Science & Cycling

Influence of stress and recovery on endurance performance

Dr. Ruby Otter

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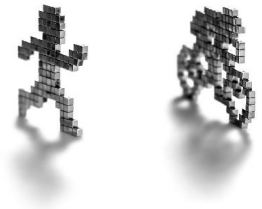
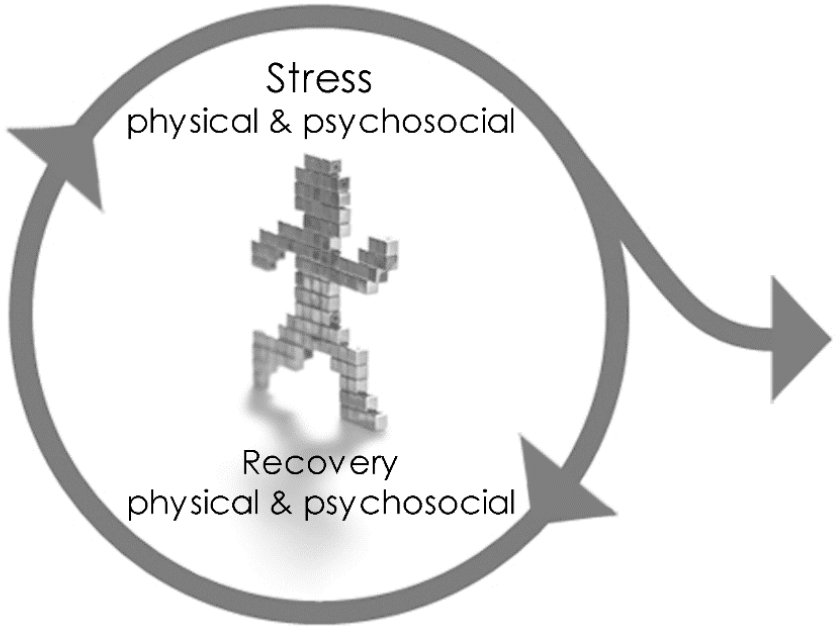


Goal

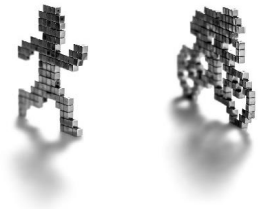
- Performance decrement is the major outcome of overtraining

- How does perceived stress and recovery influence performance development?

Model

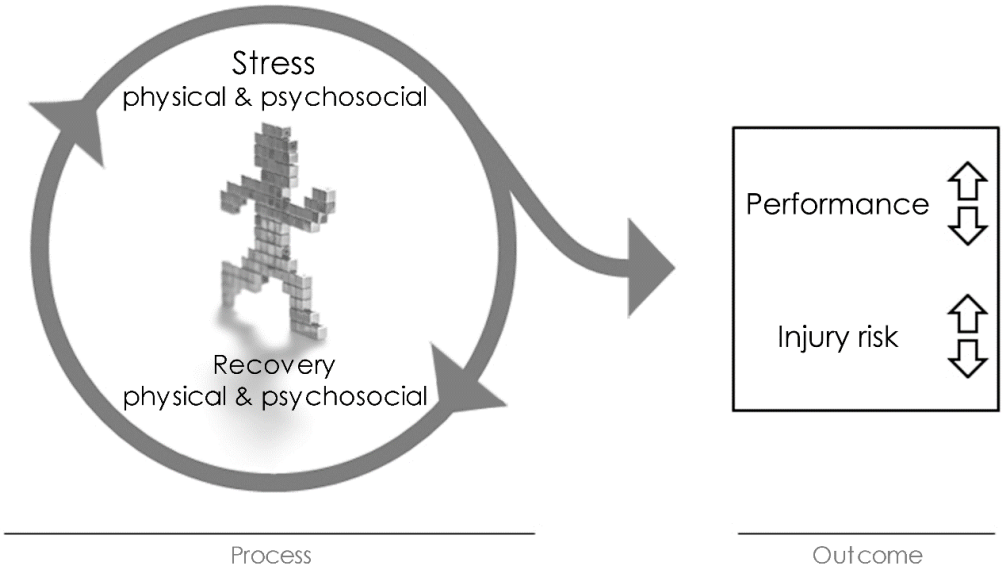


PhD thesis Otter 2016 - Adapted from Kennta & Hassmen 1998



Design

- 115 athletes
  - Runners
  - Cyclists
  - Triathletes
  - Ice-skaters
  - Rowers
- 2 years



