

ABSTRACT

Title: Leading and Decision Making in variously Stressful Conditions

Application

for

Track 3: "Sozialwissenschaft"

Panel 2

**Social Competence in Action: Teaching and Research for
Responsible Coping of Future Challenges**

Inter- und transdisciplinary exploration in the triangle practice-teaching-research

Introduction

Military leaders need to be able to make decisions while under stress and effectively lead their associates entrusted to their care under various and challenging operational scenarios. The ability to make decisions and act under stress depends on, among other things, the functionality of executive functions. Executive functions are necessary for everyday adaptive behaviours and are generally referred to higher-level neurocognitive processes controlling lower-level processes in the service of goal-directed behaviour.

One of the key executive functions, inhibition of dominant responses that are inappropriate or incompatible with current demands, may be of particular importance in stress-mood interactions. There is first evidence suggesting that the impact of acute stress on inhibitory functioning may be moderated by the way the organism handles the stressor, manifested in specific changes in the cardiovascular system.

Leadership training, respectively training of future military officers has to provide a scientifically rigorous, professional education at university level. The graduates need to have the ability to solve problems in the respective profession according to the current state of the art and the future practical requirements. They are qualified executives and meet high physiological and psychological challenges.

This qualification process requires, on the one hand, academic training by a scientifically, professionally, pedagogically and didactically qualified teaching staff. On the other hand, this is an obligation for practice-related research and development by members of the teaching and research staff. This education system enables the essential development of personality by a variety of methods in the course of the academic and military leadership training. The aim of the training is to facilitate students' individual responsibility by offering the necessary knowledge, skills and competences to successfully cope with difficult situations and challenges on their own in the future.

For self-experience of the personal behavioural adaptation to acute stressors and the changes in self-perception essential for the development of resilience training capacities, students took part in a scientifically studied bungee jumping exercise.

Research Question

Future military leaders at the beginning of their training were exposed to a moderate and to an extreme stress situation, in order to investigate the extent to which executive functions^{1,2} (and consequently the ability to decide and act) are impaired in stressful situations. By measuring physiological reactions, the relationship between, on the one

hand, the level of cognitive impairment, and on the other hand, how strongly the organism responded to the situation was examined.

Method

Participants

Sixty-four men aged between 19 and 40 were tested on two separate days. All participants had at least higher education entrance qualification and met physical, psychological and medical criteria for military leadership training (for further description of the sample, see Table 1).

Table 1

Anthropometric characteristics of the participants (n=64).

	Mean (SD)	Min	Max
Age (year)	24,50 (5,28)	19,00	40,00
Height (cm)	179,31 (6,25)	160,00	191,00
Weight (kg)	77,41 (10,03)	55,00	102,00
BMI (kg/m ²)	24,02 (2,43)	18,20	30,25

Materials

- Objective assessment of the functioning of two executive functions (updating working memory, inhibition of automatic reactions) using a behavioural test (Mittenecker Pointing Test, MPT)³. The MPT task consists of pressing nine buttons on a keyboard in the most random order possible. In a predetermined rhythm (1.2 signals/second), a total of 180 sequences need to be completed. Deviations from true random order, i.e. tendencies to press certain keys more frequently, and regularities in the given sequences, provide information about the functioning of the executive functions.
- Physiological measures: Electrocardiogram, blood tests⁴
- Rating scales for the assessment of subjectively experienced stress (tension, anxiety)

Research Design

Moderate Stress

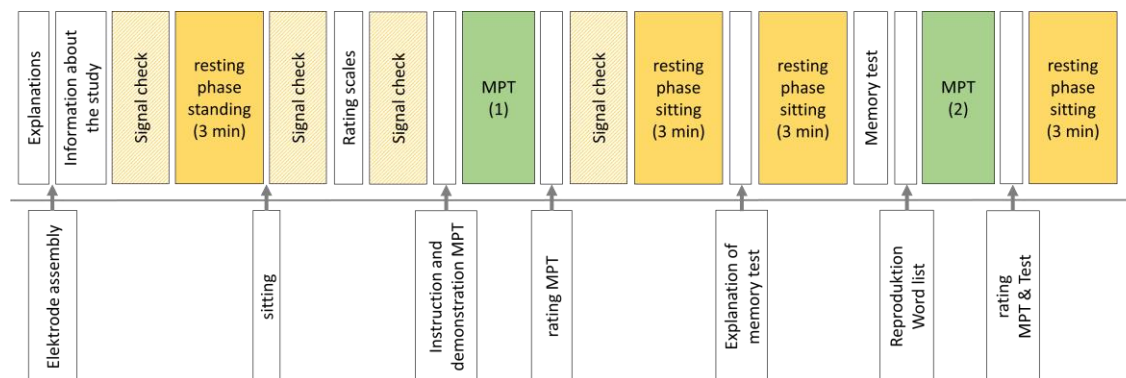


Figure 1. Study protocol for the investigation of “Moderate Stress”

The moderate stress situation was made up of a standardised memory test⁵, whereby items from a list of words heard through headphones needed to be reproduced. The MPT allows measuring the inhibition of inappropriate dominant responses reliably and for the most part independently from other cognitive and executive functions. MPT was performed before and after the memory test. Throughout the whole above pictured study protocol continuous cardiovascular monitoring was carried out.

