



Emotion Technology: Enabling Machines to Understand How We Feel

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This character barges into your office when you're busy. He doesn't apologize, and doesn't notice you are annoyed.

He offers you useless advice.

You express more annoyance. He ignores it.

He continues to be unhelpful. *The clarity of your emotional expression escalates.*

He ignores it.

You clearly tell him "Go Away."

He winks, and does a happy little dance before exiting.





...doesn't notice you are annoyed.

[Doesn't recognize your emotion]

You express more annoyance. He ignores it.

[Doesn't respond appropriately to emotion]

He winks, and does a happy little dance before exiting.

[Not clever about expressing emotion.]





Skills of EMOTIONAL INTELLIGENCE include:

Recognize emotion

Respond appropriately to emotion

Be smart about expressing emotion

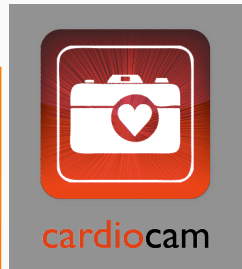


Emotion: Two main dimensions & Technologies to measure them

Arousal



Q™ Sensor



Valence

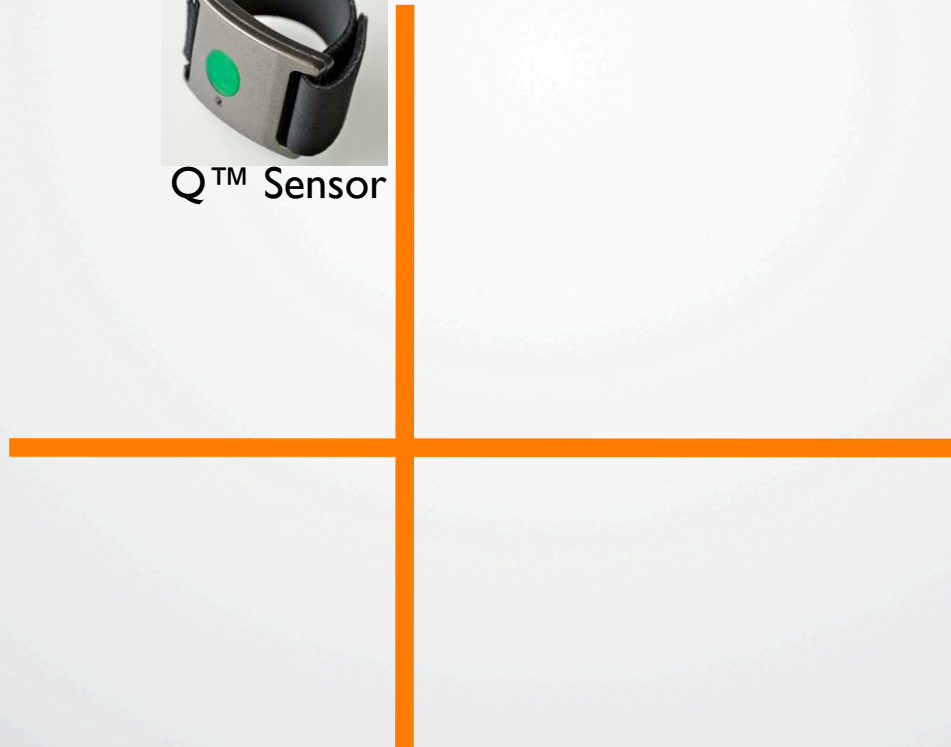


Facial Expressions: MIT
Moodmeter & Affdex

Arousal: Electrodermal Activity (EDA)



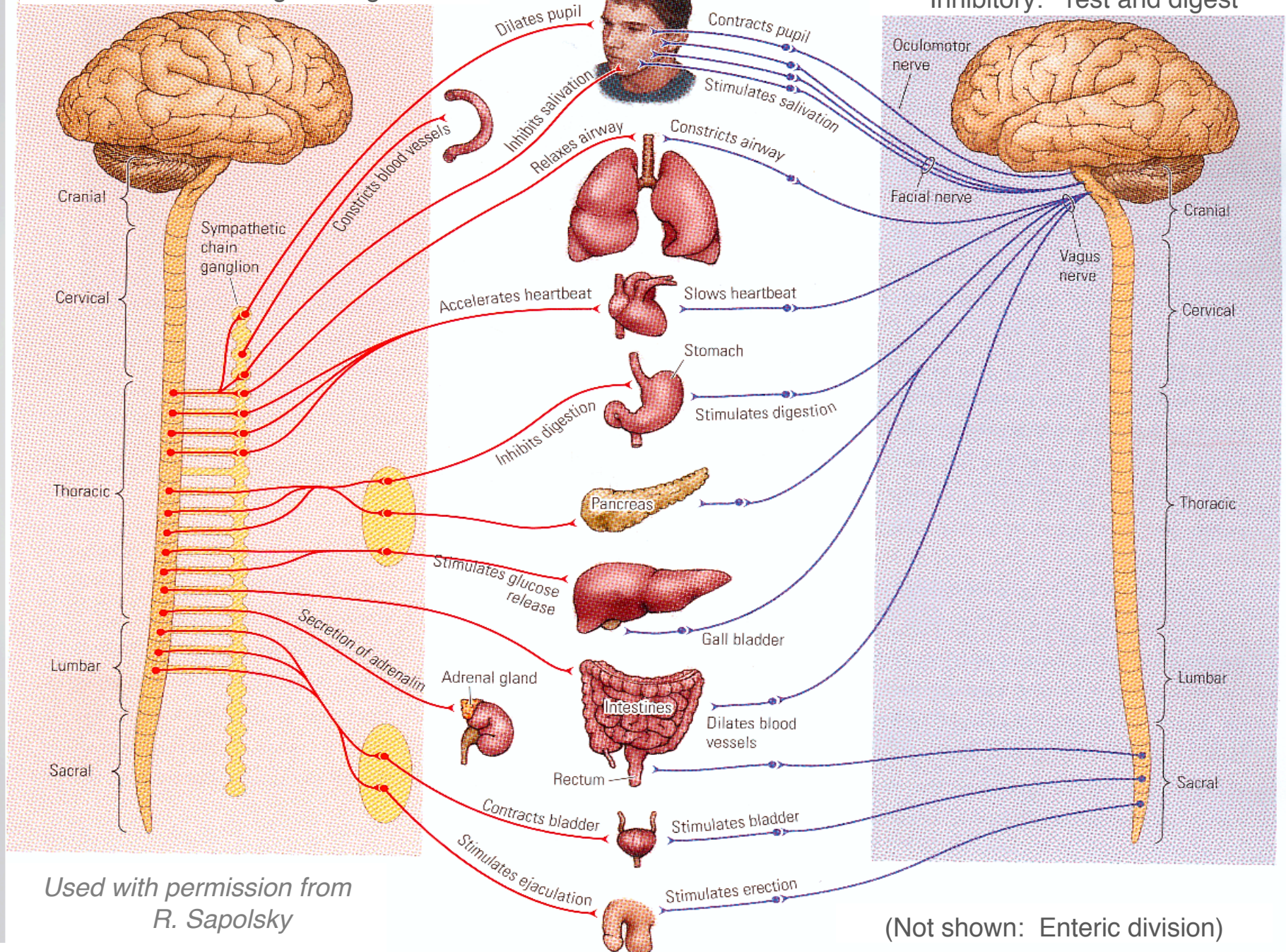
Q™ Sensor



Sympathetic division
Stimulation: "fight or flight"

AUTONOMIC NERVOUS SYSTEM

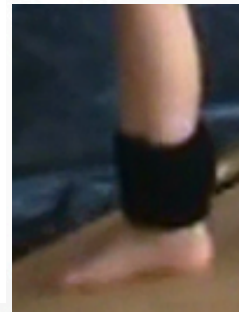
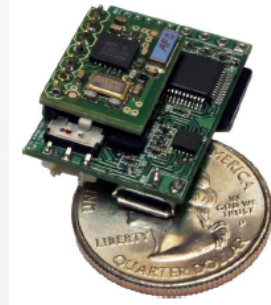
Parasympathetic division
Inhibitory: "rest and digest"



