



**WE CORDIALLY INVITE YOU TO THE PUBLIC DEFENCE OF THE DOCTORAL  
DISSERTATION IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF:  
DOCTOR IN REHABILITATION SCIENCES  
AND PHYSIOTHERAPY  
& DOCTOR IN SOCIAL AND MILITARY SCIENCES**

**OF MRS SUSAN VRIJKOTTE**

**SOLDIERS' COGNITIVE AND PHYSICAL  
SUSTAINABILITY.  
SUGGESTIONS FOR SOLDIER SELECTION AND  
MEASURING OPERATIONAL READINESS.**

**EXAM COMMISSION**

**Prof. dr. Veerle De Bosscher (chair)**  
Vrije Universiteit Brussel, Belgium

**Dr. Jos de Koning**  
Vrije Universiteit Amsterdam, the Netherlands

**Dr. Salvatore Lo Bue**  
Royal Military School, Belgium

**Dr. Alexandra Malgoyre**  
Institute of Biomedical Research for Army, France

**Dr. Gerard Rietjens**  
Vrije Universiteit Brussel, Belgium

**PROMOTORS**

**Prof. dr. Romain Meeusen**  
Vrije Universiteit Brussel, Belgium

**Prof. dr. Nathalie Pattyn**  
Vrije Universiteit Brussel, Belgium  
& Royal Military Academy, Belgium

**Prof. dr. Bart Roelands**  
Vrije Universiteit Brussel, Belgium

**PROMOTORS**

**Prof. dr. Romain Meeusen**  
**Prof. dr. Nathalie Pattyn**  
**Prof. dr. Bart Roelands**

**Prof. dr. E. Zinzen**  
Dean of the Faculty of Physical Education and Physiotherapy

**Friday, November 23, 2018 at 19:00**

**in room "Promotiezaal" (D.2.01) located on the campus of Etterbeek.**

**Please confirm your presence by November 16 to [susan.vrijkotte@vub.be](mailto:susan.vrijkotte@vub.be)**

**How to reach the Vrije Universiteit Brussel**  
**<http://www.vub.ac.be/infoover/campussen/index.html>**

Plainlaan 2 - 1050 Brussel - Tel: 02 629 27 28 - E-mail: [facfk@vub.ac.be](mailto:facfk@vub.ac.be)

## PRESENTATION OF THE DISSERTATION

When in military service, soldiers have to be operationally ready at all times. During missions soldiers are expected to operate on a high level, but also when at the barracks, soldiers constantly train their skills in order to achieve/maintain a higher performance level. With this constant drive of improving performance and being operationally ready, recovery time is under pressure and soldiers are exposed to chronic stress. Not taking (enough) time to recover, and thus lower stress, will eventually impair performance and can result in non-functional overreaching (NFOR) and the overtraining syndrome (OTS).

In chapter 1 a literature study was conducted to investigate **what is known about functional overreaching (FOR), NFOR and OTS in the military and what can be learned from research conducted in the sports domain**. The main finding of our review is the awareness problem of the terms FOR, NFOR and the OTS in military literature. This makes us believe that the guidance of soldiers to prevent NFOR and the OTS during military service can be improved. We suggest a structured testing regime consisting of a 1.5 mile run, a psychomotor vigilance test (PVT) and the POMS. When the development of NFOR or the OTS is suspected, the more specific two-bout exercise test can be used to determine NFOR/OTS and to exclude pathological causes of the performance decrement.

Soldiers are experiencing high stress and strain levels and cognitive operational performance is of lifesaving importance. A second literature review is presented in chapter 2 answering the research question **how is cognitive performance is affected during sustained military operations (SUSOPS)**. Soldiers' simple cognitive constructs (reaction time, vigilance and working memory) become quickly affected, but show inconsistent results after more than 80 hours of SUSOPS. Complex constructs (like logical reasoning) become impaired within 80 hours of SUSOPS as well and remain impaired during SUSOPS that take longer than 80 hours. Simple cognitive constructs return to baseline values quickly, whereas more time is needed for the more complex constructs to recover.

Training courses have to prepare soldiers for a mission during which stress and strain is very high and soldiers can be confronted with lifethreatening situations. A problem in the military is the high amount of drop outs during training courses. The rates remain high despite the pre selection goals that have to be met. The study in the third chapter investigated whether it is possible to **predict which soldiers are going to complete a military training course and who are going to drop out, before the actual start of the military training course**.

In a second research question it was investigated whether **completers' performance throughout are training course provides similarities compared to drop outs before the start of the training course**.

Although raw data did not reveal any predictive value, HR reactivity did and so did the reactivity of tension and fatigue values of the Profile of Mood States (POMS). HR reactivity was found to be reduced before the start of the training course in drop-outs, but not in completers. Pre-course reactivity of tension and fatigue values were found to be higher in drop-outs compared to completers. At the end of the training course, completers' HR reactivity, as well as reactivity of tension and fatigue values revealed a comparable pattern like the drop-outs before the start of the training course.

In a second experimental study it was investigated whether **mental fatigue influences physical and cognitive performance during the two-bout exercise protocol**. We found that physical and cognitive performance remained unaffected despite the experienced mental fatigue. Nevertheless, reactivity of fatigue and tension values of the POMS were affected in the mental fatigue condition.

Based on the findings of the presented studies, it is suggested to implement regular check-ups in the military. These check-ups should consist of a 1.5 mile run, PVT and the POMS. The two-bout exercise test can be conducted during the first test moment and when NFOR/OTS is suspected. Possibly, HR reactivity might be an early indicator for training course completion.

## CURRICULUM VITAE

*In 2000 Susan Vrijkotte (born 31 January 1983 in Oldenzaal, the Netherlands) went to Drake University in Des Moines, USA, to study and play volleyball for one year. Back in the Netherlands she graduated as a physiotherapist in 2005 while combining her studies with premier league volleyball. Thereafter, Susan studied Human Movement Sciences and graduated cum laude in 2007. Susan started to work as a project leader at TNO Defence, Safety & Security in Soesterberg and started her PhD in 2009 at the Vrije Universiteit of Brussels. In 2011 Susan worked at TNO Healthy Living in Leiden and later that year at Topsport Topics at the UMCG in Groningen. In March 2013 Susan accepted a position as program leader dementia at Zorggroep Solis in Deventer and three years later she became research coordinator at the same organisation. In August 2018, Susan started to work as a product expert MSZ for health insurance company Menzis.*