# NORMAL SUBJECTS' HEART - BRAIN COHERENCE : PRELIMINARY RESULTS

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# COHERENCE

- Coherence in common usage is defined as the quality of being logically integrated, cosistent and intelligible
- Coherence as global order of a single system or as synchronized interaction among multiple system
- Specific emotions are associated with specific psychophysiological patterns: emotions trigger changes in ANS but also specific changes in ASN are involved in the generation of emotional experience
- Central role of the heart (bottom-up and top-down ANS pathways)

#### EMOTIONS AND HEART RYTHM PATTERNS

Positive emotions related with synchronization between the two branches of the ANS

The coherence mode does'nt depend on heart rate, but on heart rate variability



#### EMOTIONS AND HEART RYTHM PATTERNS

HRV power spectrum shows large increase in low frequency (LF):

- LF = 0.1 Hz ANS coherence
- VLF Sympathetic
- HF parasympathetic

#### Heart Rhythm Coherence Ratio Calculation



#### EMOTIONS AND HEART RYTHM PATTERNS

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# HEART - BRAIN

- Heart beat to beat variability (coherence with blood pressure and respiration) results in an increaase in the vagal afferent traffic sent from the heart to the brain
- Breath related modulation of the heart rhythm: respiratory sinus arrhythmia (RSA)

Depth and slow breaths are related with positive emotions and HRV



BAROCEPTOR HYPOTHESIS

Bottom up inputs from the baroceptors.

Cortical activity is briefly inhibited by afferent input.

Increased perfomance with reduced baroceptor activity (heart rate deceleration prior to receiving information).

Stimulus arrives when the brain is minimaly inhibited

#### BAROCEPTOR HYPOTHESIS

Later studies evidenced the afferent way mediated by the thalamus.

Baroceptors – thalamus – brain activity (alpha rhythm): decrease in performance.

Heart rate decrease: prevention of alpha rhythm onset.

Better performance

#### HEART RHYTHM COHERENCE HYPOTHESIS

10 min. baseline

10 min. ADT

Experimental group: appreciation

Control group: no task

10 min. ADT



**HP**: HE-PAT is a stimulus useful in stimulating coherence, then promoting cognitive performance

SAMPLE

BASELINE

N. 10 subjects \*

EEG and HRV recording: 10 min. eyes closed

(n.4 males, n.4 females)

\* n.2 excluded for organic deseases

Education level: 13 years

Age

Range 18-65

mean 40 – ds 15

STIMULUS

EEG and HRV recording: 10 min. eyes closed

with HE-PAT

# HEART RATE VARIABILITY MEASUREMENT





#### HEART – BRAIN EEG TRACKS EXAMPLES

#### BASELINE

#### HE PAT STIMULUS

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## HEART – BRAIN EEG TRACKS EXAMPLES

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### HEART – BRAIN EEG EXAMPLES

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#### BASELINE

#### HE PAT STIMULUS





## HEART – BRAIN RESULTS

	HRV BASELINE	HRV HE-PAT	COHERENCE BASELINE	COHERENCE HE-PAT	
1	75	70	100	7	′5
2	78	76	70	6	8
3	62	64	90	6	8
4	78	72	70	5	8
5	76	78	35	2	28
6	70	68	78	5	8
7	70	68	85	6	;9
8	75	72	82	8	35

## HEART – BRAIN CONCLUSIONS

OUR RESULTS SUPPORTS THE HYPOTHESIS THAT STIMULATION WITH HE-PAT IS ABLE TO DEVELOP HRV AND COHERENCE.

IT MEANS THAT HE-PAT COULD BE A GOOD STIMULUS TO INDUCE A BETTER COHERENCE AND RELATED CONSEQUENCES SUCH AS COGNITIVE PERFORMANCE.