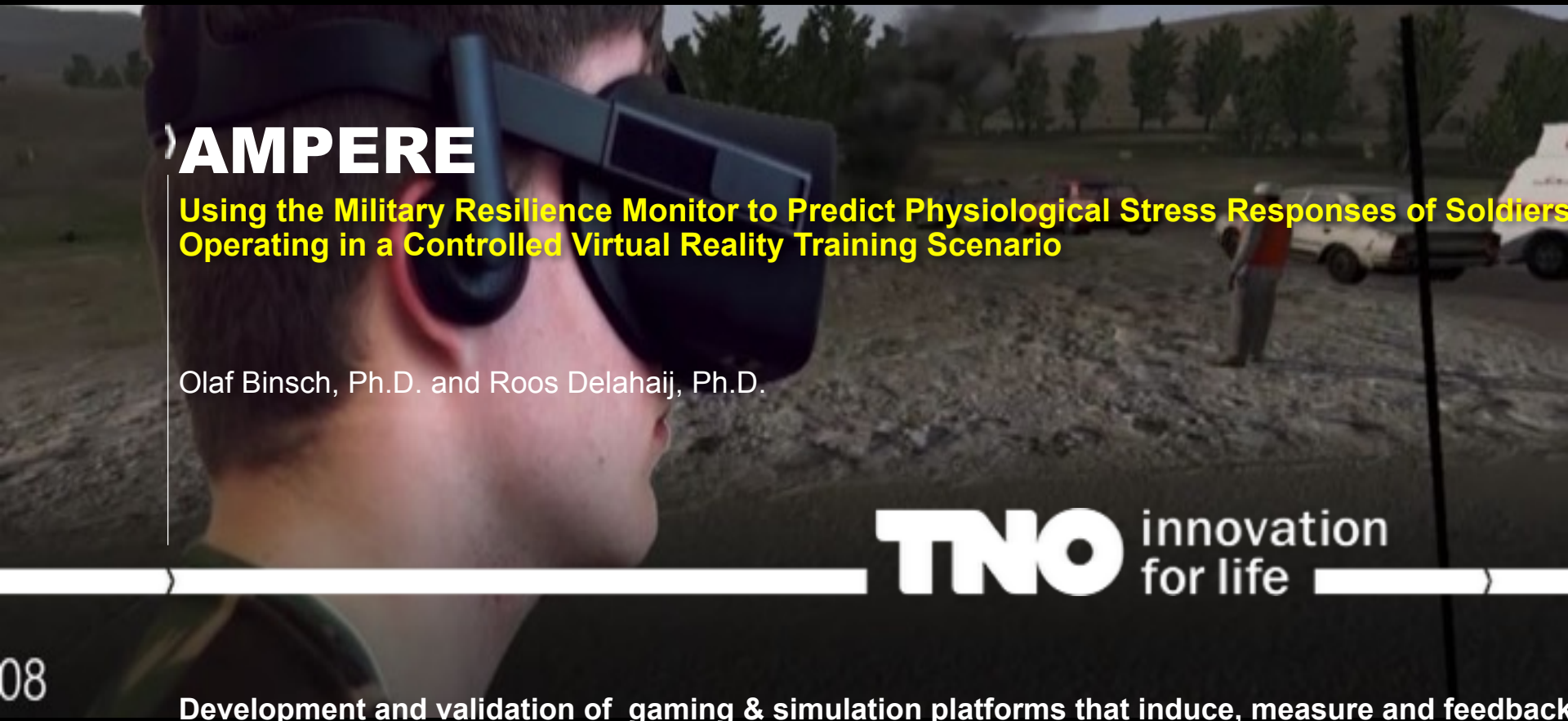

AMPERE

Using the Military Resilience Monitor to Predict Physiological Stress Responses of Soldiers Operating in a Controlled Virtual Reality Training Scenario

Olaf Binsch, Ph.D. and Roos Delahaij, Ph.D.

