Effects of Self-regulation on Executive Function & Resilience for Soldier Health, Wellbeing and Warfighter Performance

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European Football

- 2002: AC Milan – UEFA League Champion 2007
- 2006: Italian National Team – World Cup Champions
- 2009: Chelsea FC – UEFA League Champion 2012
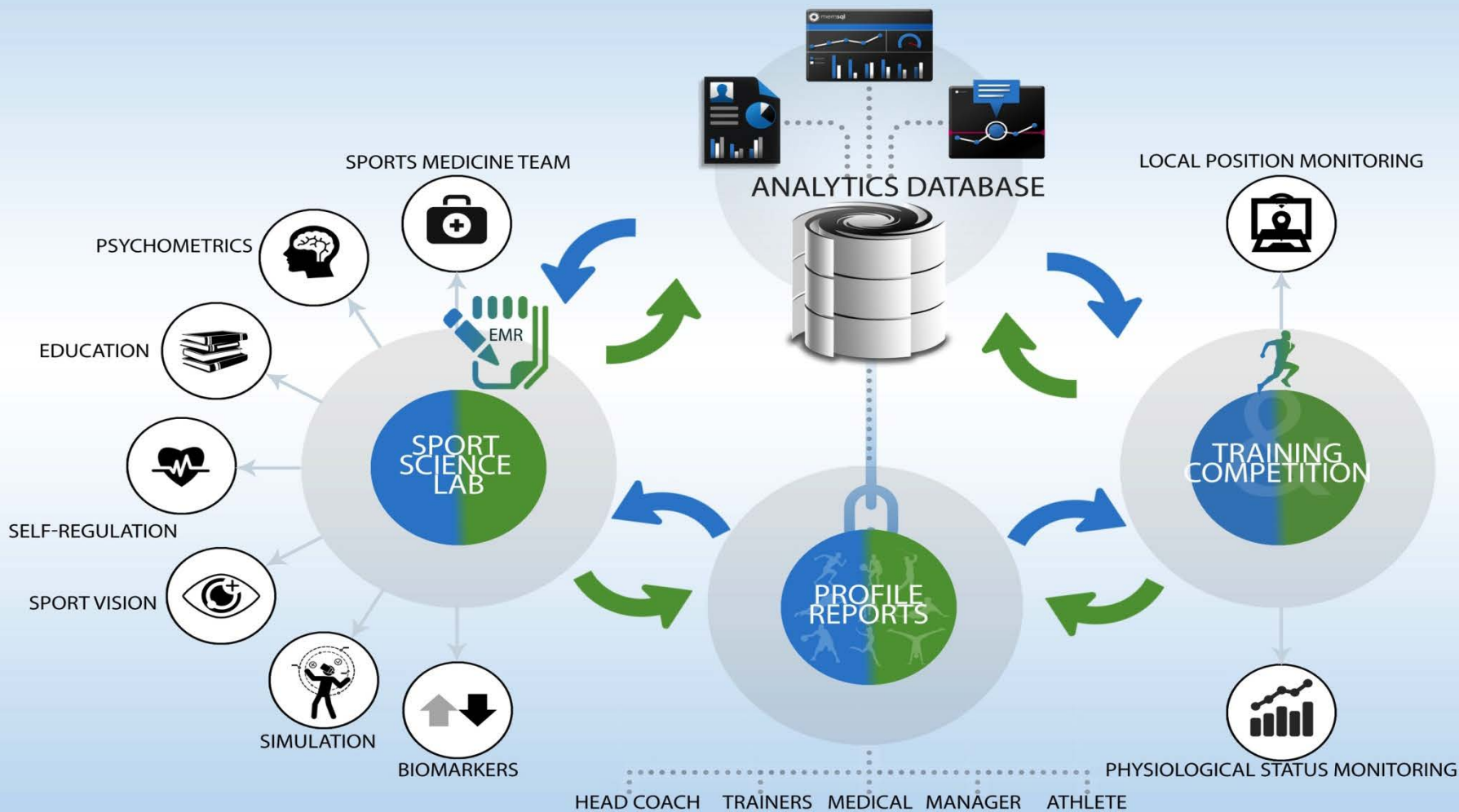- 2010: Real Madrid FC – La Liga Champions 2011-12

Olympic Training Centres

- 2007: Speed Skating Canada – 6 Medals at 2010 Winter Olympic Games
- 2010: Vancouver Canucks Hockey – Stanley Cup Finalists 2011-12
- 2011: INSEP, Paris, France
- 2012: India – London Olympic Games
- 2012: US Military Special Operations
- 2012: Russian Sports Ministry – Sochi Olympics
- 2013: Olympiatopen, Oslo, Norway
- 2016: Guatemalan Olympic Training Centre
- 2016: India – Rio, Brazil Olympic Games

