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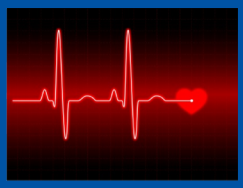

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2 Normandie Université Caen, France

Heart Rate Variability & Self-Regulation

Chieti, 7th of November 2019

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Overview

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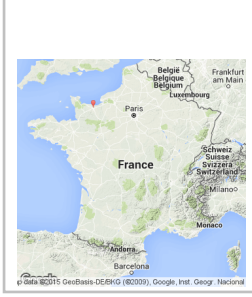
From Caen (Normandie) to...



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German Sport University Cologne

- 6000 students
- 22 Institutes

A few introductory words...

Sylvain Laborde(PhD) - FORTITUDE Mental Training
@SylvainLaborde_

Psychologist, Researcher, Lecturer at the German Sport University - Developer of FORTITUDE Mental Training - My focus: Peak performance under pressure -

Your heart makes you (emotionally) tough
HRV and the psychophysiological aspects of the response to stressful and pressurized situations

Your heart makes you smart
HRV and cognitive functions

You are *really* unique
Emotional intelligence, Intuition, Reinvestment, Chronotype, Mental toughness

I need one heart

Volunteers Needed

Overview

Tribute to Charles Darwin

- "According to Darwin's Origin of Species, it is **not the most intellectual** of the species that survives; it is **not the strongest that survives**; but the species that survives is the one that is **best able to adapt and adjust to the changing environment** in which it finds itself." Megginson (p. 4, 1963)

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1. Introduction
2. Charles Darwin & Claude Bernard
3. **How my Heart Rate Variability (HRV) journey started**
4. Get to know your heart
5. What is HRV?
6. HRV Theories: a focus on Cardiac Vagal Activity (CVA)
7. Factors influencing CVA
8. HRV Methods
9. Examples of experiments targeting CVA
10. Apps to measure CVA
11. Slow-paced breathing: Effective technique to improve CVA
12. Other techniques to improve CVA
13. Quantified-self
14. Take-home messages

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HRV Start

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Gentle French football players

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Sebastien Vahaamahina red card France vs Wales Rugby World Cup 2019 - Japan

Sebastien Vahaamahina red card France vs Wales Rugby World Cup 2019 - Japan

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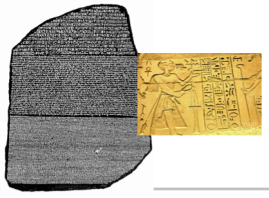
information regarding neural regulation of the heart is imbedded in the beat-to-beat heart rate pattern

Rosetta Stone



Cognition (Executive functions)
Emotion
Health
Self-regulation

Egyptian Mummies

Keeping the heart, throwing away the brain

Heart center of physical, affective, & intellectual life

Vatican Museum

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HRV theories: Focus on cardiac vagal activity (CVA)

Neurovisceral Integration Model (Thayer et al., 2009)	**Higher CVA** = better health, stress resilience, executive performance = **Better REGULATION**
Polyvagal theory (Porges, 1995)	**Higher CVA**= better social functioning = **Better REGULATION**
Biological behavioral model (Grossman, 2007)	**Higher CVA**= **Better REGULATION**
Resonance frequency model (Lehrer, 2013)	Slow paced breathing = **Higher CVA**
Psychophysiological coherence model (McCraty & Zayas, 2014)	Slow paced breathing = **Higher CVA**
Respiratory Vagal stimulation model (Gerritsen & Band, 2018)	All relaxation techniques = **Higher CVA via slow breathing**

Missing in previous HRV theories

- **A systematic consideration of the 3 Rs of cardiac vagal activity:**
  - Resting
  - Reactivity
  - Recovery

Figure 2. Vagal tank and the 3 Rs of cardiac vagal control: effect of a depleting factor

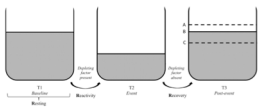

Illustration of the vagal tank and the 3Rs (resting, reactivity, and recovery) with a factor depleting cardiac vagal control. In regards to the post-event: A) displays a situation where the level of cardiac vagal control during the post-event is higher than the initial level at baseline, B) displays a situation where the level of cardiac vagal control at post-event is similar to the initial level at baseline, and C) displays a situation where the level of cardiac vagal control at post-event did not recover to the point of its initial baseline level.

frontiers in Neuroscience

HYPOTHESIS AND THEORY
published: 10 July 2018
doi: 10.3389/fnins.2018.00458

Vagal Tank Theory: The Three Rs of Cardiac Vagal Control Functioning – Resting, Reactivity, and Recovery

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There is nothing so practical as a good theory.