Electrodermal Activity (EDA) Sensors



Traditional



Media Lab
Innovations



Affective Q™

Full disclosure:
co-founder, chairman, chief scientist



What makes EDA go up? | Demo

EDA = Electrodermal Activity

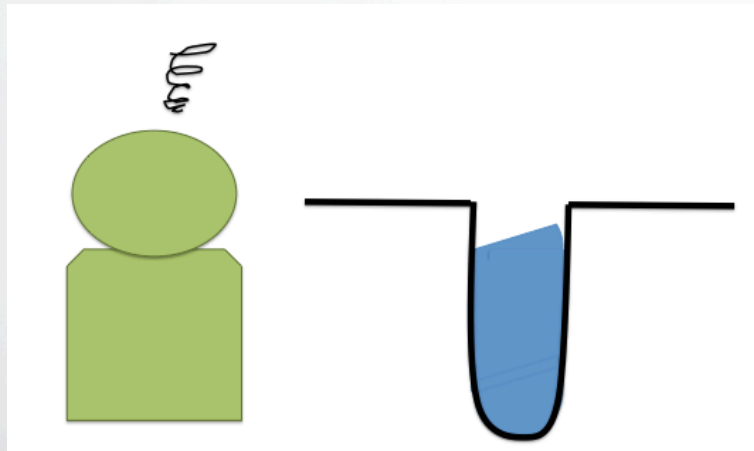
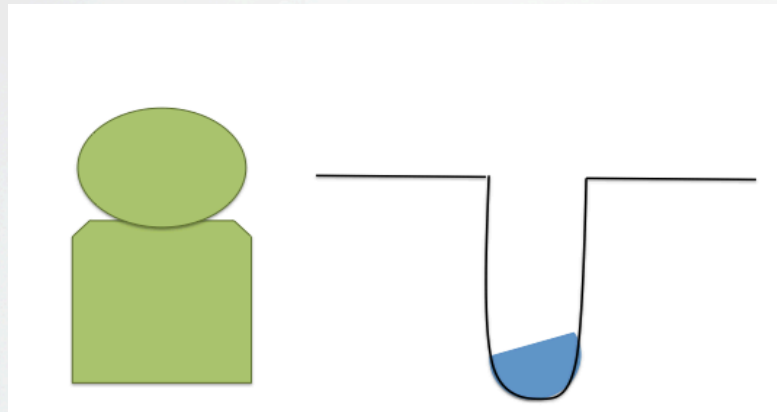
(measured as skin conductance)



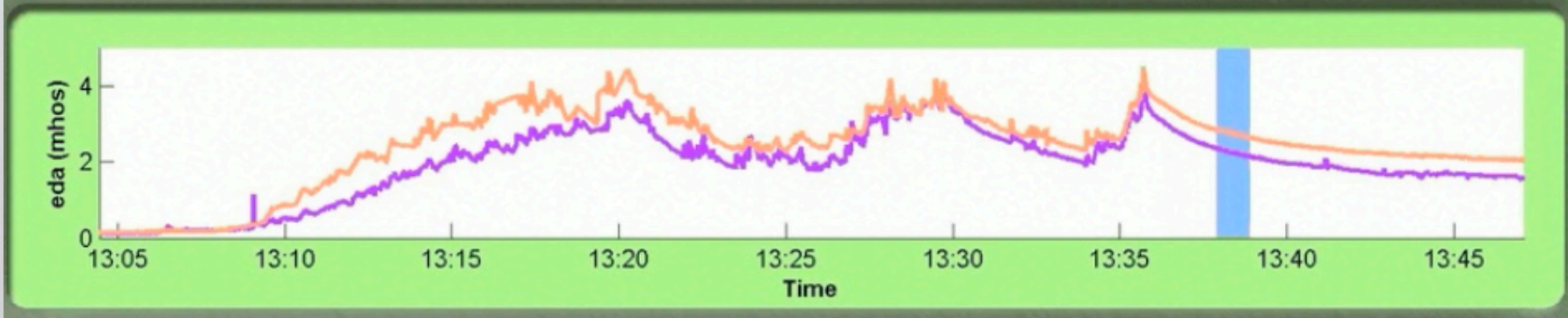
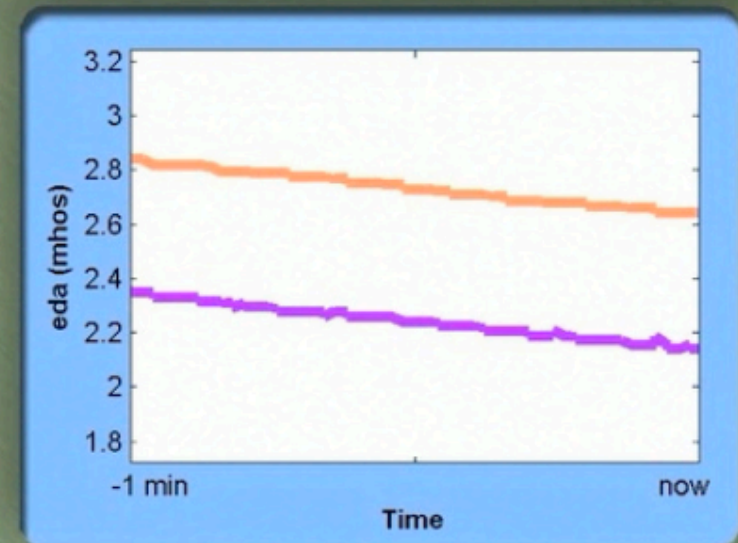
Affectiva Q Sensor measures:

- 1. Skin conductance**
- 2. Skin temperature**
- 3. 3-axis accelerometer**

Super Simplified Sweat Gland Model

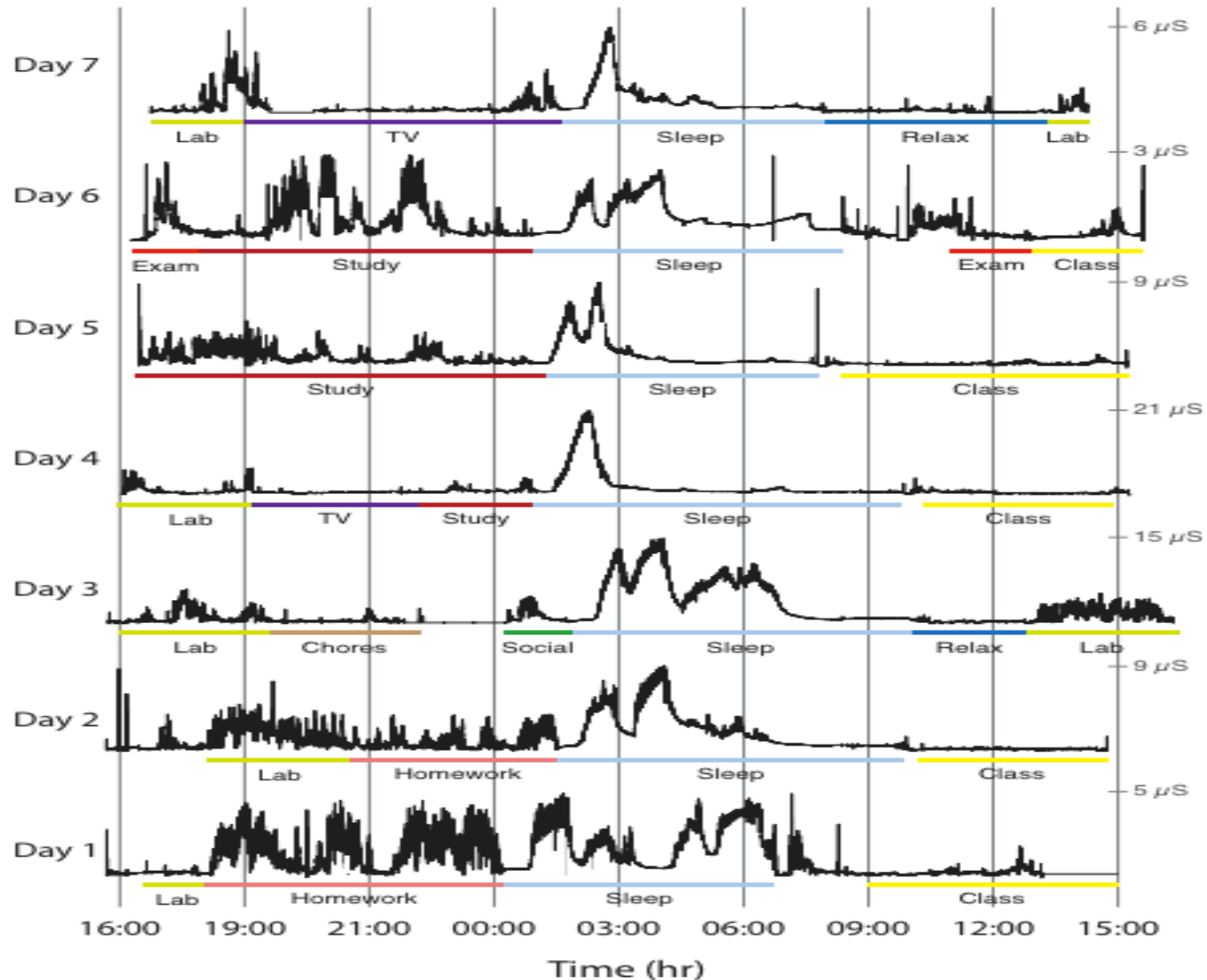


Example: Measuring sympathetic nervous system response via electrodermal activity (EDA) on lower legs