MINDROOM SPORTS PERFORMANCE & ANALYTICS

SPORTS MEDICINE TEAM

LOCAL POSITION MONITORING

PSYCHOMETRICS

EDUCATION

EMR

ANALYTICS DATABASE

SELF-REGULATION

SPORT VISION

SPORT SCIENCE LAB

TRAINING COMPETITION

SIMULATION

BIOMARKERS

PROFILE REPORTS

PHYSIOLOGICAL STATUS MONITORING

HEAD COACH   TRAINERS   MEDICAL   MANAGER   ATHLETE

Self-Regulation Research

- Self-regulation – "the ability to monitor and manage one's thinking, attention, feelings, and behavior to accomplish goals." (Thompson, 2009)

- Executive functions – include mental processes that enable us to plan, focus attention, remember instructions, and juggle multiple tasks successfully under time pressure.

HRV & Self-Regulation

Self-Regulation Research

- Cardiac regulation - Winkleman et al. (2016)
- Physiological regulation - Thayer et al. (2010)
- Emotional regulation – Thayer et al. (2012)
- Working memory – Hansen et al. (2003)
- Sustained attention – Thayer et al. (2009)
- Selected attention – Hovland et al. (2012)
- Executive Function – Jennings et al. (2015)
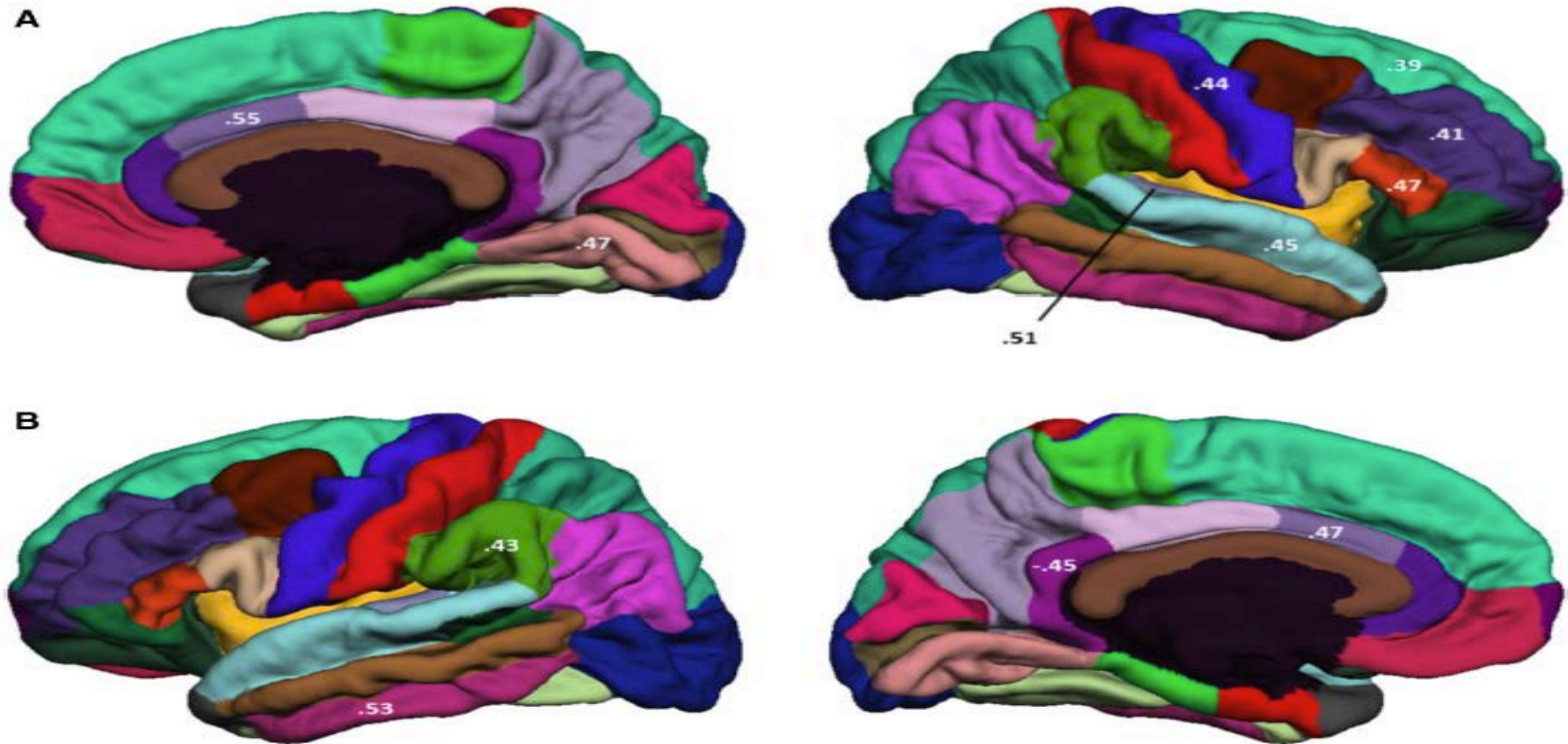
HRV & Self-Regulation