Adapted from Kennta & Hassmen 1998

Endurance performance indicators are influenced by stress & recovery

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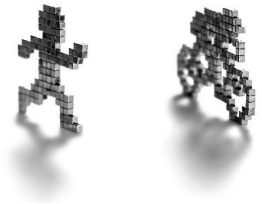
Methods – Training log

- Daily training log
  - Training duration (min)
  - Session RPE

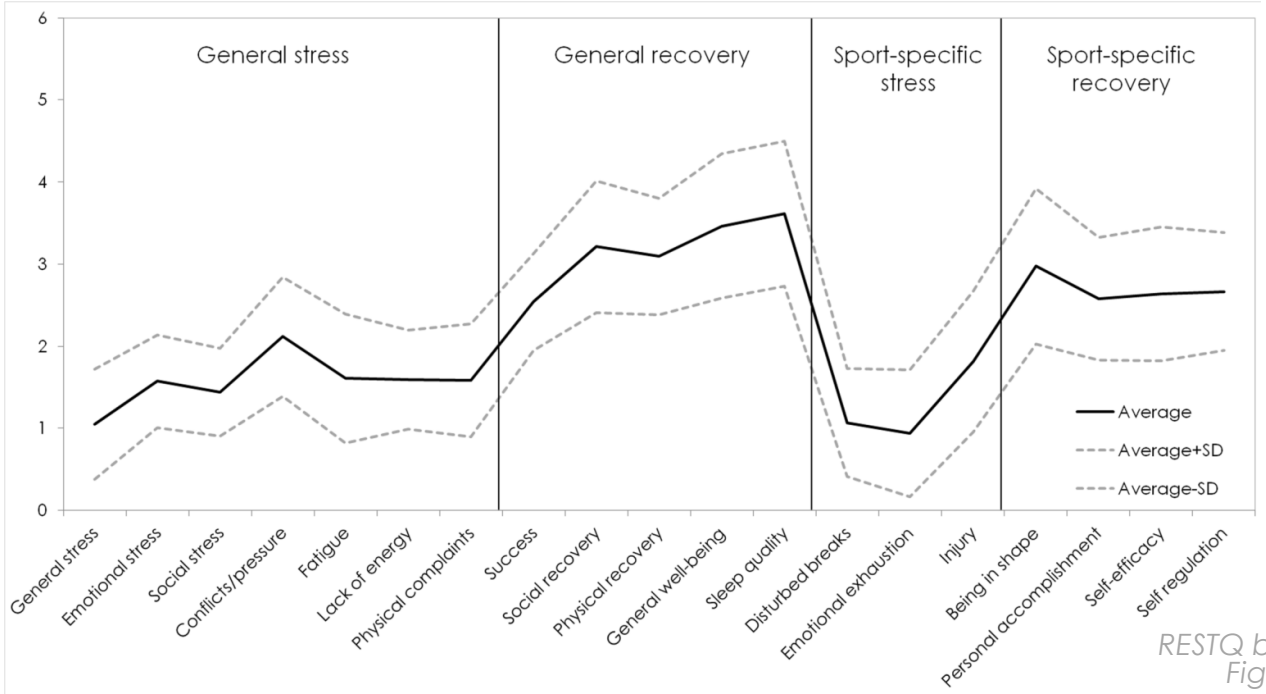
Rating of Perceived Exertion	
6	
7	Very, very light
8	
9	Very light
10	
11	Fairly light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Very hard
18	
19	Very, very hard
20	