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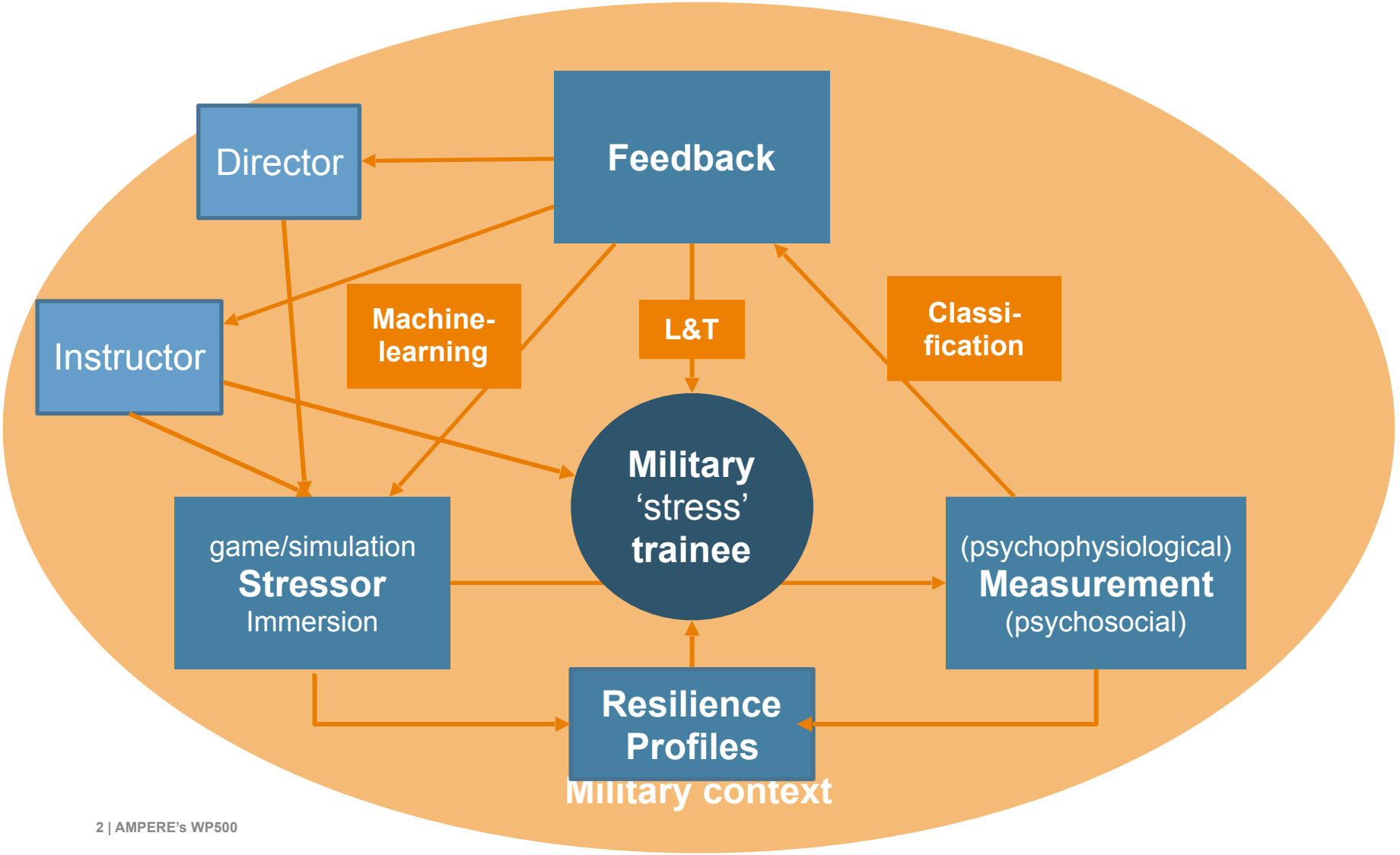
08