Fig. 2 Correlation coefficients with heart rate variability for predefined regions of interest according to Desikan et al. (2006). a Left hemisphere (LH), b right hemisphere (RH). All $p < .05$; $p < .01$ for caudal anterior cingulate cortex[1] (RH), transverse temporal cortex (RH) and inferior temporal gyrus (LH), no correction for multiple comparisons. [1]Corresponding to anterior midcingulate cortex (Palomero-Gallagher et al. 2009)

Cardiac regulation - Winkleman et al. (2016)

- Executive function and self-regulation skills depend on three types of brain function:
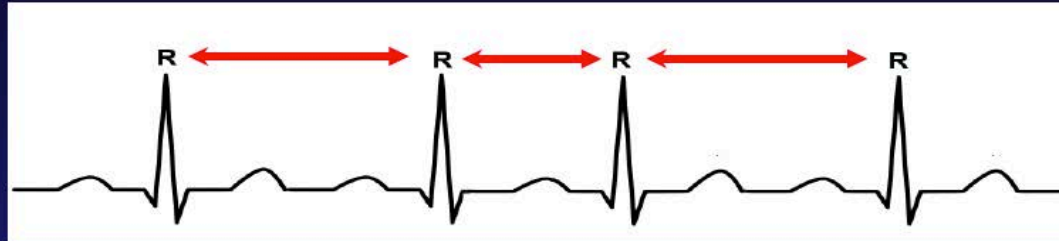
1) Working Memory
2) Mental Flexibility
3) Self-Control

HRV & Self-Regulation

HRV PHYSIOLOGICAL BASICS
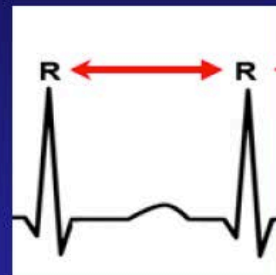
HRV: Time Domain

SDNN: Standard Deviation of all R-R (or N-N) intervals

RMSSD: Root mean square of successive R-R differences

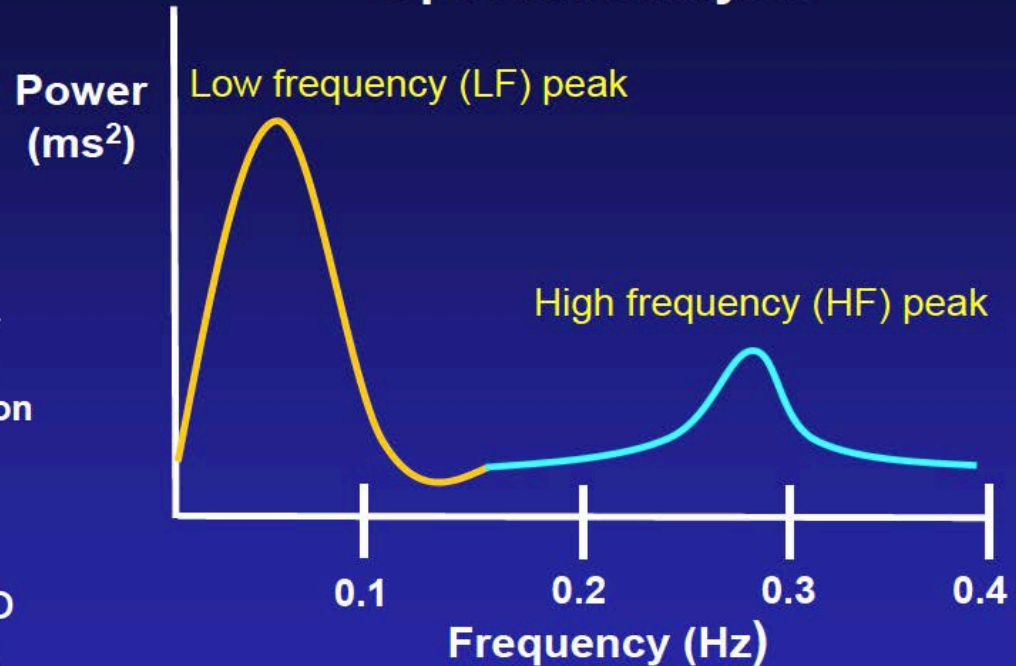**pNN50:** percentage of adjacent R-R intervals that differ by more than 50 milliseconds

