

# Preparing The Heart for Duty

Gamified virtual reality biofeedback for police to train Heart Rate Variability Control while in arousing action

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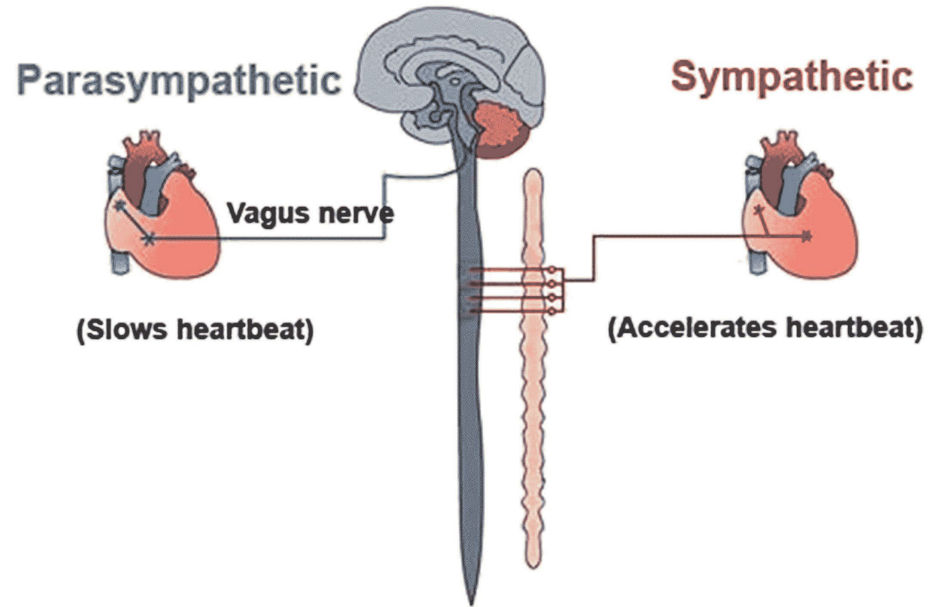


# Stress effects on police performance

- **Shooting accuracy can drop severely** (Nieuwenhuys & Oudejans, 2010)
- **Decision-making errors persist despite training** (Nieuwenhuys, 2015)
- **Excessive use of force** (Kop and Euwema, 2001; Burke and Mikkelsen, 2005; Verhage et al., 2018)
- **...long term mental health** (Carlier, Lamberts & Gersons, 1997; Van der Meer et al., 2017)

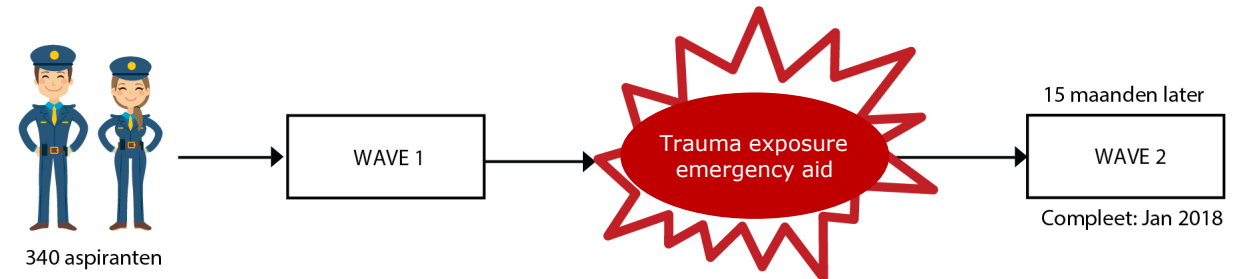
How can we better prepare police?

# Autonomic nervous system



# Police in action (PIA) study

Koch, Klumpers ea Roelofs 2018



340 Dutch police recruits tested over the course of 1.5 yrs

Regulation of ANS under threat linked to:

- **Acute performance** (Hashemi ea., Sci Rep 2019; PNEC 2021)
- **Long term stress resilience** (Jawetz ea., in prep; De Voogd ea, in prep, Zhang ea., Trans Psych 2021)

# HRV training improves:

- Performance under threat (E.g. Hansen et al., 2009)
- Cognitive control (E.g. Laborde et al., 2021)
- Stress management (E.g. De Witte et al., 2019)
- Decision-making in military and police simulated scenarios (Bouchard et al., 2012; Andersen and Gustafsberg, 2016)
- Depressive symptoms (Pizzoli et al., 2021)
- Anxiety (Goessl et al., 2017)
- ...