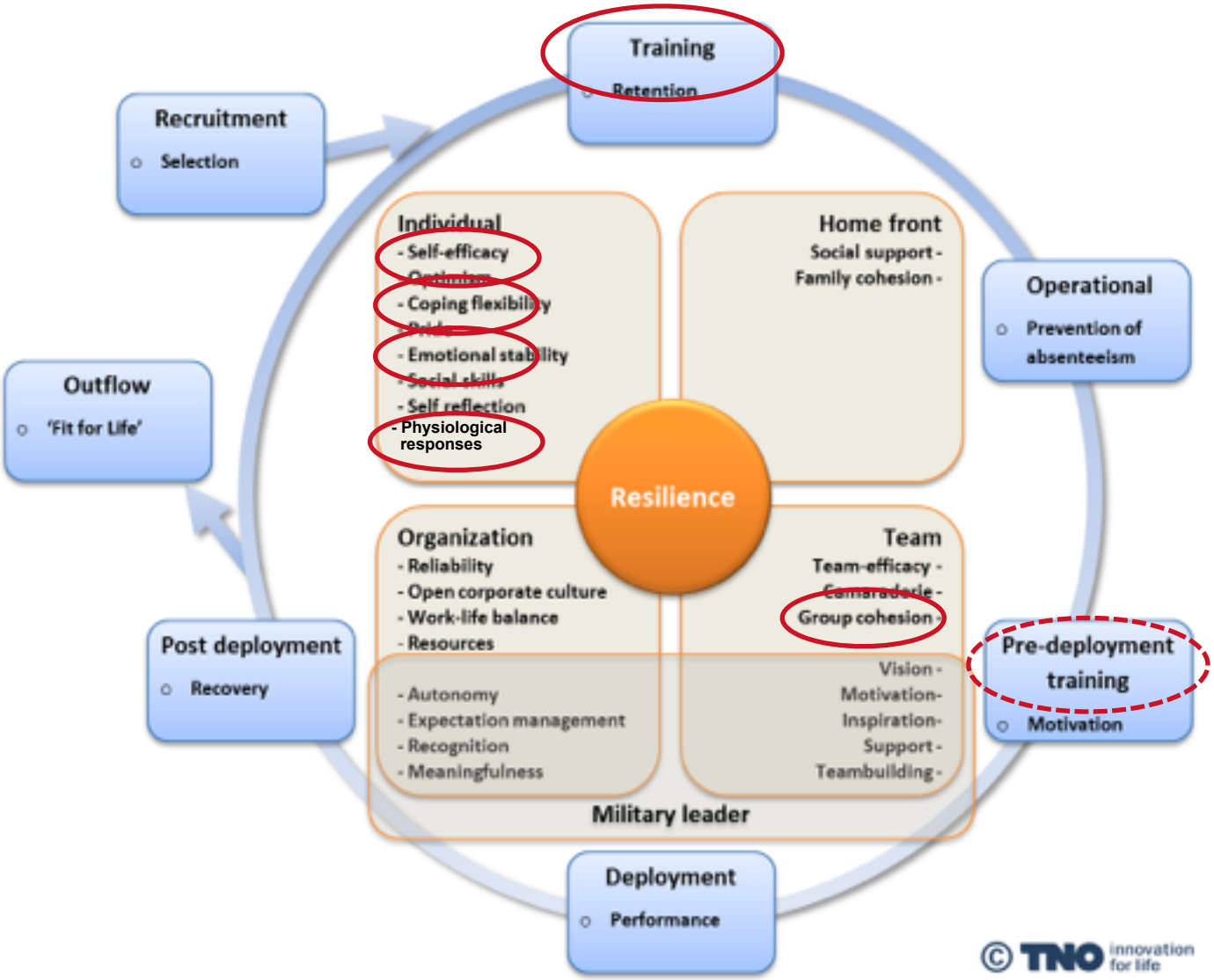
Development and validation of gaming & simulation platforms that induce, measure and feedback stress to enhance the capability of the military to perform better under stressful circumstances

Blascovich, J., & Tomaka, J. (1996). The biopsychosocial model of arousal regulation. In M. P. Zanna (Ed.), Advances in experimental social psychology, 29 (pp. 1-51). New York: Academic.
Lazarus. R.S. & Folkman, S. (1984). Stress appraisal and coping. New York: Springer Press.
Vijgh, B., van der, Beun R.J., Rood, M. van, & Werkhoven P. (2014). GASICA: generic automated stress induction and control application design of an application for controlling the stress state. Frontiers Neuroscience, 8, 400.