Foster et al 2001; Seiler & Kjerland 2006



Methods – Stress & recovery

- Weekly to 3-weekly RESTQ-sport

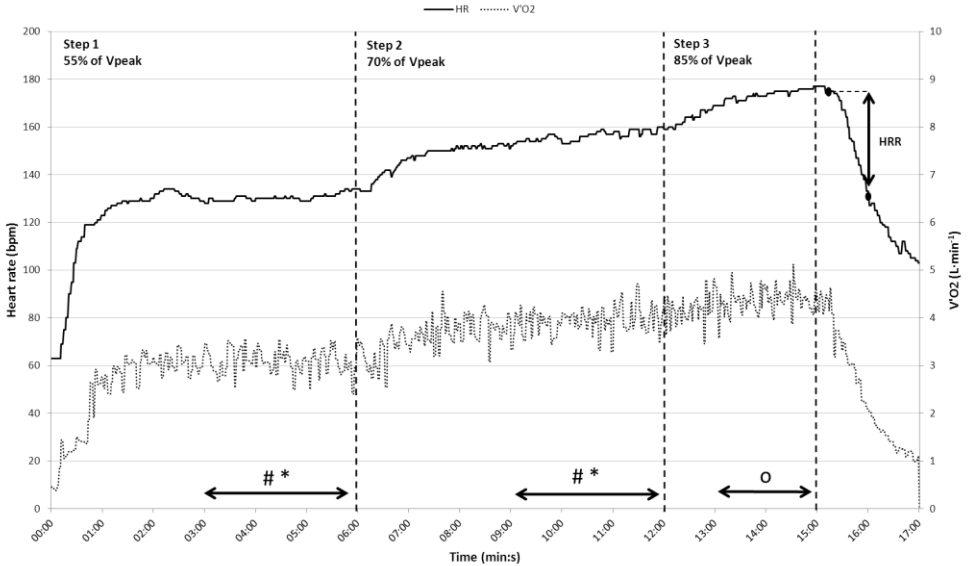


RESTQ by Kellmann et al 2001;
Figure by Otter et al 2016

Methods – Performance

Running (Otter *et al* 2015)

- Running Economy



Cycling (Lamberts *et al* 2013)