HRV – Frequency Spectrum

HRV: Frequency Domain

Spectral analysis

Power (ms²)

Low frequency (LF) peak

High frequency (HF) peak

0.1   0.2   0.3   0.4
Frequency (Hz)

Fast Fourier Transformation
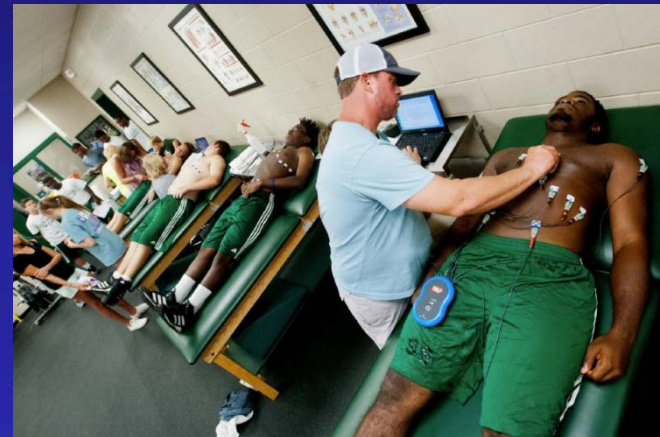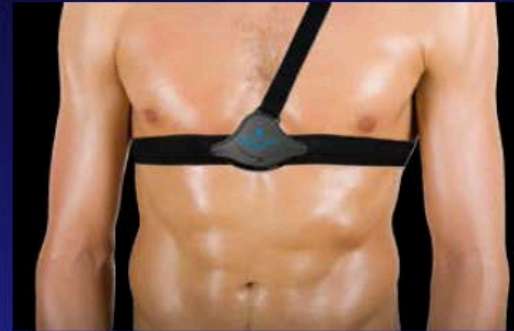
LF/HF Ratio: ratio of sympathetic to parasympathetic activity