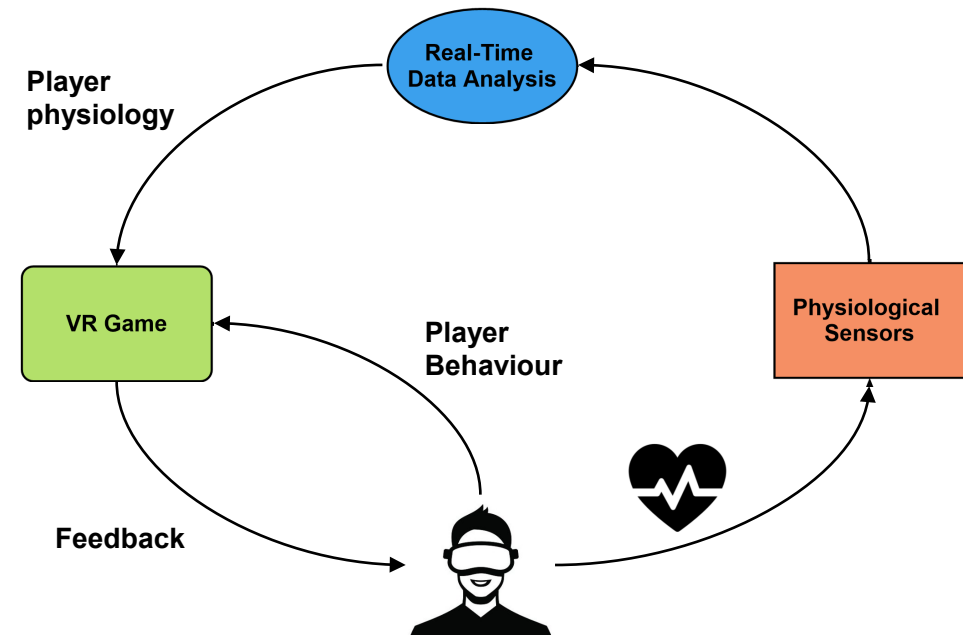


# VR game for HRV biofeedback in context

- Passive training not perceived as appealing<sup>1,2</sup>
- Training context ~ application context mismatch

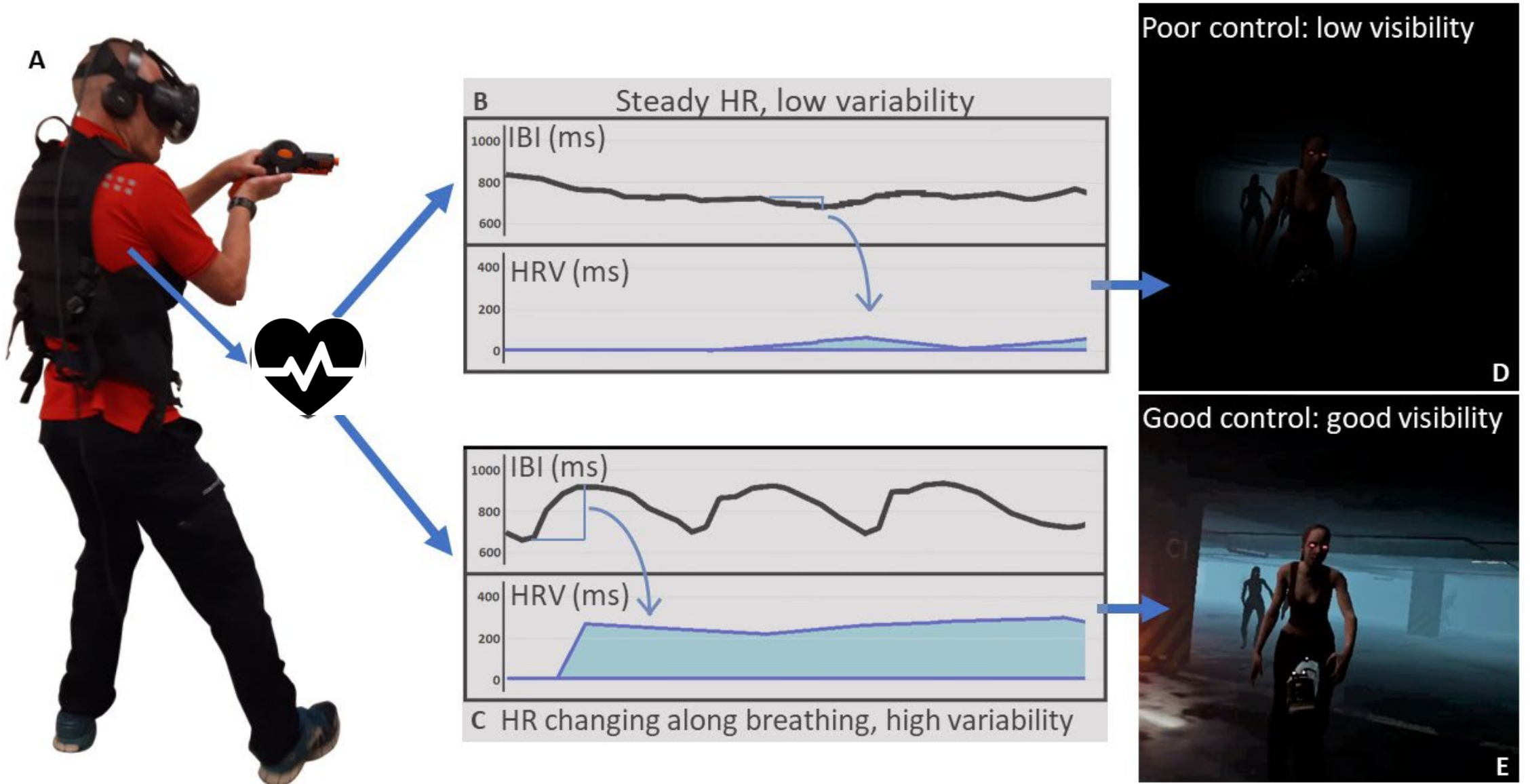
**Aim: training that offers realtime biofeedback when it matters**