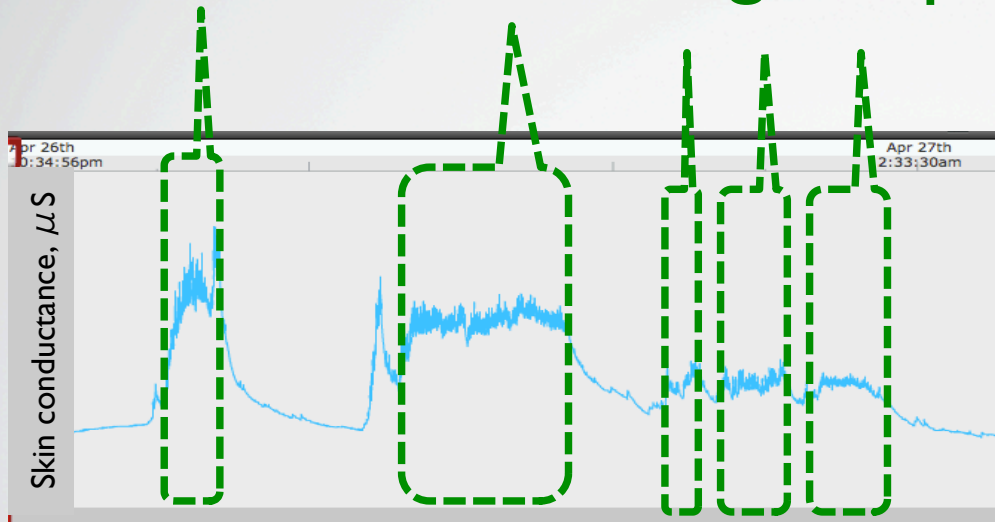


Now we can log autonomic data – sympathetic nervous system response 24/7 “in the wild”

Electrodermal Activity, μS



EDA “Storms” during sleep



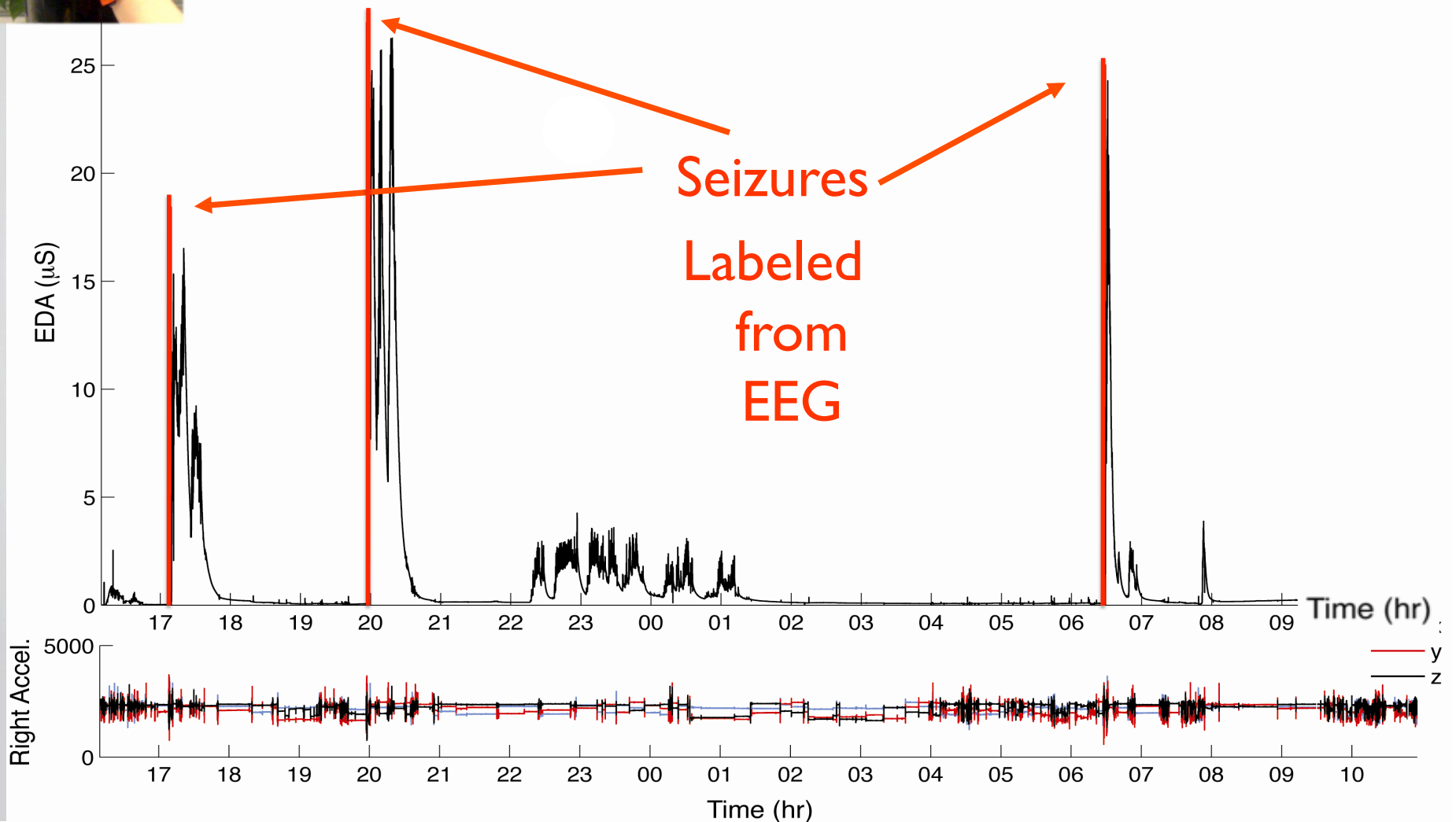
Related to sleep quality and to improvement on a visual discrimination task

Sano, Picard, Wang, Stickgold, APSS 2011.

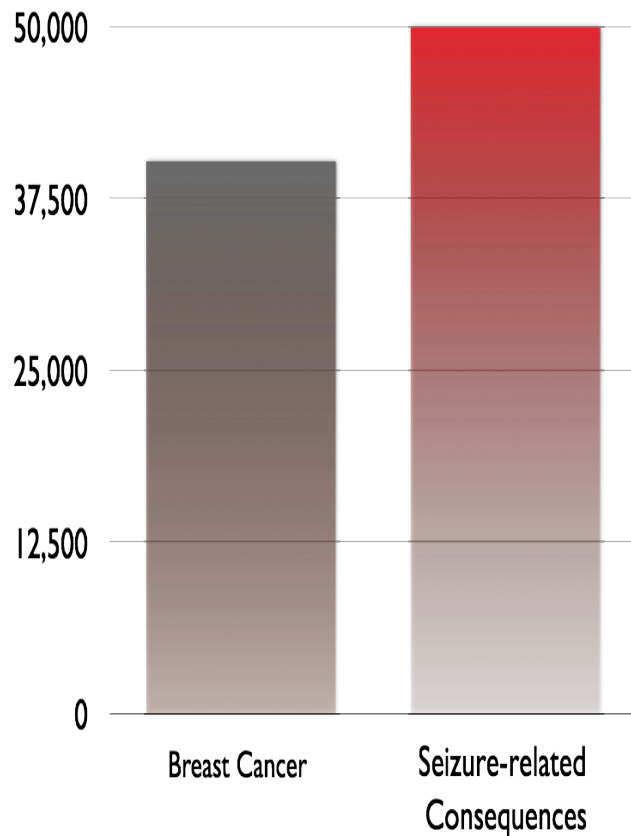
EDA arousals also related to quality of sleep in Autism Spectrum Disorders

Sano, Picard, el Kaliouby, Malow, Goldman, IMFAR 2011.