Sympathetic + Parasympathetic 0.04 to 0.15 Hz

Parasympathetic 0.15 to 0.4 Hz

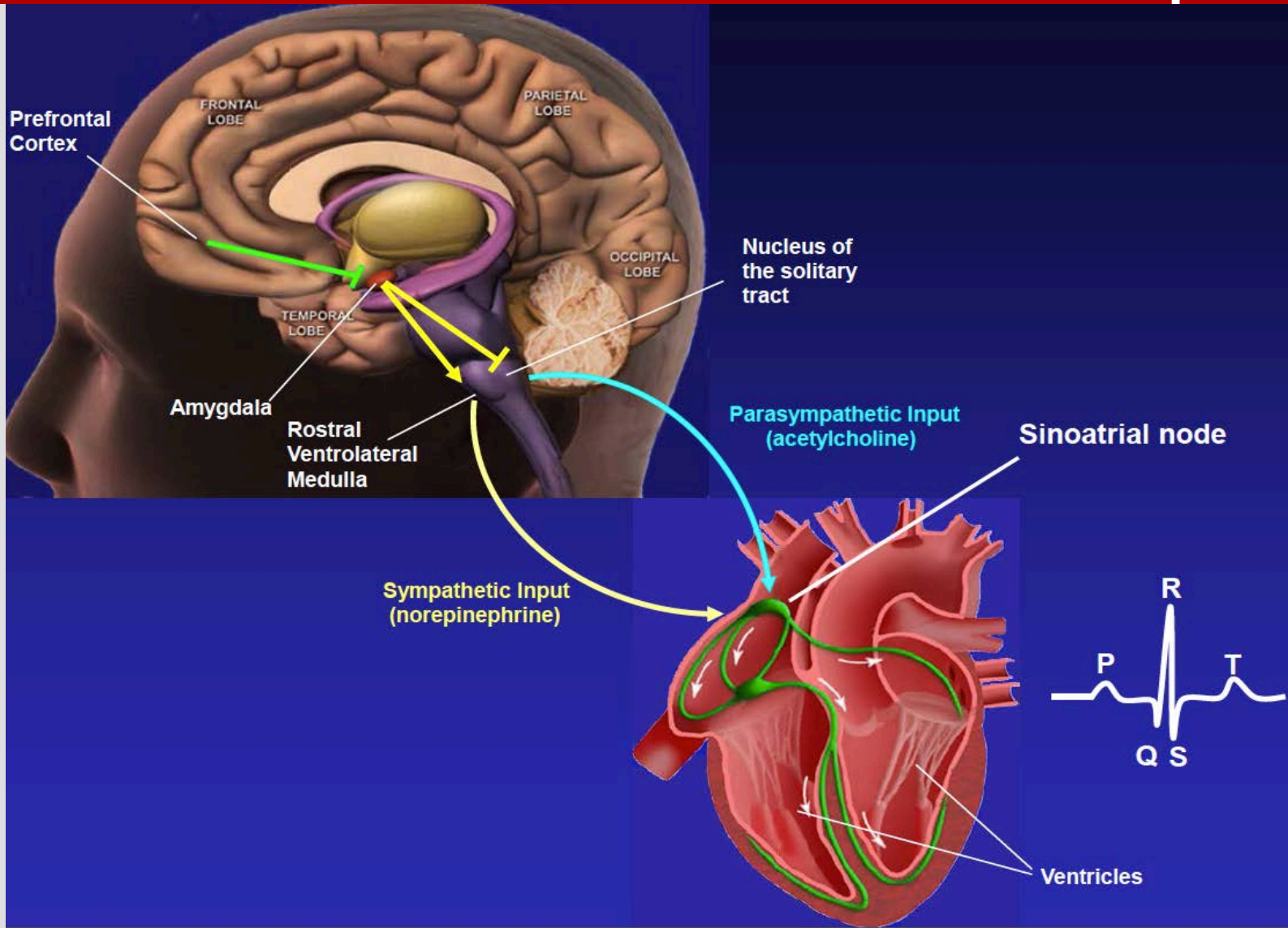## HRV Analysis

- EQ01 Equivital Life Monitor (Lifestrap)

