Integrating Heart Rate and Eye Movement Measures as a Possible Robust Indicator of Workload in an Aviation Simulation Task

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Problem
• Flight missions and remotely piloted aircraft operations can be difficult and taxing on pilots and operators
• Sustained attention can lead to errors and performance deterioration that can be potentially dangerous and costly

Background
• Monitoring physiological changes may help determine when an individual is under high workload and indicate when help should be given
• Heart rate and eye measures have independently been shown to be sensitive to workload

Objective
• To determine if the combination of heart rate and eye measures will produce a more sensitive and robust measure of operator functional state than either alone

Experimental Design
• 2x4 within-subjects design
• 10 college students; 6-7 training sessions
• Performance, physiological, and subjective data collected for 16 trials
• Air Force Multi-Attribute Task Battery (AF_MATB)
• SmartEye eye-tracker and BioSemi system

Performance Data
• Significant main effects for workload, $F(1,9) = 459.6; p < 0.05$, and for automation, $F(3,27) = 15.54; p < 0.05$
• Significant interaction, $F(3,27) = 3.468; p < 0.05$

Conclusions
• Based on nearly 300 hours of data and preliminary analyses, I expect eye measures and heart rate combined will be a more robust measure of workload

Future Work
• Additional analysis of relationship between high and low workload and different automation conditions
• Compare heart rate and eye measures as individual indicators of workload versus heart rate used in conjunction with eye measures