

Attachment 1 – DAGSI Research Topic Template

Research Title: Cognitive Technologies for Agile Performance Prediction and Adaptive, Personalized Learning

1. **Individual Sponsor:** List the AFRL research topic sponsor's contact information

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2. **Academic Area/Field and Education Level**

Cognitive Psychology/Cognitive Science/Computer Science/Data Science/Learning Sciences/Human Factors (MS or PhD level)

3. **Objectives:** We are interested in leveraging our understanding of human memory and cognition to ensure that learners have the knowledge and skills they need to be effective in specified performance domains, through the development and validation of models designed to capture, track, predict, and optimally prescribe learning regimens around individual and unique learning needs. We are interested in developing and validating novel integrations of data-driven algorithmic approaches stemming from the artificial intelligence (AI) and machine learning sciences, combined with highly principled cognitive modeling techniques designed to formally account for the nuances of human information processing and memory to better understand the complex interplay between temporal and interindividual dynamics associated with learning. We seek to fill foundational and applied research gaps for optimizing the timing, content, and most relevant selection of new and review training materials across a range of relevant timescales. We seek to develop new modeling techniques to adaptively account for the impacts of cognitive moderation on performance. We also seek to better understand the impact of presentation modality (e.g., multiple choice, fill in the blank, free recall) as it relates to types of human memory, and how input types may be optimally interleaved or scaffolded to bolster learning.
4. **Description:** The researcher will be involved in multiple aspects of the research process, including: 1) Conducting studies and synthesizing results from existing studies to address foundational and applied research gaps, 2) Assessing and analyzing quantitative data using statistical, mathematical, or machine learning modeling techniques, and 3) Extending cognitive models, machine learning, and artificially intelligent (AI) algorithms. Research questions we seek to address include: 1) How can models be extended to take into account different types of performance measures (e.g., physiological data, cognitive workload data, biometric data, response time, accuracy), 2) What is the optimal timing for reviewing previously studied items and for introducing new items, 3) How can we predict

the impacts of cognitive moderators on performance? 4) How should review materials be prioritized when the full set is greater than practice time will allow, 5) How can more intuitive interfaces be developed to guide and support human learning, and 6) How should presentation formats be optimally scaffolded to bolster learning?

5. Research Classification/Restrictions: Unclassified, no restrictions

6. Eligible Research Institutions: Universities (DAGSI)

NOTE: PA Approval #AFL-2023-3129