94% accurate convulsive seizure detection using a wrist-worn electrodermal activity and accelerometry biosensor. Poh et al (2012), *Epilepsia*.

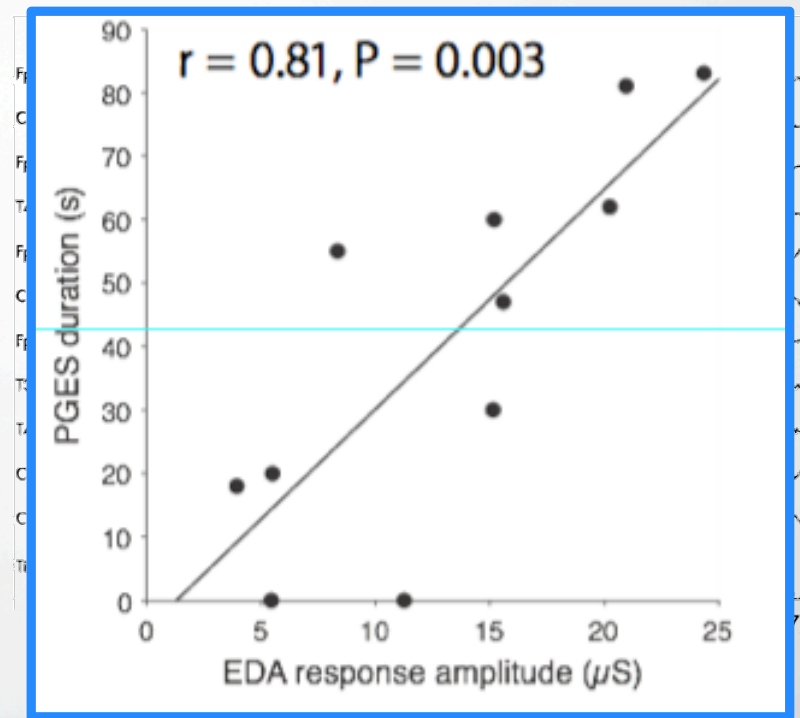


Sudden Unexpected Death in Epilepsy (SUDEP)



Estimated Deaths in the United States in 2010

Post-ictal EEG Suppression (PGES):
Possible biomarker for SUDEP risk



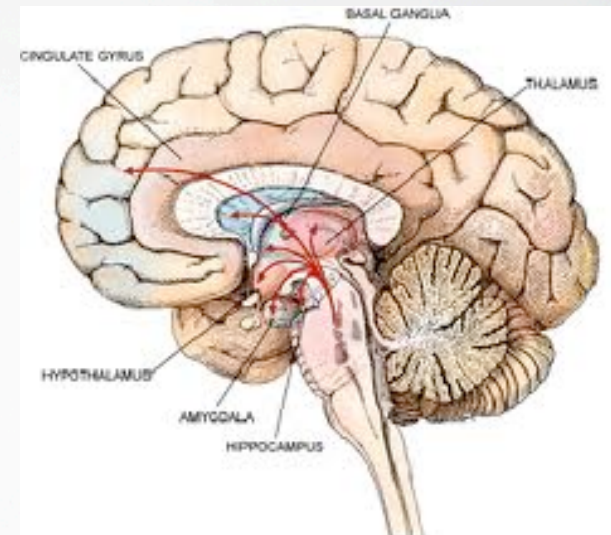
Enache, S.D. et al., Ann Neurol 66 (2010)

Why look at both left and right EDA, separately?

Right amygdala is associated with **threat/negative** stimuli

Left amygdala is associated with a mix of positive and negative arousal.

Ji G, Neugebauer V. (2009) "Hemispheric lateralization of pain processing by amygdala neurons" J Neurophysiol. 2009 Oct; 102(4):2253-64. Epub 2009 Jul 22