RESEARCH PROJECT



RESILIENCE MODEL



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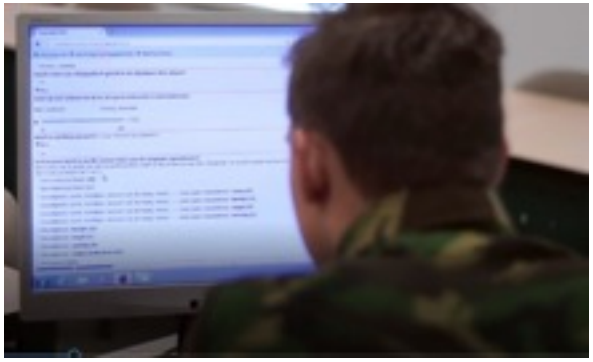
DESIGN

Cadets of Royal Dutch Military Academy *N* = 65;

Military Resilience Monitor
14 day's prior VR experiment



E.G. IED SCENARIO

TIMELINE

Welcome, explanaition, IC
3
Intake questio
STAI, state-tra
6
Sensors
4
conn
MPER
5
4
Exit questionnaire
Debriefing
Extraction in:
07:06
Measuring
08
e 08

MEASUREMENTS

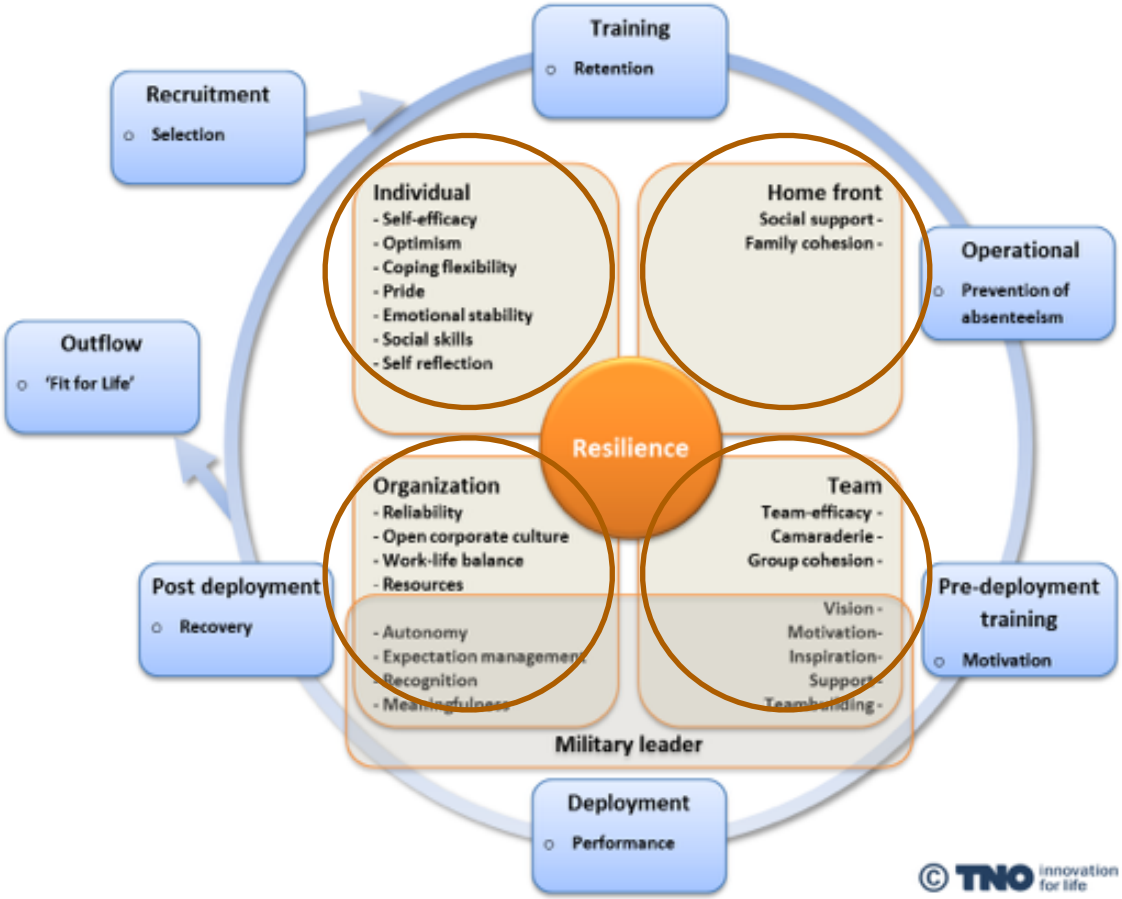
- Physiology
  - **Heart Rate (HR)**
    - Heart Rate Variability (HRV)
  - Blood Pressure (BP)
    - Systolic (SBP)
    - Diastolic (DBP)
  - **Cardiac Output (CO)**
    - Volume of blood pumped per minute
  - Total Peripheral Resistance
    - force required to maintain blood flow
  - Galvanic Skin Response
    - Average per phase
    - Number of peaks
  - **Salivary Cortisol**