- 2-lead ECG with 256 Hz sample rate
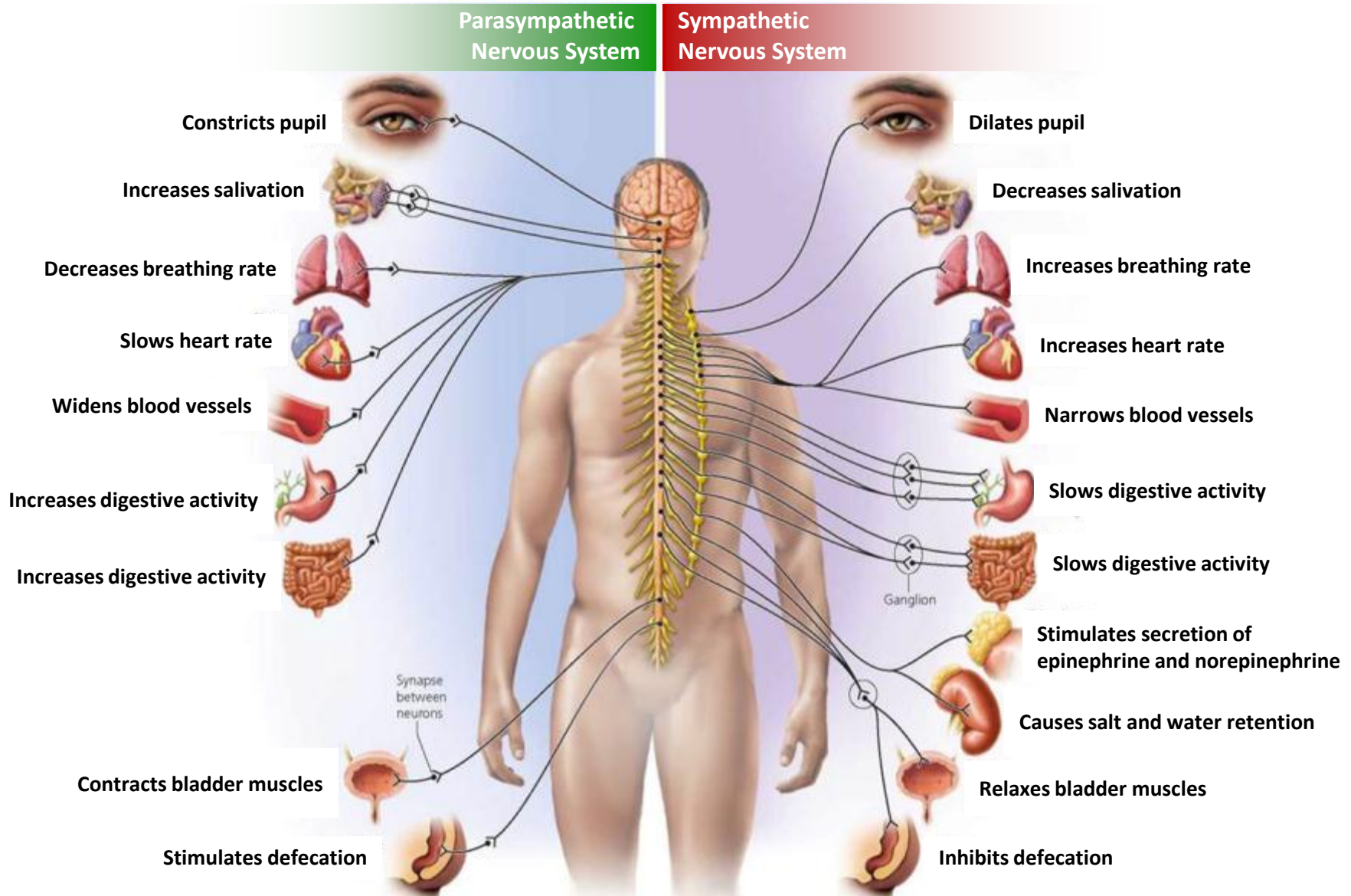
- Data recorded during 5 minute rest period
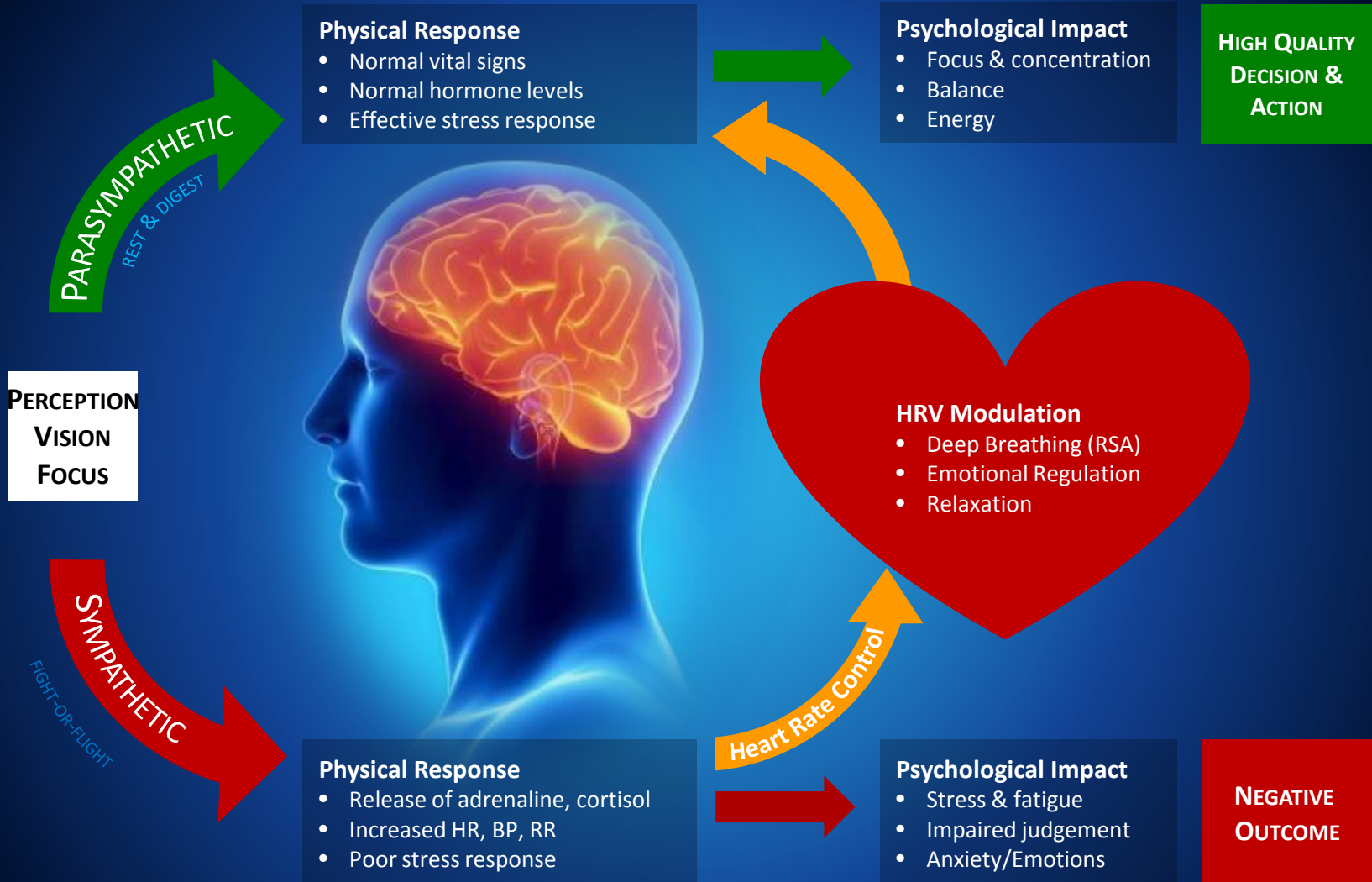
Heart & Brain Relationship