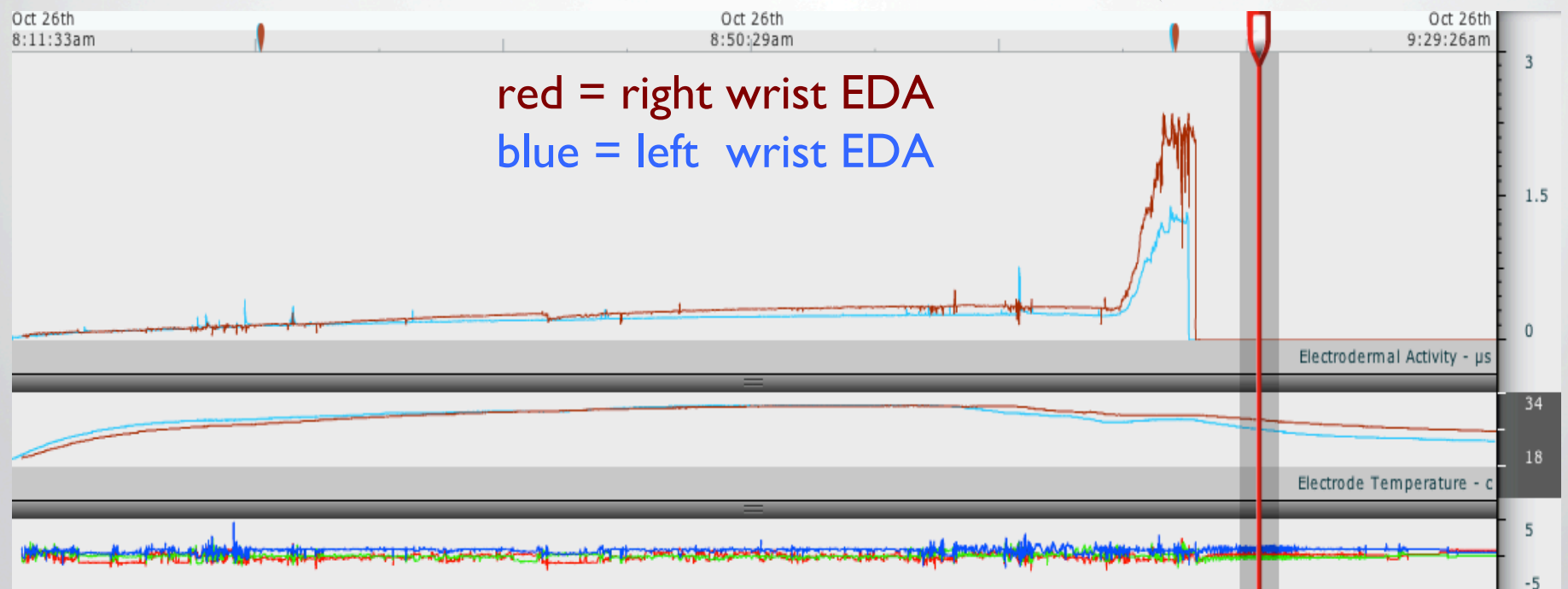


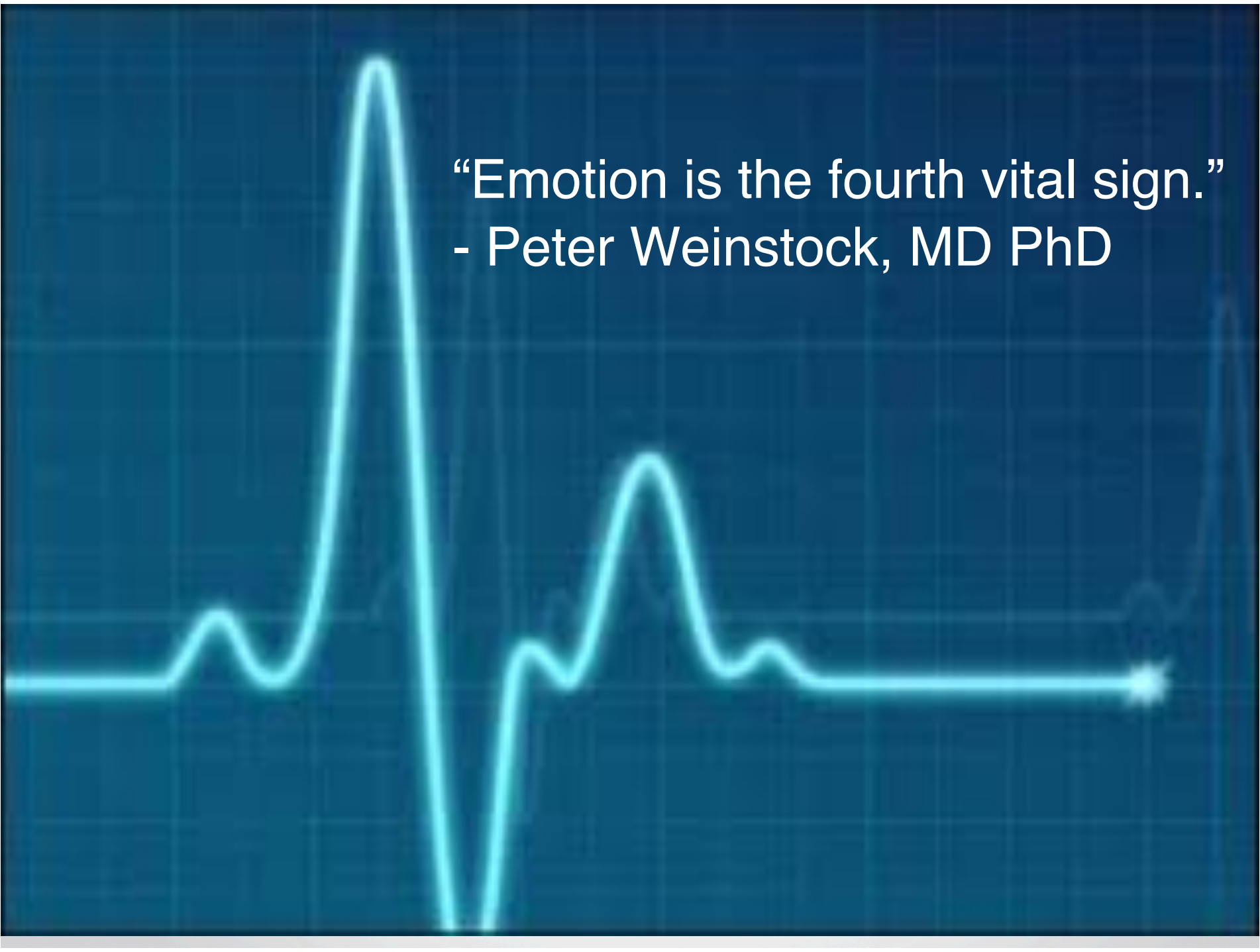
Right amygdala -> **Right** EDA response

Left amygdala -> Left EDA response

Mangina & Beuzeron-Mangina 1996, Int. J. Psychophysiology 22(1996)1-8.

Anticipation of Pain and Pain: Flu shot in left arm

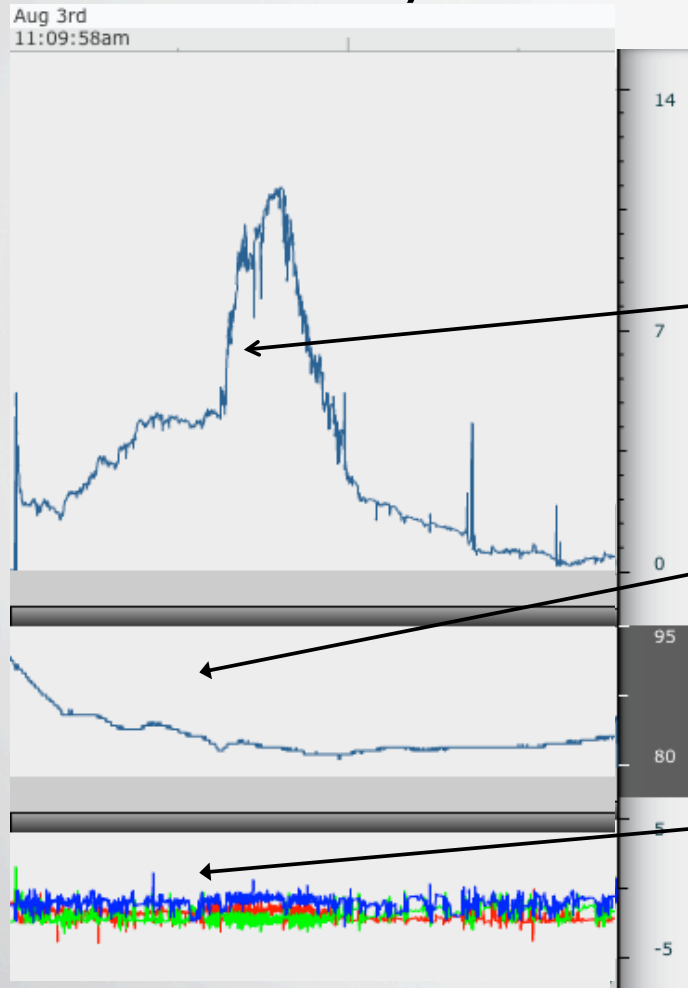


A glowing blue ECG line is plotted on a dark blue grid background. The line starts with a small peak, followed by a deep trough, then a very tall, sharp peak. This is followed by a smaller peak, a trough, and then a final, smaller peak that ends with a bright star-like glow.

“Emotion is the fourth vital sign.”
- Peter Weinstock, MD PhD

Detecting drug response: objective biomarkers

collaboration: E. Boyer, Umass.



Skin conductance shows huge sympathetic nervous system surge

Skin temperature shows drop w/vasoconstriction

3-axis accelerometer shows repetitive motion

Exp: Cocaine, adult male, user for 20 years

Clinical studies and research can now easily use emotion physiological data from real life

Clinical Trial:
Rett Syndrome



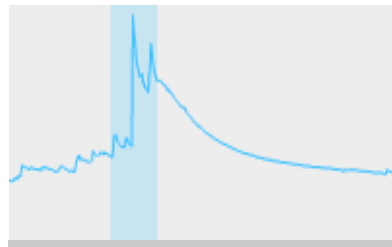
Children's Hospital Boston

Quantifying **objective**
changes in: *Seizures,*
Sleep, Stress, and
Repetitive Movements