    (engagement vs stress; cotton swaps)

- Questionnaires
  - STAI trait & state
    - pre
  - Threat & Challenge
    - pre & post
  - Dutch Military Resilience Monitor
    - 14 days before the experiment
  - Cognitive Performance Measure
  - Situational Awareness Score

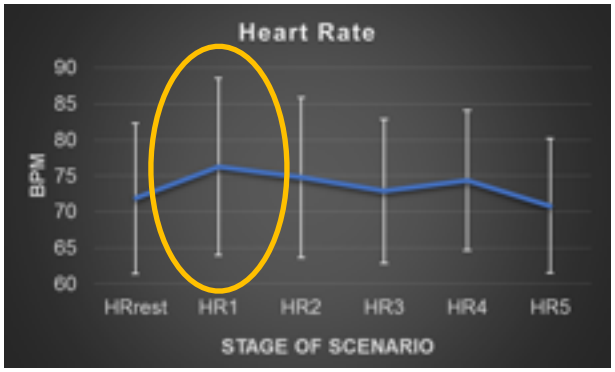
MRM

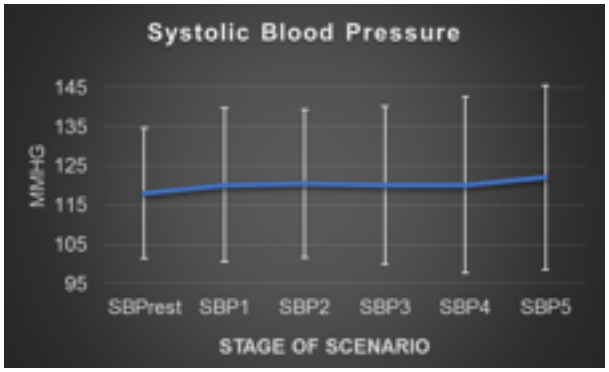
- Military Resilience Monitor: measures individual, homefront, team and organisational resources in short (30 items) scale. Validated for deployment phase.