- LSCT
  - Power output at 90% HR_{max}

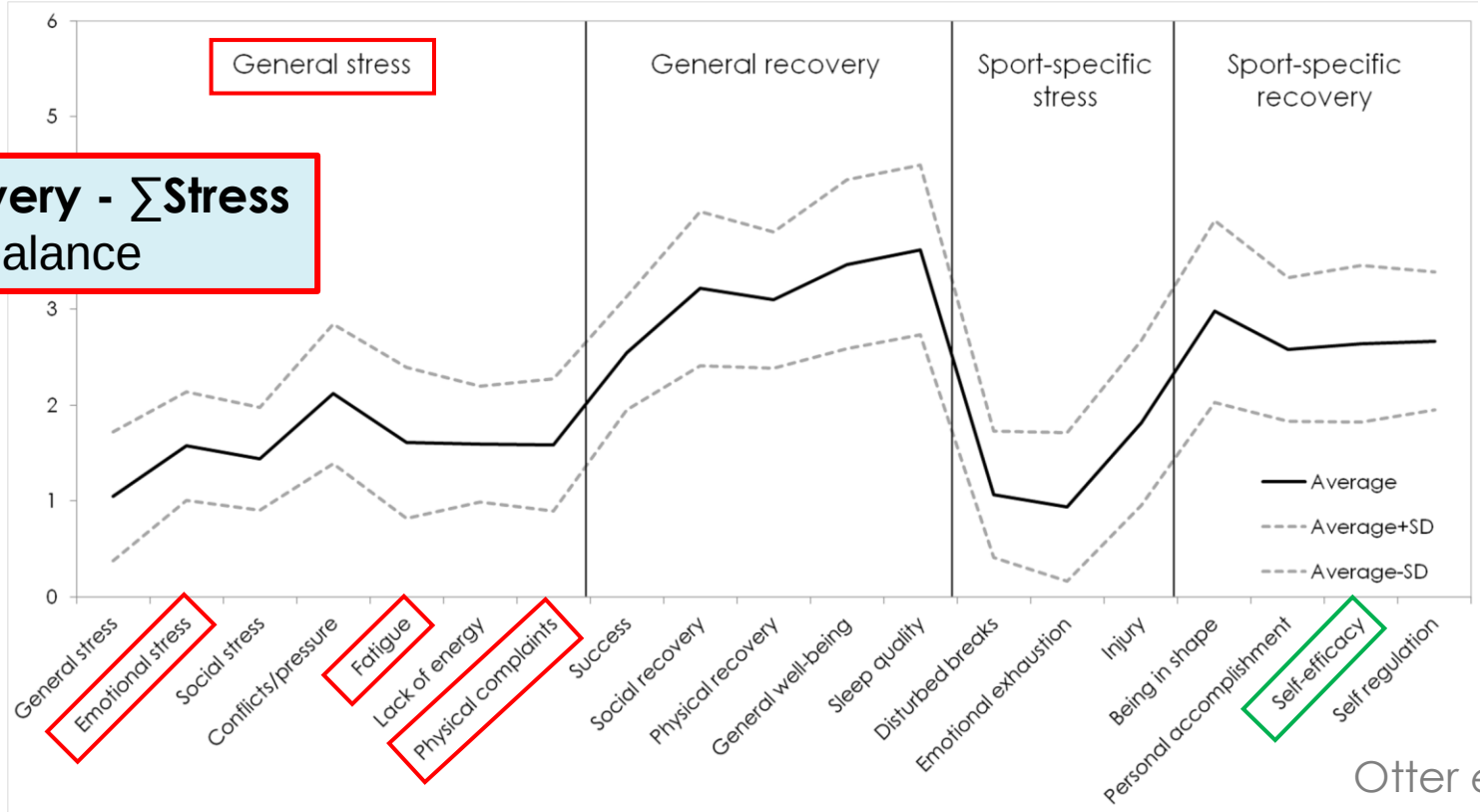
Longitudinal stress & recovery

- 20 female athletes
- 1 year – 8 submax tests – 16 RESTQ-sport

	n = 20
VO_{2max} ($mL \cdot kg^{-1} \cdot min^{-1}$)	50.3 ± 4.6
PPO ($W \cdot kg^{-1}$)	4.87 ± 0.39
PPO (W)	301 ± 24

