REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT #: AFRL-RHW-27-10

Modeling Changes in Attentional Resource Capacity Under Extended Cognitive Demand and Environmental Stress

PROJECT DESCRIPTION: Combat systems operators simultaneously perform several demanding tactical tasks (e.g., managing communications, making fast-paced calculations and decisions, and tracking mission schedules) during long-endurance missions. In an ongoing study, participants complete 40-minute simulated scenarios once per hour across two six-hour sessions: one with operational acoustic noise exposure and one in a quiet control environment. Grounded in Multiple Resource Theory, computational cognitive models can differentiate how acoustic noise and continuous time-on-task selectively tax distinct attentional capacity pools. These findings can inform operator tasking strategies and behaviors to reduce cognitive fatigue and enhance mission performance.

As an ORISE participant, you will help design a mathematical framework that maps performance across a five-task cognitive battery and subjective survey metrics to dynamic, resource-specific latent factors. Using machine learning and simulation-based tools, the model will be trained and tested on simulated data and validated using empirical human-subject data. The final output will be a hierarchical cognitive model that predicts how environmental noise and time-on-task impact individual- and group-level attentional resource pools over time.

LEARNING OBJECTIVES: Under the guidance of a mentor, you will gain hands-on experience to complement your education and support your academic and professional goals. Along the way, you will engage in activities and research in several areas, including but not limited to:

1. Develop technical skills in computational modeling for complex data.
2. Gain foundational knowledge in human factors theory and hierarchical Bayesian statistics by translating theories of mental workload and fatigue into formal mathematical models.
3. Develop problem-solving skills and learn to effectively communicate complex statistical methods to interdisciplinary research teams.

ACADEMIC LEVEL: Master's, Doctoral
DISCIPLINE NEEDED: Mathematical/Computational Psychology; Cognitive Science and Human Factors Psychology
RESEARCH LOCATION: Wright-Patterson Air Force Base, Dayton, Ohio
RESEARCH MENTOR: Elizabeth Fox, Ph.D.
Human Factors and Industrial / Organizational Psychology Wright State University, 2019



Dr. Elizabeth (Betsy) Fox is a Research Psychologist with the Air Force Research Laboratory (AFRL) within the Digital Models of Cognition Core Research Area, where she leads research on human performance, cognitive modeling, and human-autonomy teaming. She earned her Ph.D. in Human Factors and Industrial/Organizational Psychology from Wright State University and specializes in using mathematical modeling and computational methods to evaluate operator decision-making and multitasking in high-workload, operational environments. An active leader in the scientific community, Dr. Fox serves as President-Elect of the

The material was CLEARED on 19 Oct 2026; Case Number: AFRL-2026-1821

Society for Mathematical Psychology, Secretary-Elect of the Southern Ohio Chapter of the Human Factors and Ergonomics Society, and holds positions on the editorial board of the Journal of Mathematical Psychology and the advisory board of Women of Mathematical Psychology. Students interning in her lab gain direct, hands-on experience developing cutting-edge cognitive models and conducting applied research designed to optimize warfighter decision-making and human-machine collaboration.

The material was CLEARED on 19 Oct 2026; Case Number: AFRL-2026-1821