- While aroused
- In action
- Engaging
- Scalable
- Cost efficient





# HRV biofeedback implementation in VR



## Game elements

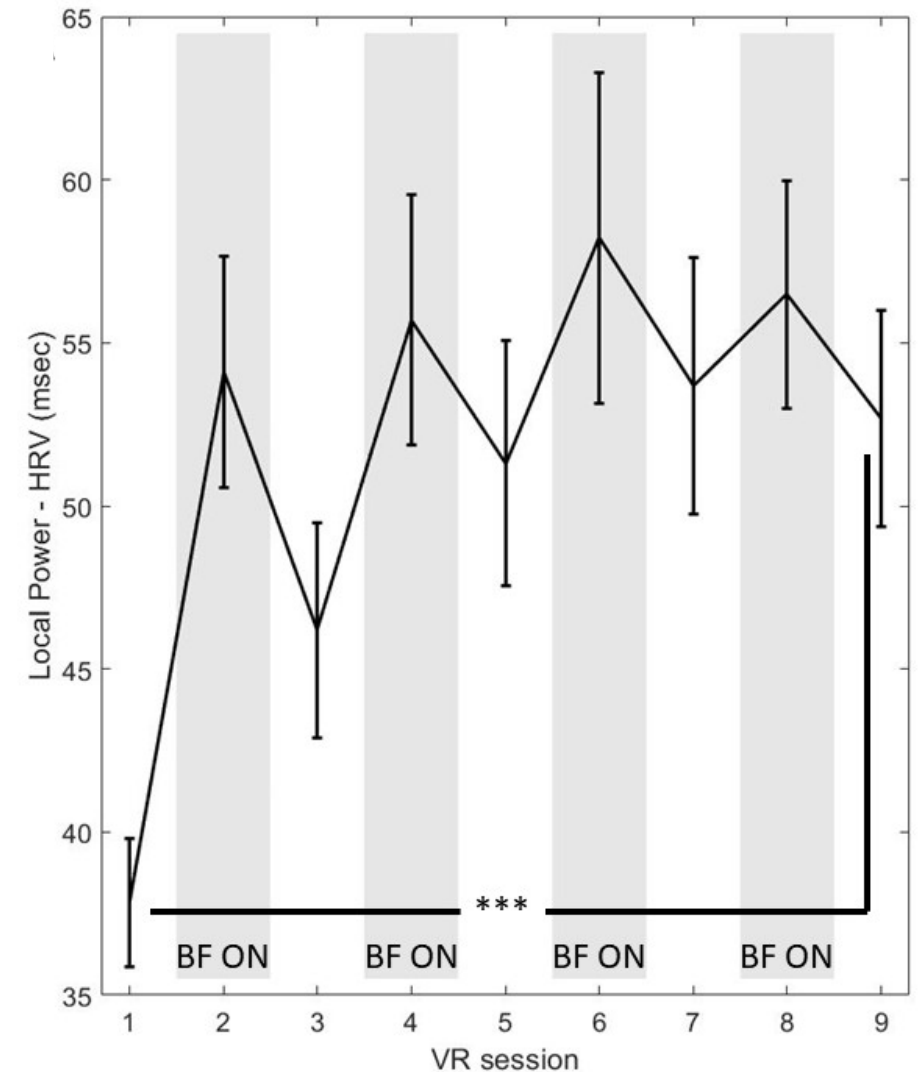
- Eliciting genuine emotion and motivation: Not realistic but believable
- Reliably arousing
- Assessment of police-relevant behaviour:
  - ✓ Bias resistance
  - ✓ Response inhibition
  - ✓ Spatial awareness