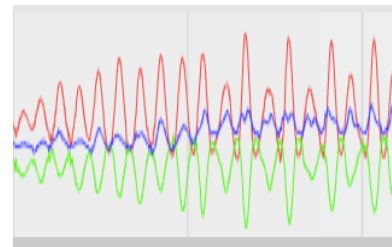
Objective Measures



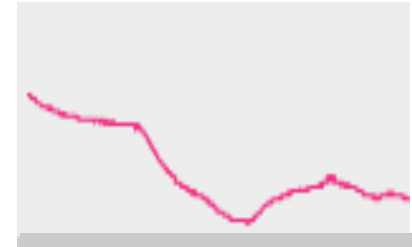
Affectiva Q Sensor



Skin conductance



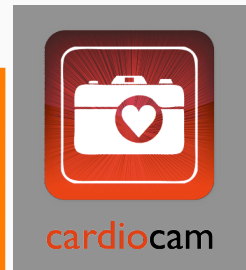
3-axis acceleration



Skin temperature

Emotion: Two main dimensions

Arousal



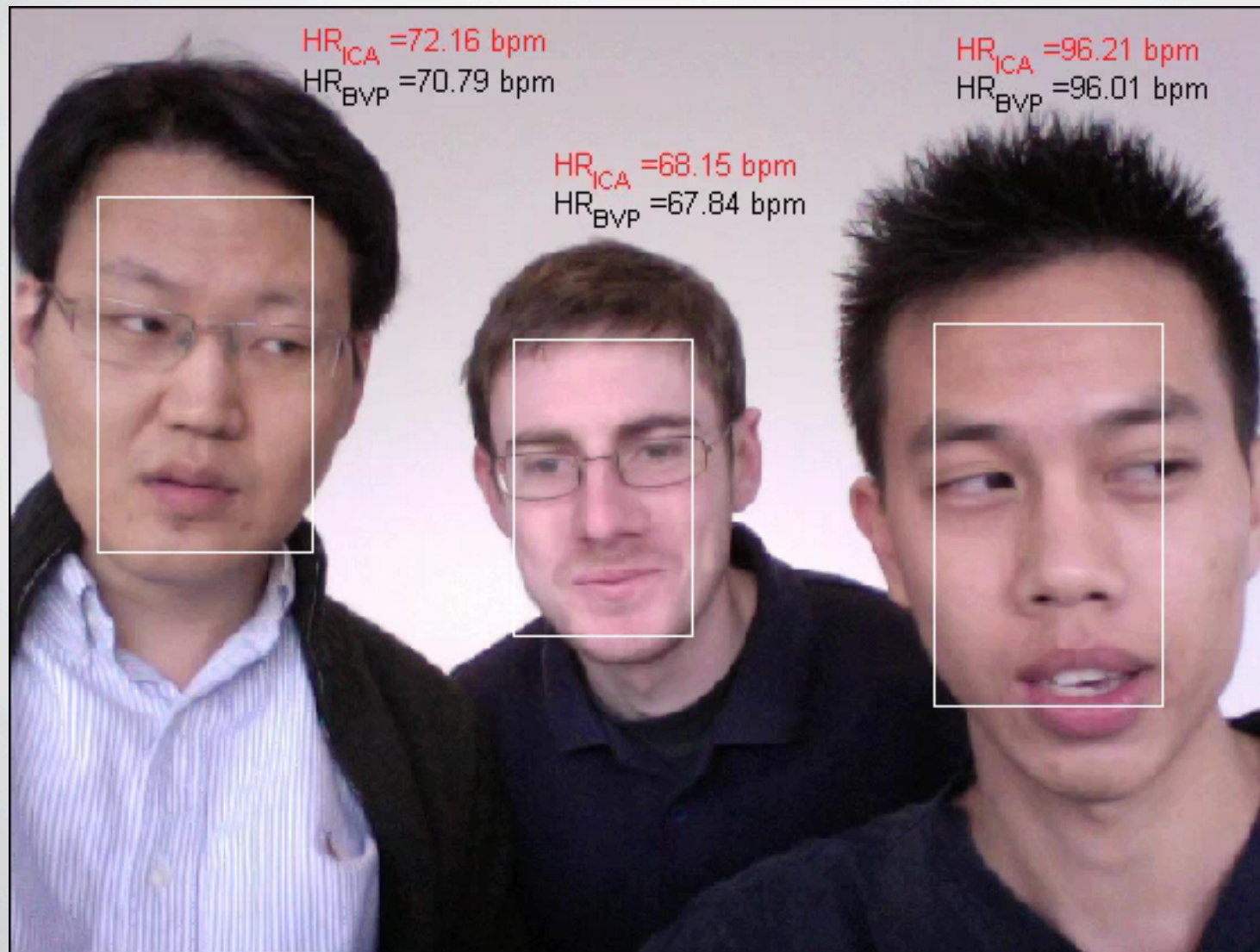
Cardiocam: Reading heart-rate, respiration and more with an ordinary web cam *(Poh, McDuff, Picard)*



POPSCI **THE
FUTURE
NOW**

Won Popular Science's
“Top Ten Inventions of 2011”

Cardiocam: Heart Rate Measurements with your webcam



Non-contact, automated cardiac pulse measurements using video imaging and blind source separation.

Ming-Zher Poh^{1,2,*}, Daniel J. McDuff²,
and Rosalind W. Picard²

(C) 2010 OSA

10 May 2010 / Vol. 18, No. 10 / OPTICS EXPRESS 10762

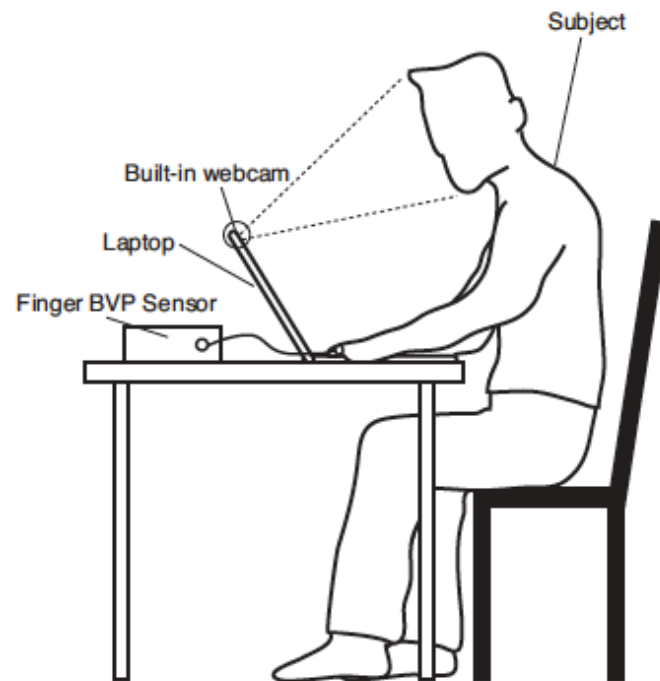
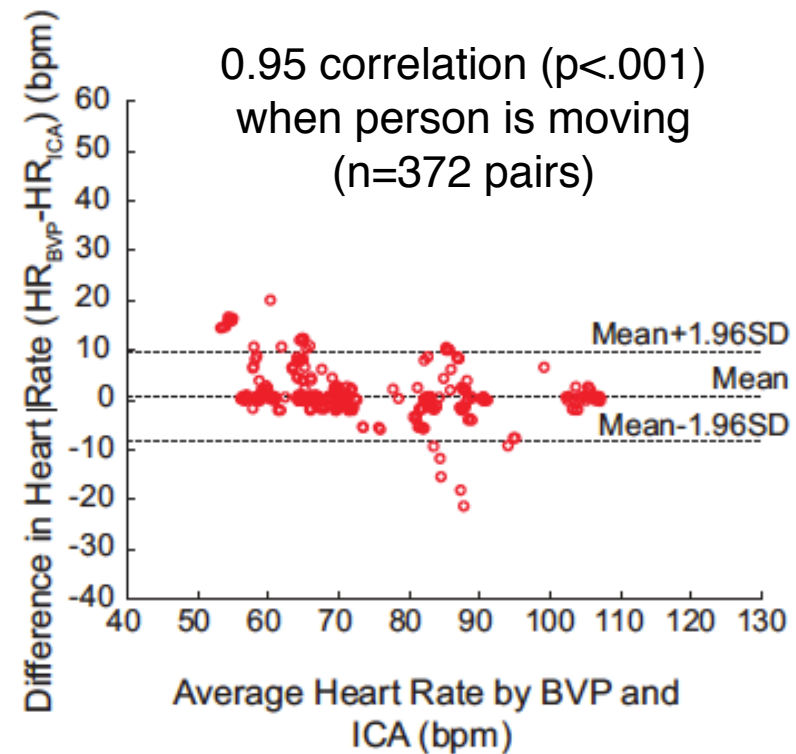


Fig. 1. Experimental setup.

