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EVALUATING A PHYSIOLOGICAL SENSOR FOR COGNITIVE WORKLOAD ASSESSMENT IN TWO DIFFERENT MILITARY SETTINGS

MOTIVATION

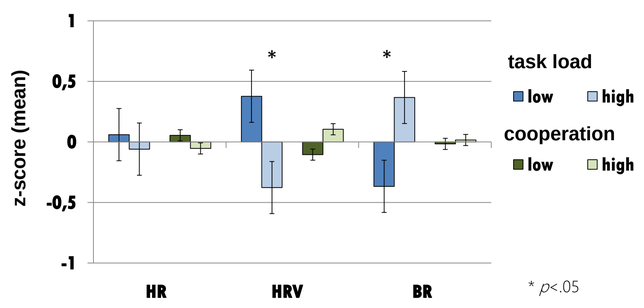
- **Cognitive workload** (too high and too low) can cause human error.
- **Assessment** of cognitive workload is important for Human Factors Engineering.
- **Physiological measures** allow for a rather non intrusive continuous measurement.

OBJECTIVE

- Evaluation of metrics from the **cardio sensor Bioharness 3** for cognitive workload assessment:
- heart rate (HR),
- heart rate variability (HRV),
- breathing rate (BR).

LAB EXPERIMENT

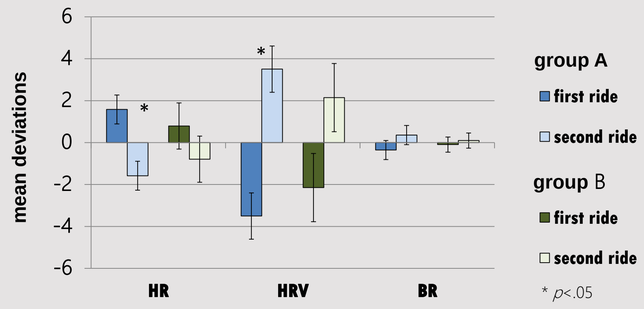
- Workload evaluation on a simulation based air traffic control task.
- *N* = 10, ♂ 8, ♀ 2, Age = Ø 31,4
- 2x2 Balanced repeated measures design:
  - task load (low vs. high),
  - level of cooperation of air tracks (low vs. high).
- Assumption: higher arousal (high HR, low HRV, high BR) for high task load and low cooperation.



Repeated measures ANOVA: significant main effect for task load regarding HRV ($F(1,9)=8.552$, $p<.05$) and BR ($F(1,9)=6.834$, $p<.05$)

FIELD STUDY

- Drivers' workload evaluation using two different night vision devices.
- *N* = 24, ♂ 23, ♀ 1, Age = Ø 30,75
- Balanced repeated measures design:
  - Group 1: device A – device B,
  - Group 2: device B – device A.
- Assumption: First ride is more demanding than second ride.



ANOVA with group (between-factor) and ride (within factor): significant main effect for ride regarding HRV ($F(1,21)=8.519$, $p<.01$)
Pairwise comparisons: significant differences for HR $p<.05$ and HRV $p<.01$ in group A

SUMMARY

- Lab Experiment: variations in task load are reflected by HRV and BR, not HR.
- Field study: learning effect is reflected by HRV and to a lower extend by HR, not BR.
- Consistent and significant findings only for HRV in both studies.

CONCLUSION

- Cardio sensor Bioharness 3 can be used to differentiate between different workload conditions in lab and field settings.
- Multiple metrics are needed for a more reliable and valid differentiation.

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