructure. These educational efforts will improve diversity and inclusion in STEM and address structural inequities in our society that may lead to limited opportunities and resources for STEM careers and academic pursuits among underprivileged minorities. Furthermore, a new tool for assessing and training visual cognition will be developed as a course of this research, which will benefit society and improve inclusion and equity by enhancing functions, health, and safety among people with cognitive deficits and declines.