Decision Making & Performance Cycle

PROFESSIONAL SPORT APPLICATIONS & SIMULATION

Mindroom Self-regulation 5-step Approach:

1) Assessment (HRV, RSA, PSP, Neurotracker Baseline)

2) Education - Circular diaphragmatic rhythmical breathing

3) Training - Breathing exercises – 4min; 8min; & 12min

4) Simulation - Integrated with athlete routines in simulator

5) Evaluation – Observe changes in physiology and actions

# **Mindroom-Cognisens 5-Step Program**

Interpreting Your HRV Score

Color Zones of Recovery

The number under your name on your report is your RMSSD (Root mean squared standard deviation of your R to R Intervals). This index is on a scale that represents your HRV. Unlike resting-pulse, a higher HRV number is better than a lower one.

The charts below will aid you in interpreting your RMSSD score, and understanding how it can guide your work or training.
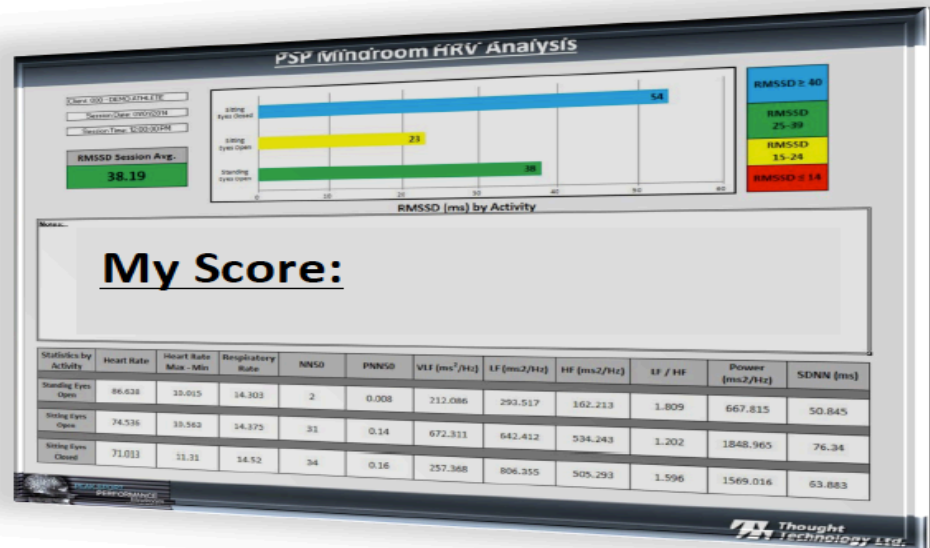
Zone	Description
RMSSD ≥ 80	**Blue Zone Normal Training - Suggests that you are sufficiently recovered and healthy.**
RMSSD 50–79	**Green Zone Normal Training – Monitor your health & lifestyle behaviors.**
RMSSD 30–49	**Yellow Zone Lighter Training - Suggests that you need to consider rest & recovery strategies.**
RMSSD ≤ 29	**Red Zone Rest Day- Demonstrates that you need to take a time out from work or training.**

Mindroom PSP

HRV Training

Attentional Focus

Dual Task - Tactical Awareness

Mindroom Sport Performance: Human Performance Lab

Visualization — Pattern Recognition — Self-Regulation — Athlete Readiness — Perceptual Decision-Making — Reaction Time / Anticipation — Focus Concentration

Mindroom Performance Results

Heart Rate Variability	Increase	93%
Stress Profile	Increase	53.5%
Selective Attention	Increase	83.6%
Reaction Time	Increase	10.8%
Decision-making	Increase	1.0

Executive Summary

Top Multidimensional Performance Factors

- Sport Specific Skills

- Physical (Power, Strength, Endurance)

- Technical Motor Skills

- Tactical Skills for Competition

- Psychological Skills for Competition - Confidence

- Functional Readiness State (Biomarkers)

- Emotional Regulation (CNS & ANS)

- Attentional Focus (e.g., Selective)

- Biographical Data
- Neuro-Cognitive Function
- Cardiac Function (HRV)
- Neuromuscular Function
- Metabolic Function
- Allostatic Training Load
- Sleep Quality & Quantity
- Overall Functional State

Athlete Readiness Index

MILITARY APPLICATIONS AND SIMULATION

Mindroom PSP & Cognisens Joint Offering

Vision

Absorbing a complex scene.

