

International Laboratory of Social Neurobiology Moscow 2023

# Vegetative signs of emotion valence

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(a) Cardiovascular measures



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#### sigh Vt Ttot I/E ratio FRC tonic HV thoracic Vt sigh peak HV Ρ Ros **Ti/Ttot** Vi/1

(b) Respiratory measures

Kriebig, 2010



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(c) Electrodermal measures

Kriebig, 2010



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(d) All measures of autonomic functioning



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## HRV

Improvement of HRV Methodology for Positive/Negative Emotion Assessment (Wu, Lee, 2009)

The HRV decreased under the negative emotion. And increased under the positive emotions.





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# **Face temperature** (Infrared Thermal Imaging)

Emotion analysis in children through facial emissivity of infrared thermal imaging (Goulart et al, 2019)

- decreased facial temperature is a sign of negative emotions (consistent with previous findings);
- decreased nose temperature disgust, fear and... happiness.



Fig 7. Representative frames of the emissivity decrease (in relation to baseline) in nose of a child during the emotions. Pixel intensity 0-255





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### **Pupil dilation**

Pupillary Behavior in Positive and Negative Emotions (Babiker et al, 2013)

 there is significant difference between negative and positive emotions in terms of pupil sustainability, duration and dilation diameter.





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#### Startle reflex

Emotion, attention, and the startle reflex (Lang et al, 1990)

- the startle response (an aversive reflex) is enhanced during a fear state and is diminished in a pleasant emotional context.
- the effect is found when affects are prompted by pictures or memory images;
- the effect changes appropriately with aversive conditioning, and may be dependent on right-hemisphere processing.



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#### **Head motion**

Head Motion Elicited by Viewing Affective Pictures as Measured by a New LED-Based Technique (Kosonogov et al, 2019)

- unpleasant pictures provoked more sway;
- and faster movements than both neutral and pleasant pictures.



Figure 3. Sway of head motion in the medial-lateral direction according to the affective pictures (bars represent mean  $\pm$  SEM).



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#### Comparisons of Negative and Positive Emotions by Physiological measure

#### The psychophysiology of emotion (Cacioppo et al, 2000)

Measure	More in N than P*	р	Number of comparisons				
Diastolic blood pressure	0,54	0,01	7				
Blood volume	0,5	0,01	2				
Nonoscillary duration of the skin blood							
flow response	-0,25	0,02	5				
Electrodermal response duration	-0,29	0,01	5				
	*greater activation by negation	*greater activation by negative emotion compared to positive					



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#### Emotion Fingerprints or Emotion Populations? A Meta-Analytic Investigation of Autonomic Features of Emotion Categories

(Siegel et al, 2018)

- For anger: HR, CO, DBP, SBP, RR, and SCR +
- For fear: HR, SBP, RR, and SCR +
- For disgust: SCL and SCR +
- For happiness: HR, DBP, RR, SCL, and SCR +
- For sadness HR, DBP, SBP, and RR +

Emotion Category and Physiological Measure	k (n)	d	95% CI (Lower/Upper)	Q	$H^2$	I <sup>2</sup> (%)
Anger						
Heart Rate	86 (3,684)	0.52***	0.39/0.66	243.00***	7.00	65.02
Heart Rate Variability	9 (252)	-0.18	-0.52/0.16		1.03	2.88
Pulse Transit Time	0					
Cardiac Output	8 (398)	0.44 **	-0.11/0.87	18.64	2.66	64.44
Stroke Volume	4 (105)	0.64*	0.13/1.18	32.09***	10.70	90.65
Total Peripheral Resistance	8 (398)	0.74	0.43/1.06	2.32	0.33	
Diastolic Blood Pressure	60 (2,646)	0.57***	0.42/0.72	251.31***	16.17	76.52
Systolic Blood Pressure	63 (2,782)	0.66***	0.51/0.81	215.39***	11.38	71.68
Mean Arterial Pressure	2 (82)	0.65*	0.03/1.34			
Temperature	2 (68)	0.09	-0.56/0.76		0	
Respiration Rate	5 (109)	1.47**	0.89/2.13	40.36***	9.95	90.09
Expiratory Time	1 (16)					
Inspiratory Time	2 (32)	0.57	-0.49/1.80	1.22	1.22	18.30
Tidal Volume	0					
Skin Conductance Level	22 (772)	0.19	-0.04/0.42	47.36*	2.26	55.66
Skin Conductance Response	14 (476)	0.45*	0.12/0.92	15.96	1.23	15.65
Total	286 (11,820)					



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#### Autonomic Nervous System Activity During Positive Emotions: A Meta-Analytic Review

(Behnke et al, 2022)

Findings in approach motivation dimension:

 positive emotions are characterized by strong approach tendencies, such as joy and excitement, were accompanied by a higher sympathetic reactivity (e.g., DBP, MAP) than low-approach positive emotions like amusement.



Mean effects (Cohen's d) for each of the 11 discrete positive emotions with symbols representing the mean effect sizes and horizontal lines representing 95% confidence intervals

Summary of Meta-Analysis



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