Extreme Stress



Figure 2. Study protocol for the investigation of “Extreme Stress”

The extreme stress situation consisted of a bungee jump from a height of 60 meters. MPT was performed before preparation, immediately before and after the bungee jump. Throughout the whole above pictured study protocol, continuous cardiovascular monitoring was carried out. Additional blood sampling before and after the experiment for the evaluation of general metabolism by “Clinical Stress Assessment” complements the general view on the physiological burden placed by the stressor.

Results

Moderate Stress

Figure 3 (left) shows the ability of the brain to inhibit automatic responses and the emergence of routines (context redundancy), both prior to and following the stress of the memory test. The values for a group in which no or only a small increase in heart rate in anticipation of the stress was observed (Δ HR low), and a group with a somewhat stronger heart rate reaction (Δ HR moderate), are shown. While the context redundancy did not change in the more strongly reacting group, it did improve in the weakly reacting group. Note that lower scores of context redundancy denote better performance.

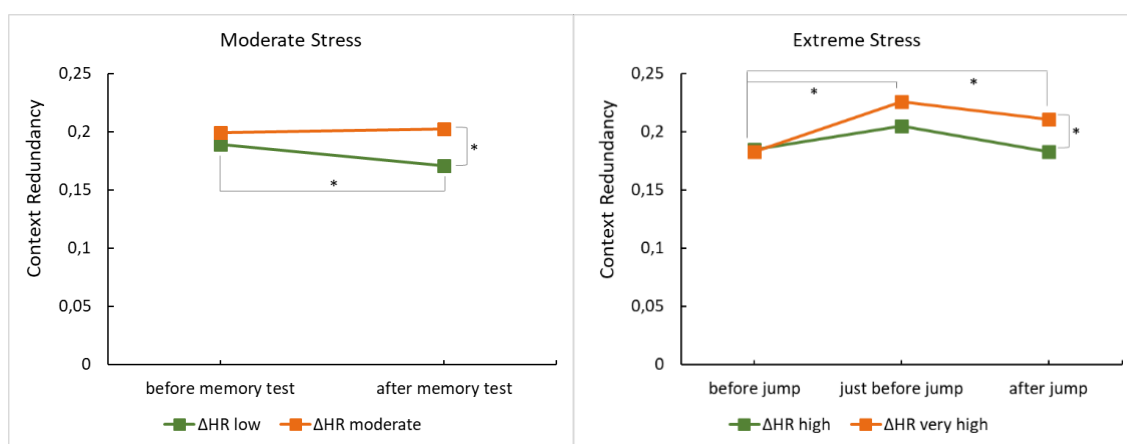


Figure 3. Results for investigations of “Moderate Stress” (figure on the left) and of “Extreme Stress” (figure on the right)

Extreme Stress

Figure 3 (right) shows the context redundancy before, immediately prior to, and after the bungee jump, for a group with a very strong heart rate increase in anticipation of the stress situation (Δ HR very high), and for a group with moderate to strong heart rate increase (Δ HR high). In the very strongly reacting group, the context redundancy in the stress situation was increased, and remained impaired also afterwards. The less strongly reacting group showed little impairment.

The results of the “Clinical Stress Assessment” also showed effects of the extreme stressor (bungee jumping) on stress relevant blood parameters; i.e. CO₂-partial pressure (pCO₂), base excess (BE), hydrogen carbonate (HCO₃), O₂-partial pressure (pO₂), O₂-saturation (O₂-Sat), sodium (Na), lactate (Lac) and blood sugar (BS).

Conclusions

- Results indicated that the ability to inhibit automatic responses and the development of routines after exposure to stress depends on the increase of heart rate in anticipation of the stress.
- The impairment of cognitive functions, which are important for maintaining the decision-making ability and ability to act as leaders, depends on the extent of stress experienced, which can be objectively described by the heart rate response.
- In relatively young men, very strong stress results in the impairment of the executive functions investigated here. By contrast, minor challenges that do not present a major burden on the organism, appear to have even slightly positive effects on inhibition performance in the weak responding group. In the more responsive group, inhibition performance did not change.
- The results of these investigations provide, on the one hand, a useful foundation for teaching resilience capacities to future military officers and, on the other hand, an initial point for further research on the development of successful coping strategies for future challenges.

References

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