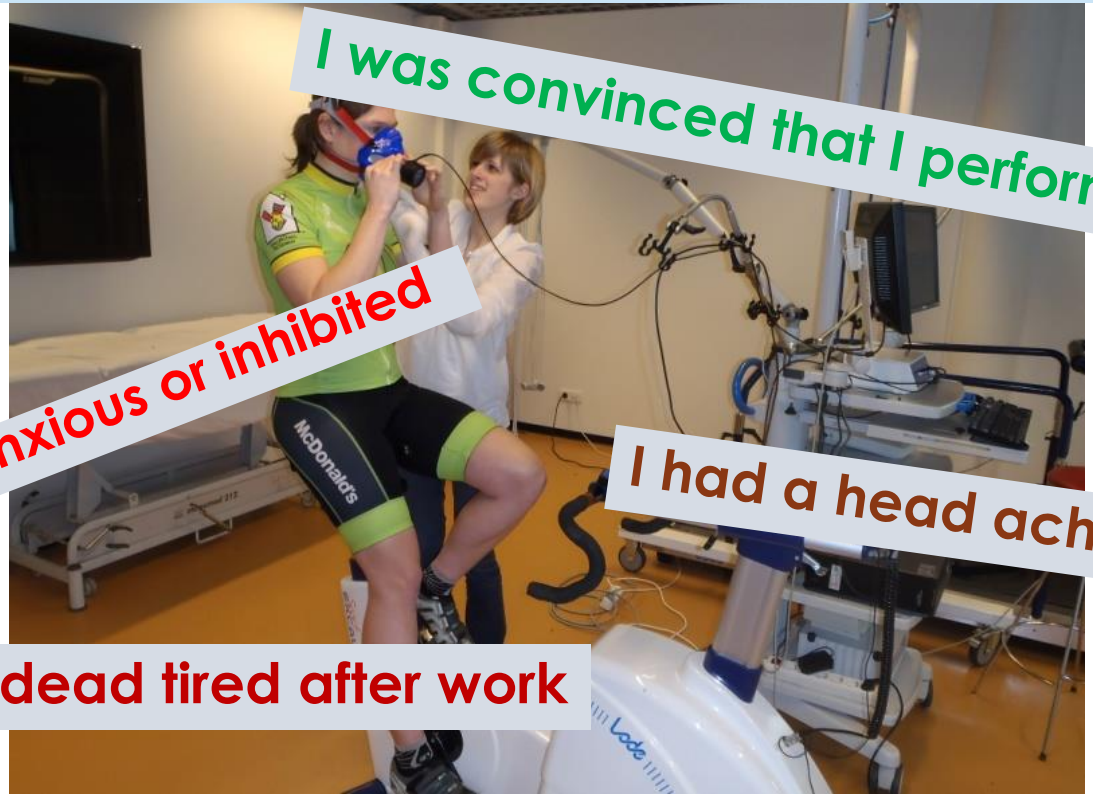
Results

∑Recovery - ∑Stress
balance



Otter *et al* 2016

Conclusion


I was convinced that I performed well
I felt anxious or inhibited
I had a head ache
I was dead tired after work
McDonald's
Lode