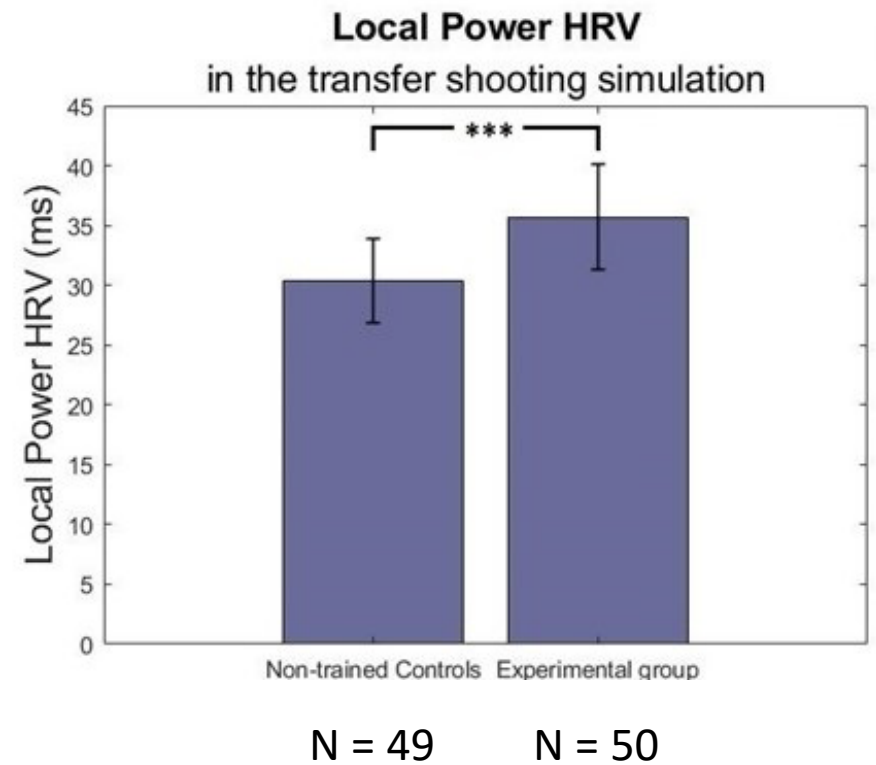


# Results (N=57 Police trainers)

- Successful upregulation of HRV
- HRV also up during gameplay without feedback
- HR increases substantially when playing
- Parallel increases in performance



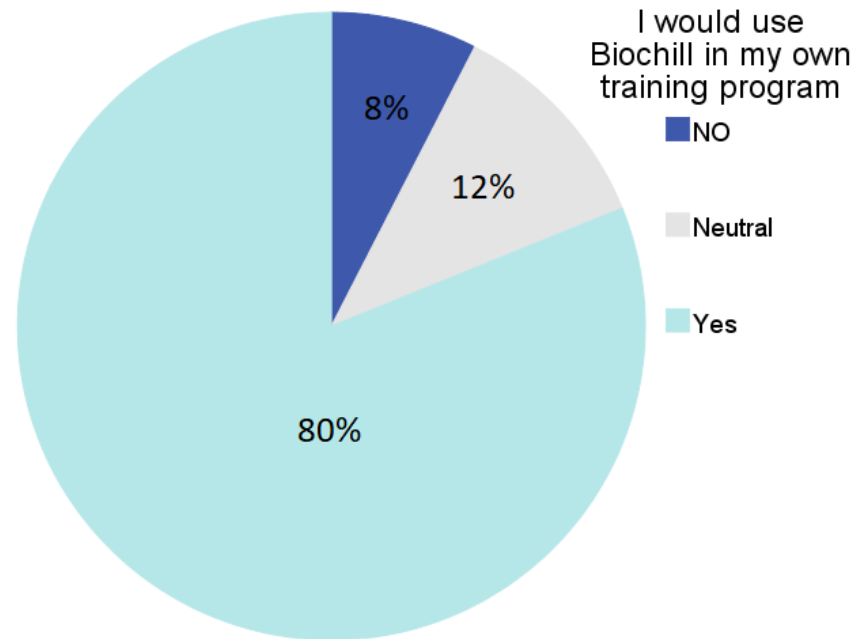
# Transfer of HRV control to a shooting test outside VR





# Police trainer perception

(after participation of +/- 25% police trainers in Netherlands)



Next step: adaptations for large scale implementation in police curriculum

# Acknowledgements

## Science team:

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- Police Academies of Apeldorn, den Haag and Leusden
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## Game Designers:

Ken Koontz, Erik van den Berg, Thijs Doornbos



Experimental Psychopathology  
& Affective Neuroscience

