STRONG - Cycle 1, FY19

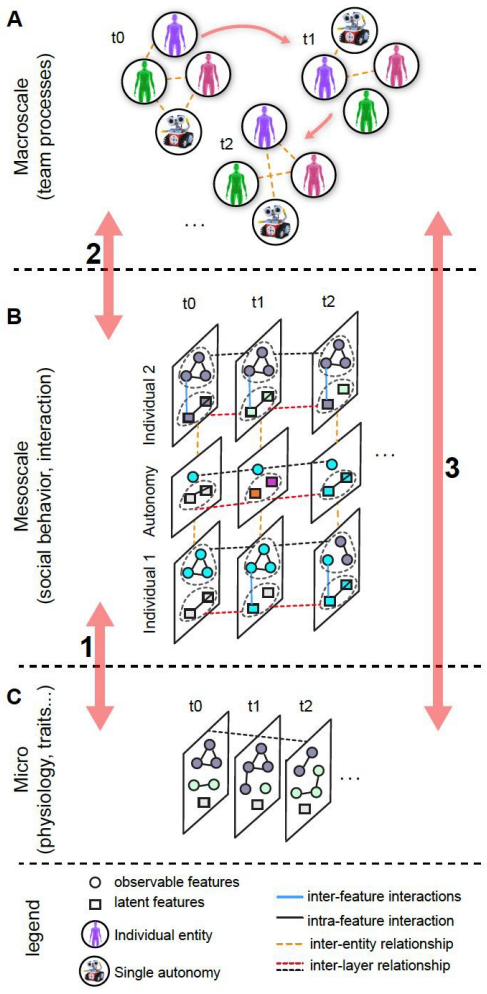
Micro and Meso Signatures of Success in Human-Autonomy Teams

PIs / Collaborators: PI: Christoph Riedl (Northeastern University), Co-PIs: Brooke Foucault Welles (Northeastern University), Richard J. Radke (Rensselaer Polytechnic Institute), & Paul Sajda (Columbia University)

Primary POC: Dr. Christoph Riedl, c.riedl@neu.edu

Summary: U.S. Army squads are facing two transformative changes, each with the potential to significantly augment military capability. First, advances in AI and machine learning are enabling intelligent, autonomous agents to join military teams. This invites new theorizing on how the processes and outcomes of human-autonomy teams extend or amend current theories on human teams. Second, sensors and advanced real time processing are making it possible to leverage multimodal data streams from various sensors (e.g., physiological signals, audio, video, text) to understand and enhance performance not only in human teams but to also feed data into autonomy systems to enable smooth human-autonomy collaboration.

Leveraging state-of-the-art sensing technology, this project aims to theorize and model team communication at the micro- and meso-scales in order to develop virtual agents that are able to fully understand and effectively participate in dynamic human-agent teams. Our team brings together leading experts in human physiology (Columbia), non-verbal and verbal sensing (RPI), and dynamical team communication (NEU), in collaboration with ARL scientists (Bansal-Garcia and Bohannon-Lauharatanahirun) and a companion macro-scale proposal (NWU, GA, Cornell), to collect a rich and comprehensive record of team communication dynamics across modalities and scales. We will combine dynamical streams of multimodal data from human-autonomy team communication in a variety of army-relevant scenarios, collected at the micro- and meso- levels (see figure), into a single, unified model of team interaction and performance.



Specifically, in this project we propose to combine dynamical streams of multimodal data from human-autonomy team interaction, collected at the micro and meso levels, into a single, unified model of team performance focusing on two research aims:

> RA1. *identifying streams of data that are uniquely, or in combination, predictive of team performance, and*
> RA2. *identifying critical windows where autonomy can intervene to alter, augment, and/or improve team performance outcomes.*

To achieve these research aims, we will build custom technology packages (mobile smart conference room, mSCR), integrate these custom technology packages with existing biosensing technologies (mobile smart conference room plus biosensing, mSCR+), develop algorithms to integrate multimodal data streams collected at different time scales and with different degrees of detail, and analyze the integrated data streams to identify signals of effective performance and opportunities for agent intervention. Together, the technology and algorithms we develop will allow autonomous agents to dynamically and effectively participate in human-autonomy teams in the two task scenarios within this proposal, the two tasks in the companion proposal, as well as tasks proposed by our ARL collaborators.