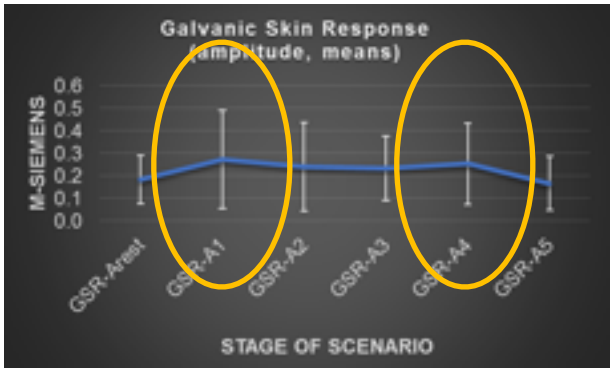


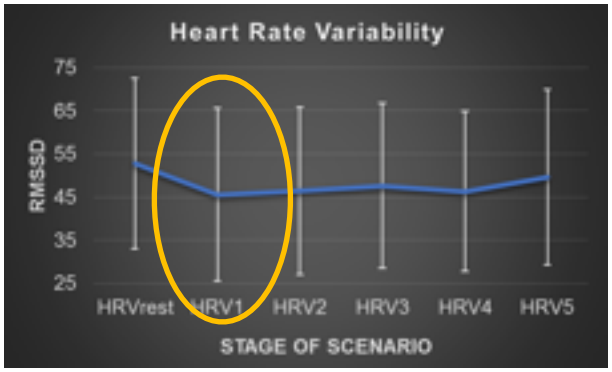
- Adapted for training setting:
  - Emotional stability, self-efficacy, social competence
  - Coping style (active, avoidance, social support, humor, acceptance, spiritual, reappraisal)
  - Family support & cohesion
  - Instructor support
  - Group/team cohesion
  - Reliability & open/safe culture

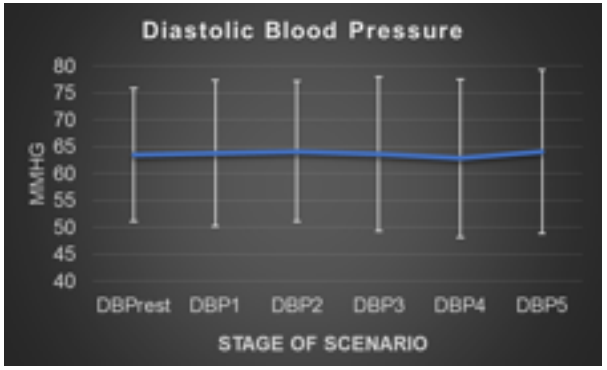
PHYSIOLOGICAL RESULTS (GROUP)