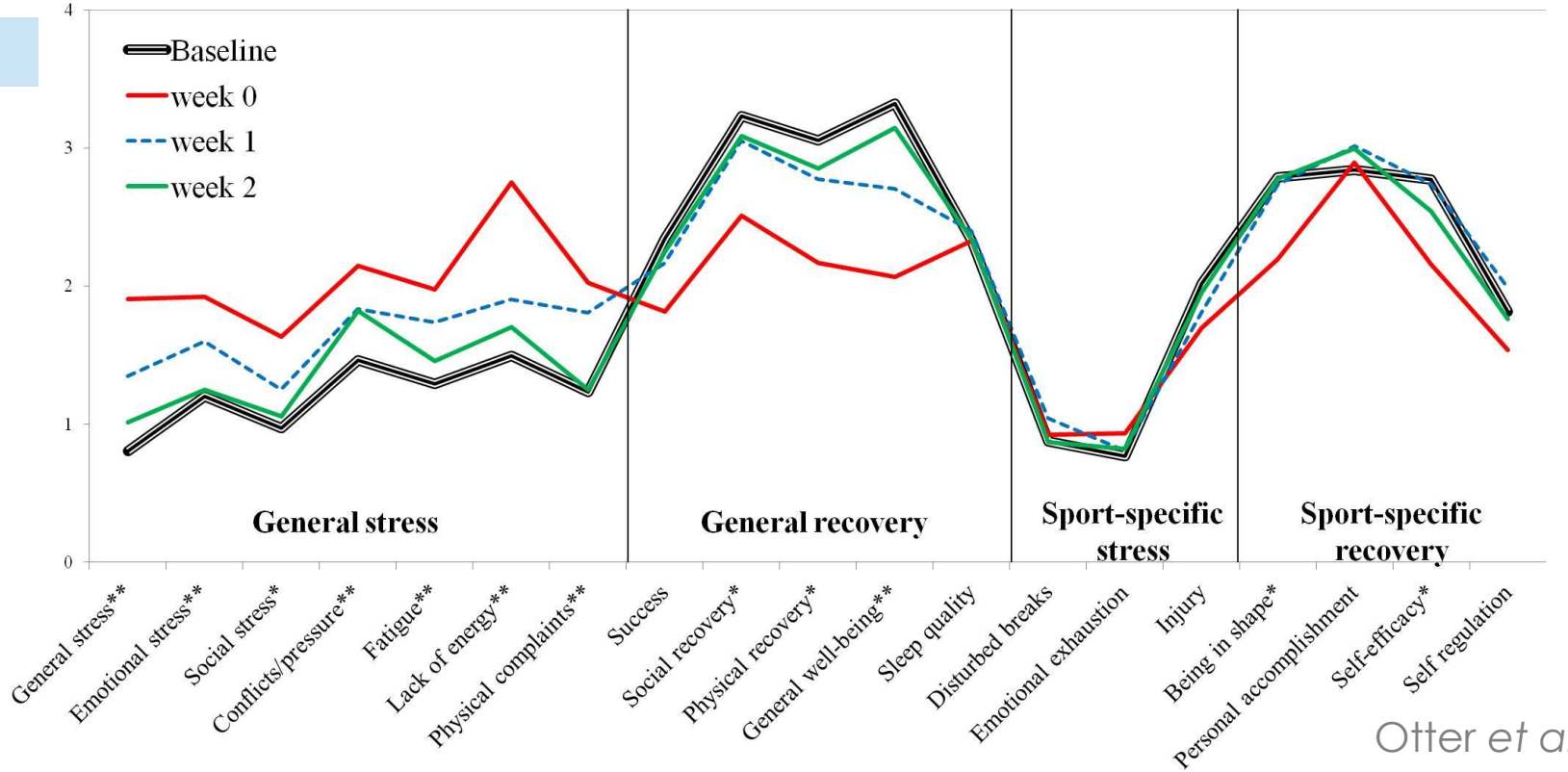
Second study

- 16 runners (VO_2max 60.9 ± 5.90 ml·kg^{-1}·min^{-1})
- 3 weeks baseline

- Negative life event (NLE)
- 3 weeks follow up
- Submaximal performance test

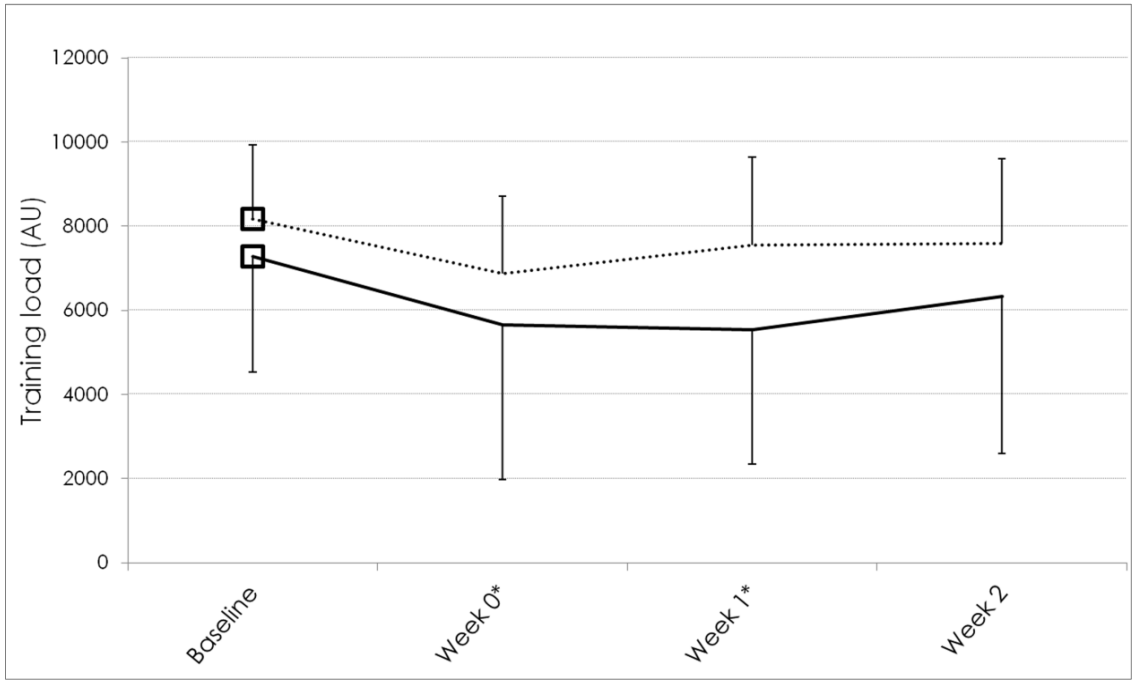
Results – RESTQ-sport

n = 16



Otter *et al* 2016

Results – Training & Running Economy

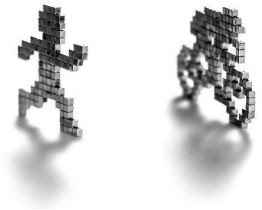


n = 7	Before NLE (SD)	After NLE (SD)
VO_2-2	3689	3820
($ml \cdot min^{-1}$)	(666.4)	(659.6)

RE = 3.6%

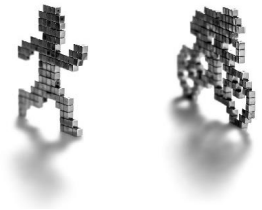
Second conclusion

- A NLE disturbs psychosocial stress & recovery over a relatively short period
- A NLE impairs running economy slightly but significantly



Practical implications

- **Do not neglect an athlete's personal life**



How to monitor?