— Kurt Lewin —

AZ QUOTES

Figure 2. Vagal tank and the 3 Rs of cardiac vagal control: effect of a depleting factor

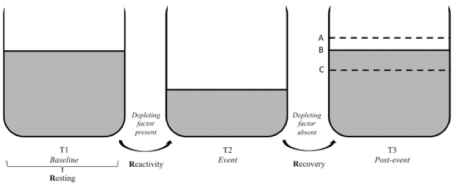

Illustration of the vagal tank and the 3Rs (resting, reactivity, and recovery) with a factor depleting cardiac vagal control. In regards to the post-event: A) displays a situation where the level of cardiac vagal control during the post-event is higher than the initial level at baseline, B) displays a situation where the level of cardiac vagal control at post-event is similar to the initial level at baseline, and C) displays a situation where the level of cardiac vagal control at post-event did not recover to the point of its initial baseline level.

Figure 3. Vagal tank and the 3 Rs of cardiac vagal control: effect of a replenishing factor

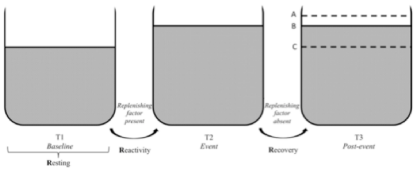

Illustration of the vagal tank and the 3Rs (resting, reactivity, and recovery) with a factor replenishing cardiac vagal control. In regards to the post-event: A) displays a situation where the level of cardiac vagal control during the post-event is higher than the level during the baseline, B) displays a situation where the level of cardiac vagal control at post-event is similar to the event level, and C) displays a situation where the level of cardiac vagal control at post-event returned to baseline level.

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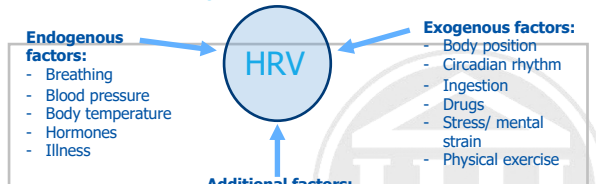
Factors influencing HRV



Endogenous factors:
- Breathing
- Blood pressure
- Body temperature
- Hormones
- Illness

Exogenous factors:
- Body position
- Circadian rhythm
- Ingestion
- Drugs
- Stress/ mental strain
- Physical exercise

Additional factors:
- Age
- Sex
- Body fat / weight / height
- Physical fitness
- Genetics

Fatisson, J., Oswald, V., & Lalonde, F. (2016). Influence diagram of physiological and environmental factors affecting heart rate variability: an extended literature overview. *Heart International, 11*(1), e32-e40. doi:10.5301/heartint.5000232
Laborde, S., Mosley, E., & Mertgen, A. (2018). A unifying conceptual framework of factors associated to cardiac vagal control. *Heliyon, 4*(12), e01002. doi:10.1016/j.heliyon.2018.e01002

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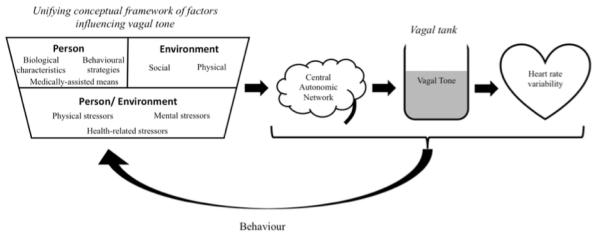
Illustration of the unifying conceptual framework for vagal influences, based on the ecological rationality theory



43,293 unique results

Laborde, S., Mosley, E., & Mertgen, A. (2018). A unifying conceptual framework of factors associated to cardiac vagal control. *Heliyon, 4*(12), e01002. doi:10.1016/j.heliyon.2018.e01002

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Table 1. Overview of the unifying conceptual framework of factors influencing cardiac vagal control.

1	2	3	4	5
Person	Biological characteristics	Stable biological characteristics		
		Transient biological characteristics		
	Somatic interventions and stimulation methods	Pharmacologic factors		
		Vagus nerve stimulation		
		Transcutaneous vagus nerve stimulation		
		Brain stimulation	Repetitive transcranial magnetic stimulation	
			Transcranial direct current stimulation	
			Transcranial pulsed current stimulation	
			Deep brain stimulation	
			Electroconvulsive therapy	
		Carotid baroreceptors stimulation		
		Esophageal electrostimulation		
		Oxygen inhalation		
		Continuous airway positive pressure		
	Behavioral strategies	Nutrition		
			Diet	
			Beverages	
			Supplementations	
		Non-ingestive oral habits		
		Water immersion		
		Body temperature reduction		
		Sleeping habits		
		Relaxation methods		
		Cognitive techniques		

(continued on next page)

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Table 1. (*Continued*)

1	2	3	4	5
		Praying		
		Media entertainment		
		Music		
		Exercise		
Environment	Social environment	Contact with humans		
		Contact with animals		
	Physical environment	Aromas		
		Lights		
		Sounds (excluding music)		
		Temperature		
		Electromagnetic fields		
		Outdoor environment		
		Altitude		
Person/Environment	Physical stressors			
	Mental stressors			
	Health-related stressors	General mechanisms	Pain	
			Inflammation	
			Fatigue	
		Medical conditions	Symptoms	
			Syndroms	
			Disorders	
				Psychopathology/psychiatric disorders
				Eating disorders
				Functional somatic disorders
				Breathing disorders
			Diseases	
		Addictions		