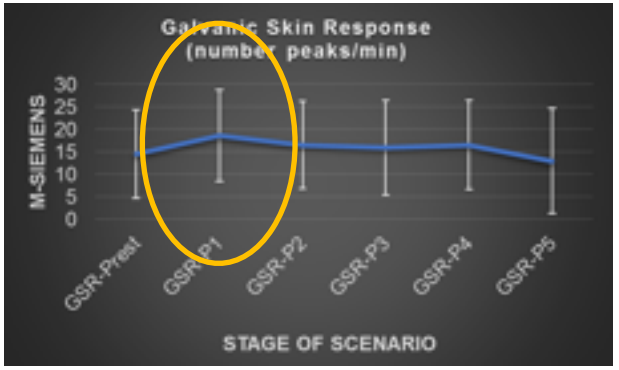


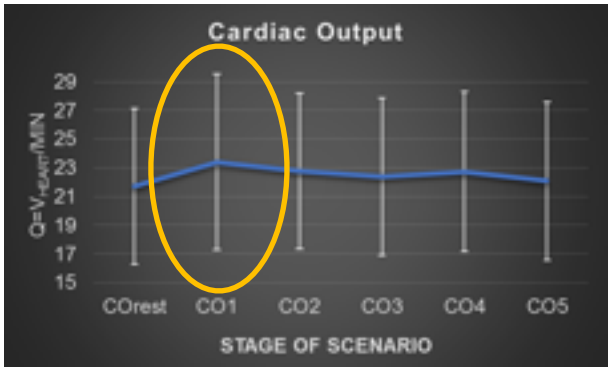


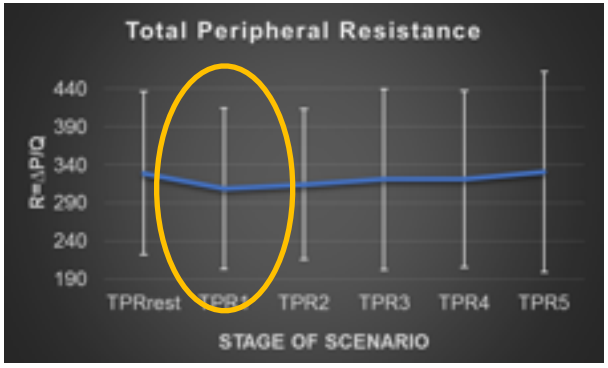


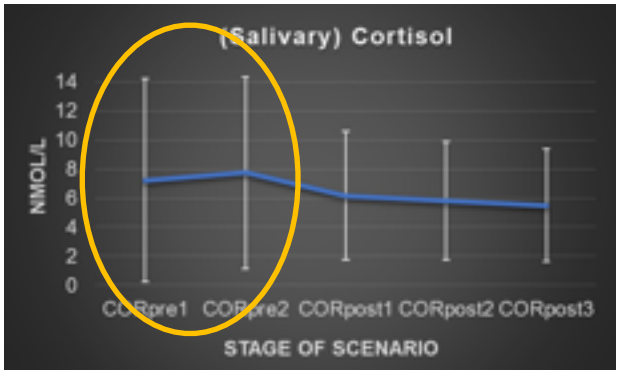












INDIVIDUAL RESULTS

- We categorised the physiological responses in threat and challange by applying the biopsychosocial model of stress (Blascovich and Mendes, 2000).
  - Higher HR, higher CO, no increase of TPR → challenge state (+ stress)
  - Higher HR, higher CO, increase of TPR → threat state (- stress)
    - 29 participants showed challenge states
    - 3 participants showed threat states
    - (33 participants showed higher HR during the rest measurement in the run-up of the experiment compared to the first simulation scenario)
  - We used the threat and challenge survey (Drach-Zahavy & Erez, 2002) to examine whether the physiological classification in challenge and threat responders was in line with the individually perceived (psychologica) stress appraisals.

MRM RESULTS (GROUP)

- Instructor support → higher cortisol level (r^2 = .42; p < 0.01)
  - implying that if the cadets receive more instructor support, that lead to higher (physically) responses of engagement/activation (in the run-up of the experiment)
- Coping style 'avoidance' → higher cortisol level (r^2 = - .30; p < 0.05)
  - implying that the applied coping style avoidance would lead to lower (physically) engagement/activation
- Coping style 'active' → higher cortisol level (r^2 = .31; p < 0.05)
  - implying that the 'active' coping style lead to higher (physically) engagement/activation
- Coping style 'acceptance' → peripheral resistance (r^2 = .27; p < 0.05)
  - implying that the emotion regulation to accept a challenging/threatening context lead to higher (threat) stress response.
- Coping style 'humor' → peripheral resistance (r^2 = - .29; p < 0.05)
  - implying that the emotion regulation to engage a challenging/threatening context with 'humor' lead to lower (threat) stress responses during the simulated scenario's.
- Coping style 'humor' → higher heart rate and cardiac output

  (r^2 = .32; p < 0.02; r^2 = .33; p < 0.01, respectively)
  - implying that the trait/state of using humor in difficult situation leads to higher heart rate and blood flow during the simulated scenario's.

RELATIONSHIP WITH EARLIER FINDINGS

- In 2016, we found that cortisol and optimism were predictors of attrition/ perseverance in a maritime infantry (Marines) training setting.
  - Higher levels of cortisol were correlated with higher optimism scores (i.e., training success)
  - The relationship between optimism and training perseverance were moderated by higher levels of cortisol.

Binsch, O., Van Wietmarschen, H., & Buick, F. (2016). Relationships Between Cortisol, Optimism, and Perseverance Measured in Two Military Settings. Military Psychology. http://dx.doi.org/10.1037/mil0000146.

CONCLUSIONS

- It is possible to induce and measure arousal and indices of stress within VR gaming & simulation settings, also in the military domain.
- Different stressors are induced, also stressors only indirectly attributable to the VR&M gaming/simulation platform. VR necessary?
- Appling ‘fancy’ VR technology and add-ons are not a guaranty to induce more arousal and/or stress.
- Not every cadet was susceptible/sensible to VR settings and the simulated (military) VR scenario.
- Cortisol seems to be a reliable biomarker in predicting states of activation in young military service members.
- Relationship with cortisol implies that if the cadets receive more instructor support that lead to higher physical activation, higher chance of perseverance and training success.

QUESTIONS?