Perception

Updating mental picture.
Anticipating what's next.

Execute

Complete the Action

Cognition

Evaluating options. Making decisions.

Self-regulation Program

Mindroom PSP Training

Step 1: Self-Regulation Tr.

Step 2: MOT- Neurotracker

Threat Recognition

Athlete calls out decision

Step 3: Dual Task Identification
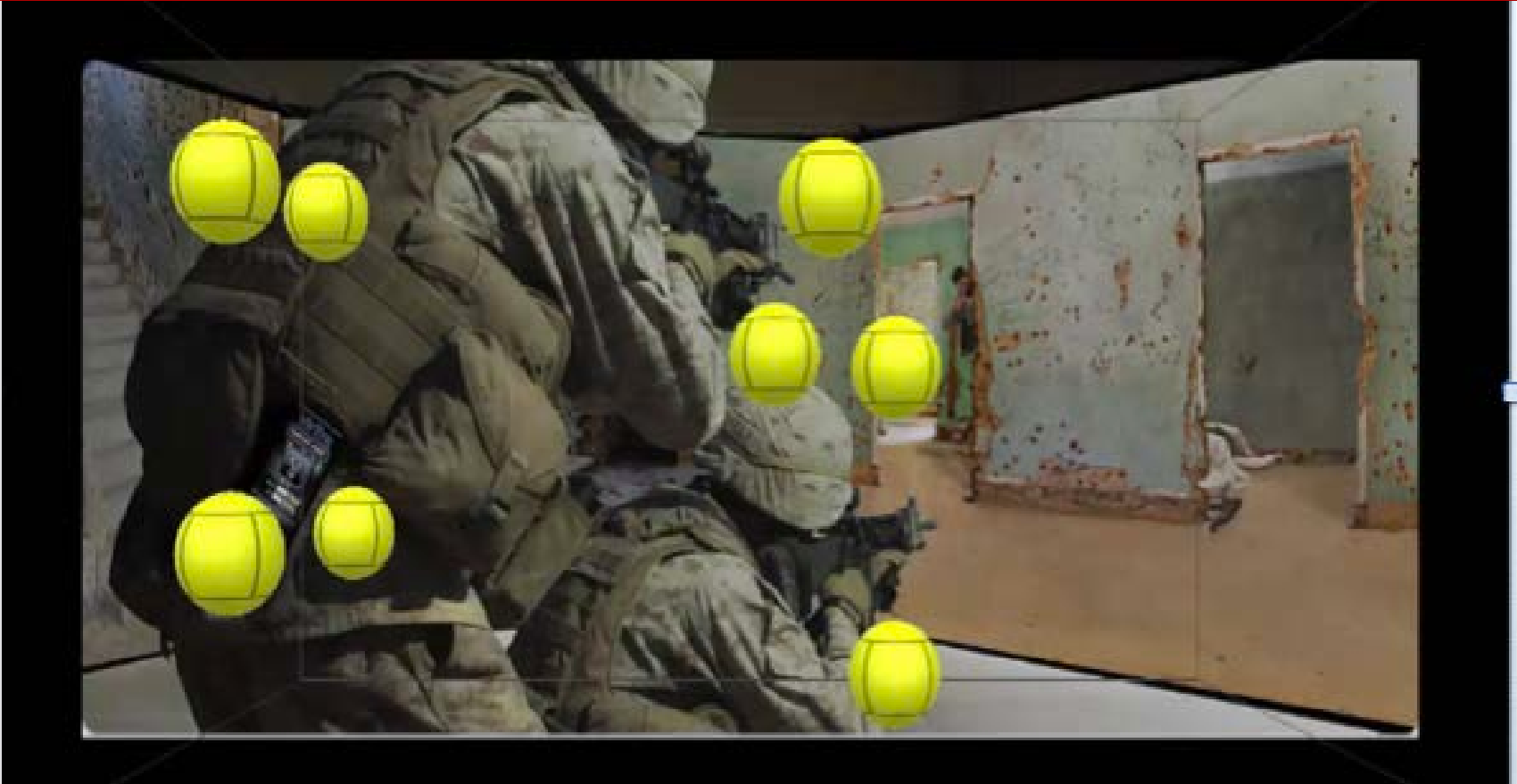
Step 4: Video Decision Training

Step 5: Simulation Training

PEAK SPORT PERFORMANCE Mindroom

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