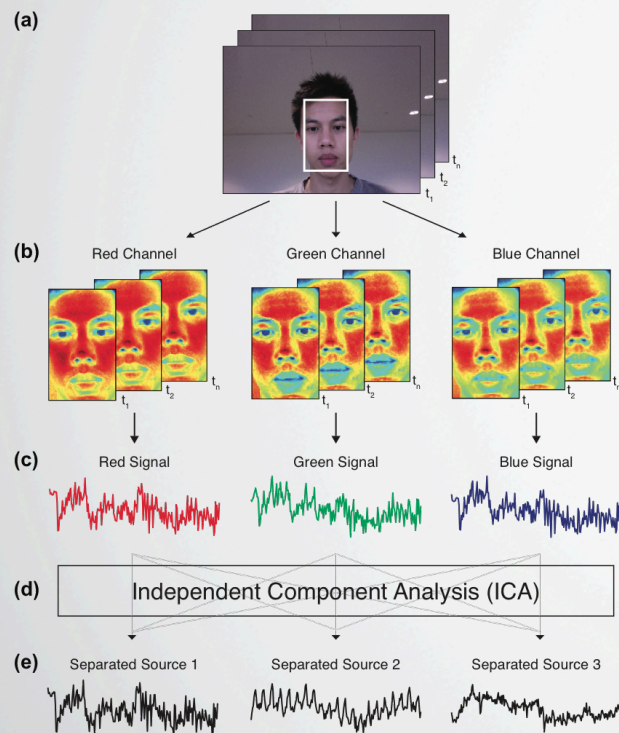




cardiocam

CARDIOCAM: NON-CONTACT PHYSIOLOGICAL SENSING

M. Z. Poh, D. J. McDuff and R. W. Picard, *IEEE Trans Biomed Eng*, 2010



Parameters measured:

Respiration rate

Heart rate variability (HRV) indices

Low frequency power (LF)

High frequency power (HF)

LF/HF

**CIMIT Prize for Primary
Healthcare**

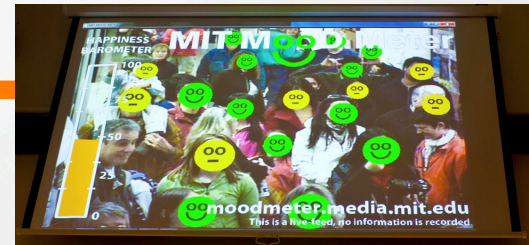
Popular Science
Top Ten Inventions of 2011



Emotion: Two main dimensions

Arousal

Valence



MIT MoodMeter

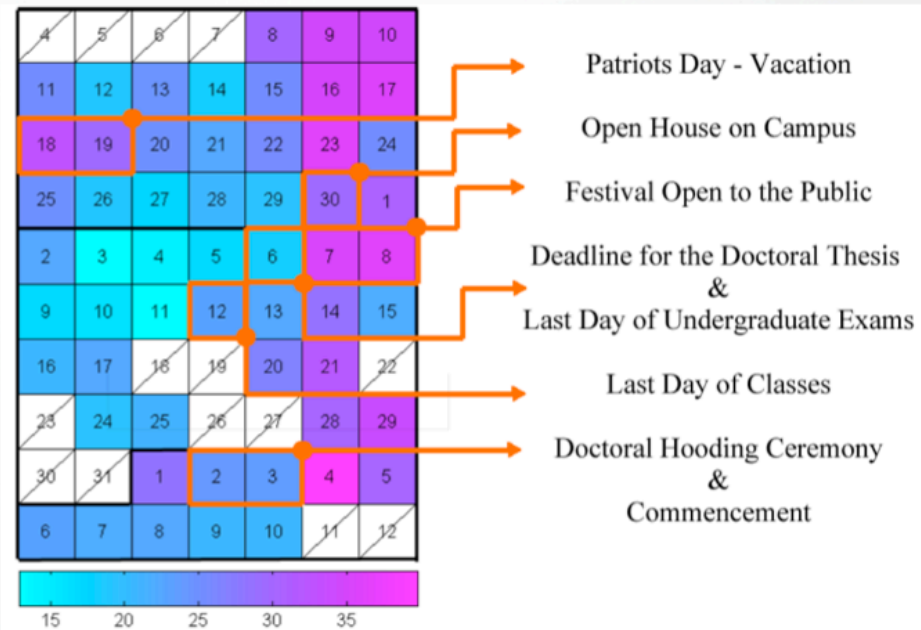
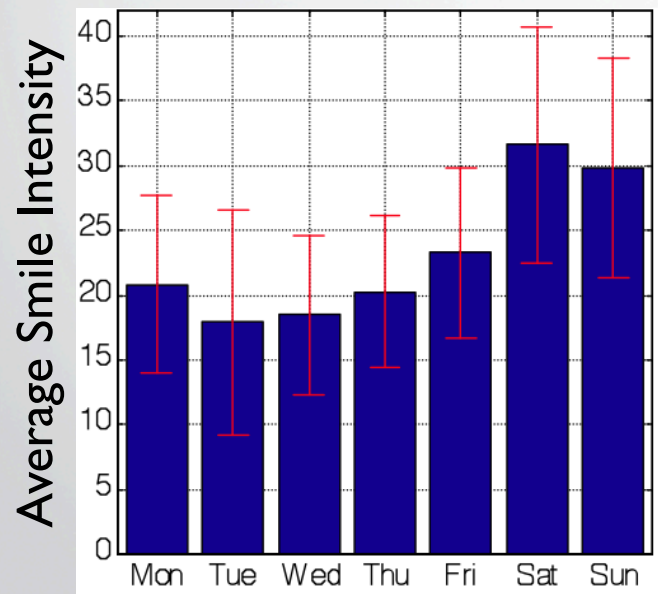
Hernandez, Hoque, Drevo, Picard, "Mood Meter: Counting Smiles in the Wild"
Proc. UBIComp 2012, Pittsburgh, PA

MIT MoodMeter



New insights from MIT MoodMeter

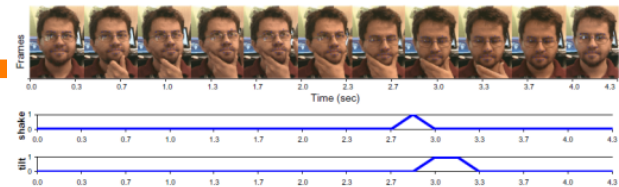
Javier Hernandez-Rivera, Ehsan Hoque, Rosalind Picard



