

4-17-2013

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## Recommended Citation

"Integrating Heart Rate and Eye Movement Measures as a Possible Robust Indicator of Workload in an Aviation Simulation Task" (2013). *Stander Symposium Posters*. 231.  
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# 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

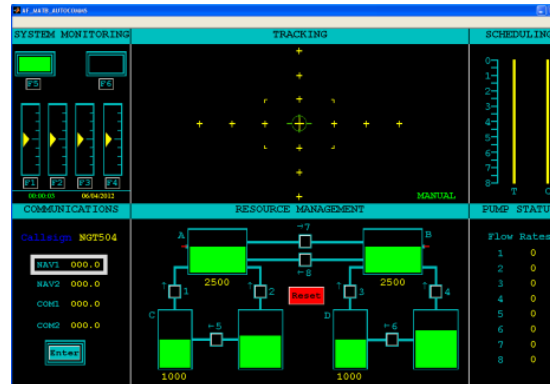


## Background

- 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

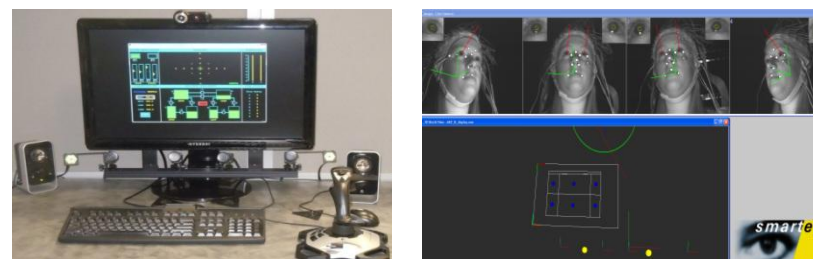
- To determine if the combination of heart rate and eye measures will produce a more sensitive and robust measure of operator functional state than either alone



## Experimental Design

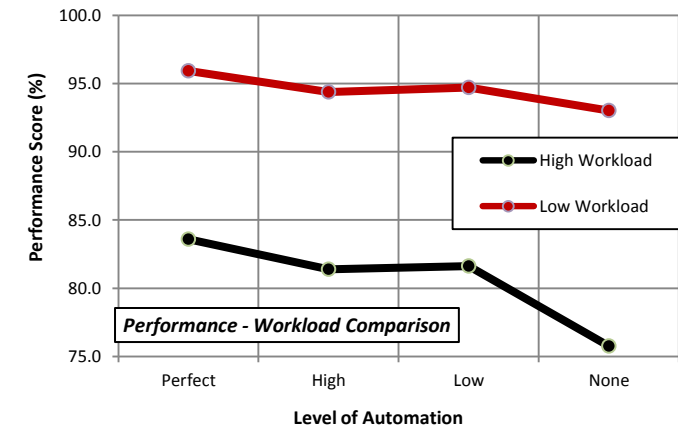
- 2x4 within-subjects design
- 10 college students; 6-7 training sessions
- Performance, physiological, and subjective data collected for 16 trials
- Air Force Multi-Attribute Task Battery (AF\_MATB)
- SmartEye eye-tracker and BioSemi system

|            |                                   |
|------------|-----------------------------------|
| Workload   | High (individual titration point) |
|            | Low (stage 3)                     |
| Automation | Perfect (no errors)               |
|            | High Reliability (2-3 errors)     |
|            | Low Reliability (7-8 errors)      |
|            | No Automation                     |



## 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