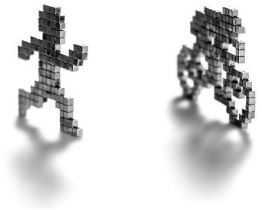
- Monitor physical **and** psychosocial stress & recovery

Increased training load within ~5 days prior to these outcomes	Power or speed	HR	RPE	Symptoms of stress
	↔	↓	↑	↑
	↑	↔	↑	↑

TRIQ

TRIQ.ai

Roete *et al* 2021



How to act?

- Lower (training) stress
- Improve recovery

Follow up

Coach in Control

- Research into planned and actual training load
  - Relationship with perceived stress and recovery
  - Relationship with performance

- **Feedback in a coach-dashboard**

Questions? – t.a.otter@pl.hanze.nl

Photo cc- by Adam Bowie

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Research Institute
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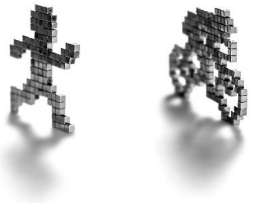
Ruby Otter

Monitoring endurance athletes

Monitoring endurance athletes

A multidisciplinary approach

Ruby Otter



Methods – Stress & recovery

I felt at ease

I felt energetic

I felt depressed

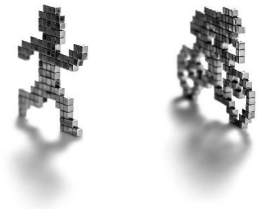
I felt that I wanted to quit my sport

I was successful in what I did

I recovered well physically

I had muscle pain after performance

I was unable to concentrate well



Thesis outline

Chapter 1	Monitoring perceived stress and recovery in relation to cycling performance in female athletes (Otter et al. 2015)
Chapter 2	A negative life event impairs psychosocial stress, recovery and running economy of runners (Otter et al. 2016)
Chapter 3	Monitoring training intensity, submaximal heart rate and running economy of competitive runners
Chapter 4	A delay between high load and increased injury rate: using an individual approach in high-level competitive runners
Chapter 5	A new submaximal ergometer rowing test to predict 2000 meter rowing performance

Female cyclists

	Fixed	*Random*				
n = 110	**Intercept**	**Estimate**	**Level 2**	**Level 1**	**-2***	**p**
	constant		between cyclists	within cyclists	**Log-likelihood**	
Empty model	67.06 (1.13)	-	22.63 (8.12)	15.56 (2.32)	657.2	-
∑General stress	71.25 (2.07)	-2.68 (1.09)	24.58 (8.61)	14.39 (2.15)	651.5	0.02*
∑General recovery	66.31 (3.61)	0.23 (1.08)	22.79 (8.20)	15.53 (2.31)	657.2	0.82
∑Sport-specific stress	69.25 (1.77)	-1.72 (1.06)	22.80 (8.15)	15.11 (2.25)	654.6	0.11
∑Sport-specific recovery	63.14 (2.47)	1.44 (0.80)	25.28 (8.92)	14.74 (2.20)	654.2	0.08
∑Recovery - ∑Stress	65.08 (1.53)	0.65 (0.32)	25.03 (8.84)	14.62 (2.18)	653.3	0.05*
Emotional stress	70.88 (1.88)	-2.40 (0.92)	24.75 (8.73)	14.28 (2.13)	650.9	0.01*
Fatigue	69.95 (1.65)	-1.79 (0.72)	24.32 (8.56)	14.40 (2.15)	651.4	0.02*
Physical complaints	69.06 (1.52)	-1.27 (0.64)	22.25 (7.97)	14.98 (2.23)	653.4	0.05*
Self-efficacy	62.66 (1.95)	1.67 (0.58)	26.91 (9.38)	13.86 (2.07)	649.7	0.01*