Emotion: Two main dimensions

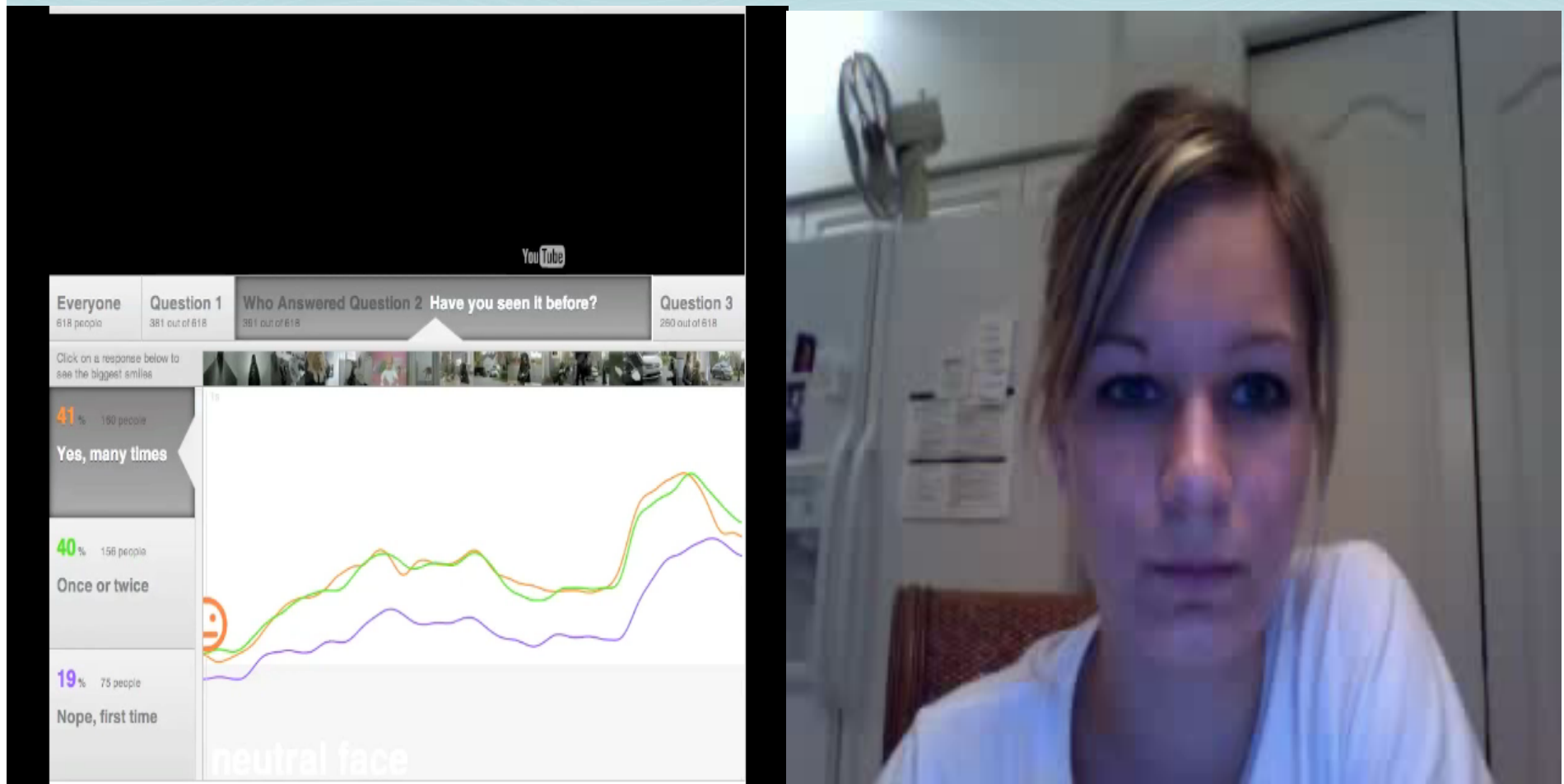
Arousal

Valence



Affdex Facial Coding

Affectiva.com: try demo live with your webcam



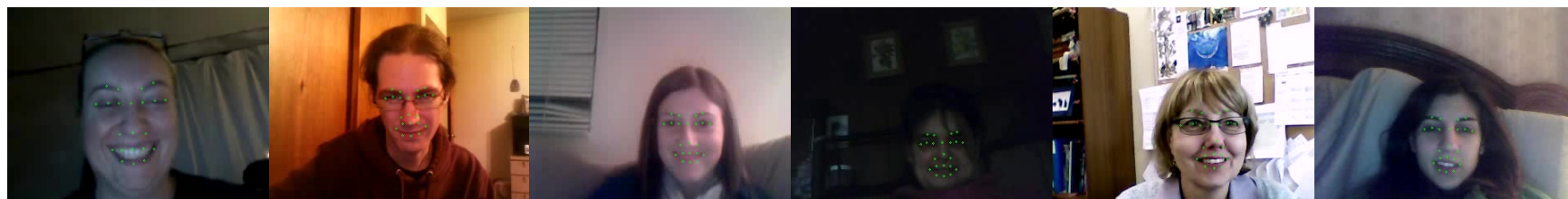
McDuff, el Kaliouby, Picard, "Crowdsourcing Facial Responses to Online Videos," to appear in the IEEE Transactions on Affective Computing, 2012

Affdex | Raising Scientific Standards

The Score “AUC” combines correct answers with penalty for false ones.



Academic Science: Posed expressions, no head movement; well lit, high res, small scale. Academic state of the art results: ~90% AUC on posed expressions, ~65% AUC on real-world expressions



High intensity Subtle intensity Blurry video Dark, small face Cluttered Asymmetric

Affdex brings even better science results $\geq 90\%$ AUC on posed expressions, $\geq 80\%$ AUC on real-world expressions

Affdex | Facial Coding at Scale



Australia
Brazil*
China*
France
Germany
India*
Israel
Italy
Japan
Mexico
Panama
Poland
Turkey
UK*
USA*

★ Validation study

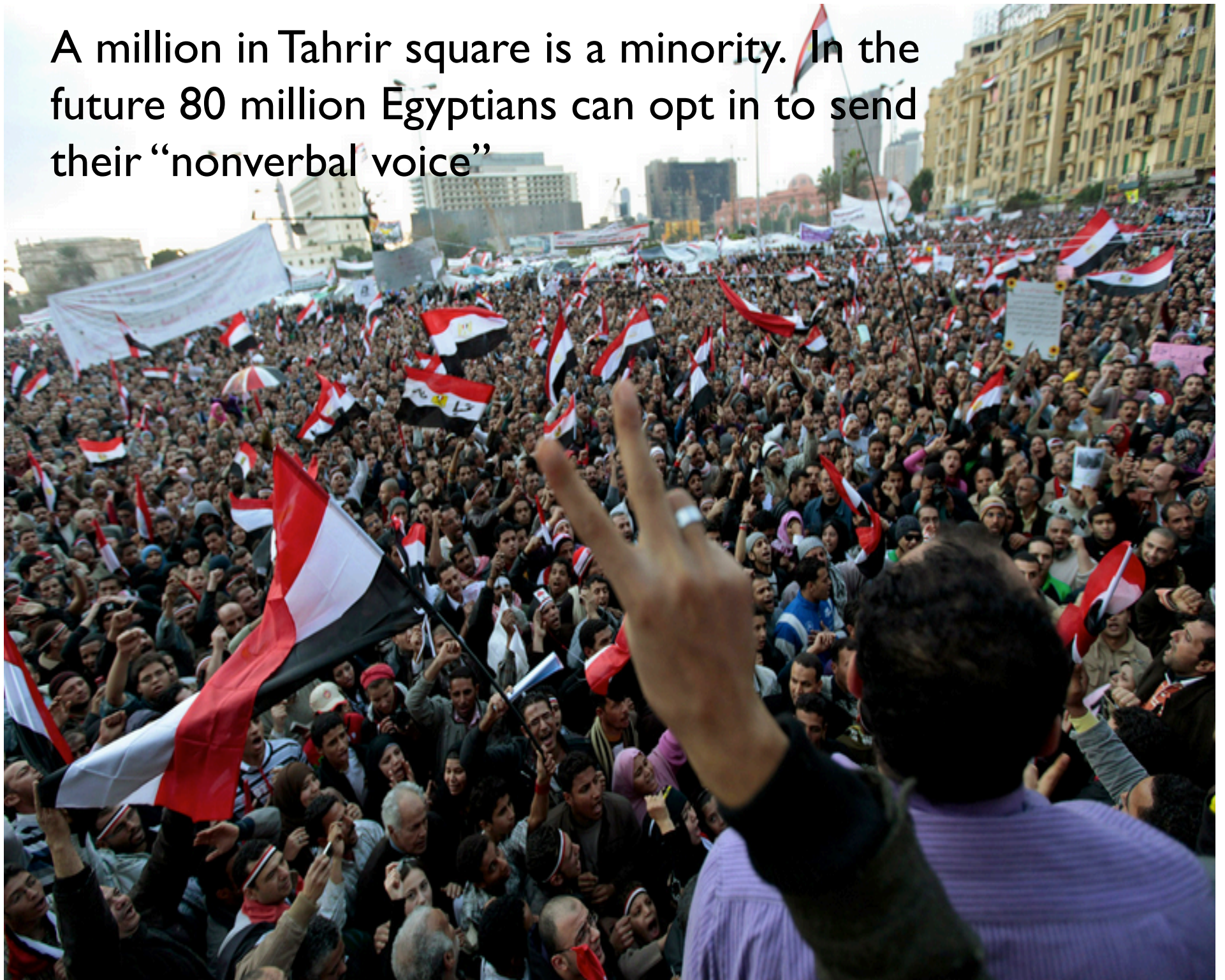


<http://www.bbc.co.uk/news/magazine-17733455>

affective 

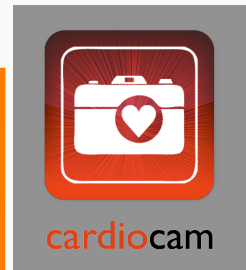


A million in Tahrir square is a minority. In the future 80 million Egyptians can opt in to send their “nonverbal voice”

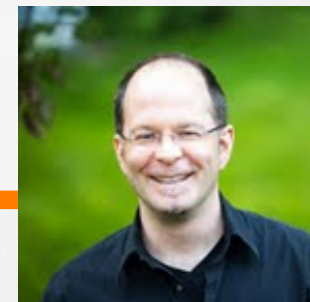


Information/software/publications: <http://affect.media.mit.edu>

Q Sensor:
sales@affectiva.com
info@affectiva.com



Cardiocam iPhone
app download:
cardio.com



Try demo of Affdex:
Affectiva.com



ANALYTICS

Data Scientist

ENGINEERING

Principal Software Engineer

QA Engineer

Software Engineer

PROFESSIONAL SERVICES

Professional Services Manager

Statistician

Q SENSOR

DSP Engineer

Hardware Quality Engineer

Support Lead - Q Sensor

Technical Leader - Q Team

VISIONEERING

Computer Vision Scientist

Director - Computer Vision

Jobs!

Affectiva.com
Waltham, MA

Meet: Jason

