

REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT #: AFRL-RHW-24-04

Cognitive Models of Decision-making

PROJECT DESCRIPTION:

In order to make decisions, people make sense of a situation by gathering information through the senses and/or previous experiences stored in memory, and then employ cognitive processes like reasoning to determine a course of action. Depending on the context, individuals may multitask, experience high cognitive workload, weed out less useful or misleading information, and have performance decrements due to fatigue. This research opportunity involves foundational research to better understand cognitive processes and mechanisms of decision-making to predict, explain, and simulate human behavior. To achieve these goals, experimental research is leveraged with behavioral, subjective, and physiological (EEG, eye-tracking, and FNIRS) measures, and holistic cognitive models with end-to-end (perception to action) processing capable of performing complex tasks while tracking cognitive processes at high resolution. There is an interest in a range of tasks and topics in the decision-making space capable of supporting these goals and applying to Air Force strategic objectives. An ideal project would include multiple cue decision-making and address at least one of the following: 1) perception and situation awareness, 2) factors influencing performance like fatigue and cognitive workload, 3) learning through exploration/exploitation (e.g., strategies), and 4) ways cognitive vulnerabilities/biases could be exploited. A good project would be scoped appropriately and may include reviewing relevant literature, analysis of behavioral and physiological data, and developing or expanding on an existing cognitive model. The student intern will gain fundamental knowledge about decision-making in various contexts and its relation to situation awareness, cognitive workload, learning, and cognitive biases. There will be opportunities to learn or expand knowledge on coding for data analysis and cognitive modeling.

ACADEMIC LEVEL: Masters; Doctoral

DISCIPLINE NEEDED:

- Cognitive science
- Psychology
- Human factors

RESEARCH LOCATION: Wright-Patterson Air Force Base, Dayton, Ohio

RESEARCH MENTOR: Alexander Hough, Ph.D.

Human Factors/Industrial-Organizational Psychology, Wright State University, 2021



Dr. Hough is a Research Psychologist in the 711th Human Performance Wing, Warfighter Interactions & Readiness Research Division, Cognition and Modeling Branch. His background is in decision making, problem solving, reasoning, coordination within game theory, and computational cognitive modeling. He has published work related to the identification of strategy use and detection of strategy switching in decision making and coordination tasks, cognitive mechanisms of analogical reasoning and transfer, cognitive models of complex visual tasks, and how cognitive biases/vulnerabilities can be exploited to influence individuals and groups. His current efforts include: 1) building a foundation for a cognitive theory and model of anticipatory thinking to support complex decision making and planning, 2)

leveraging analogical reasoning research to extend ACT-R cognitive architecture capabilities to facilitate resolving gaps in knowledge and generalization, 3) evaluating methods to detect and model (ACT-R) fatigue, its cognitive mechanisms, and effects on performance, and 4) building computational models to explain how cognitive vulnerabilities could be exploited to influence individuals and groups.

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