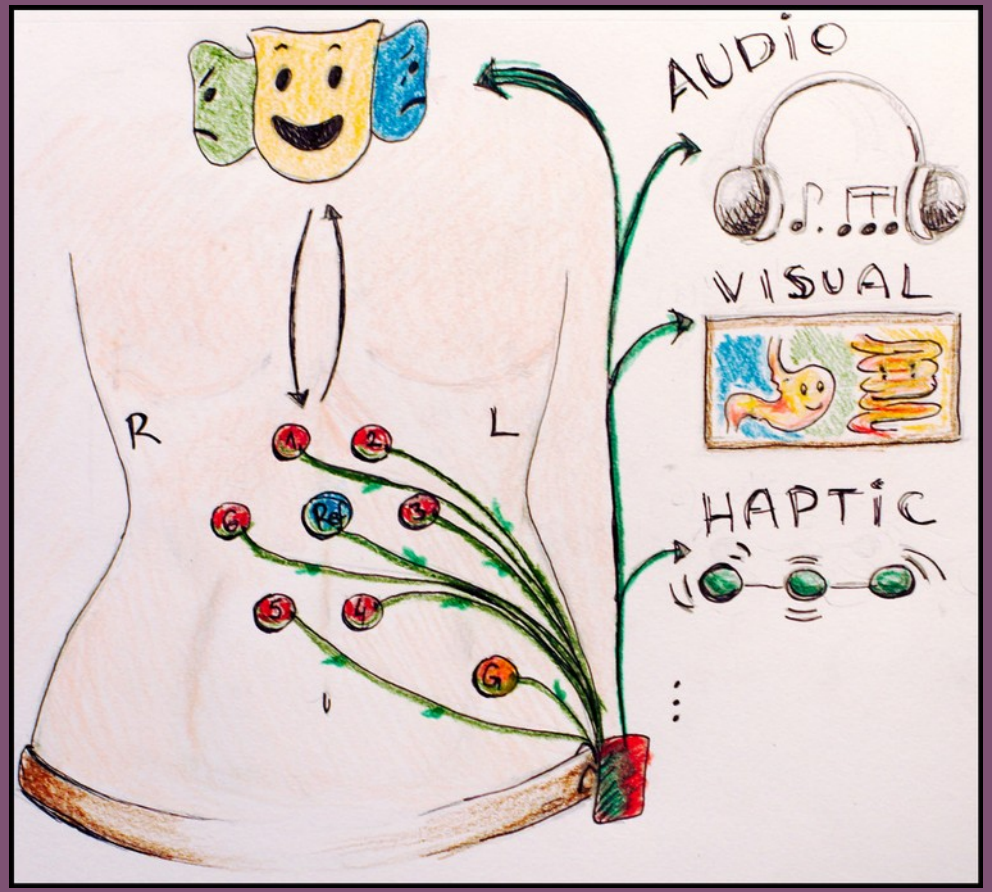
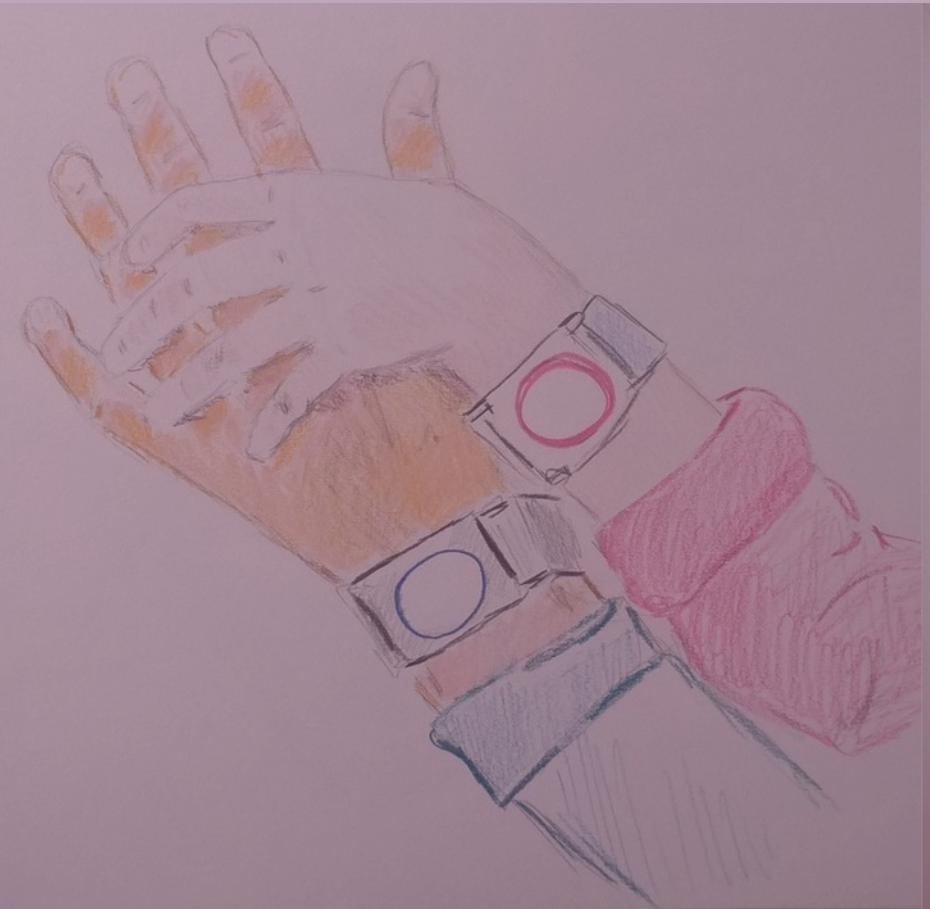
Considering Gut Biofeedback for Emotion Regulation



Jelena Mladenovic
Inria Bordeaux, France
Lyon Neuroscience Research Center, France

Physiological sensors in HCI

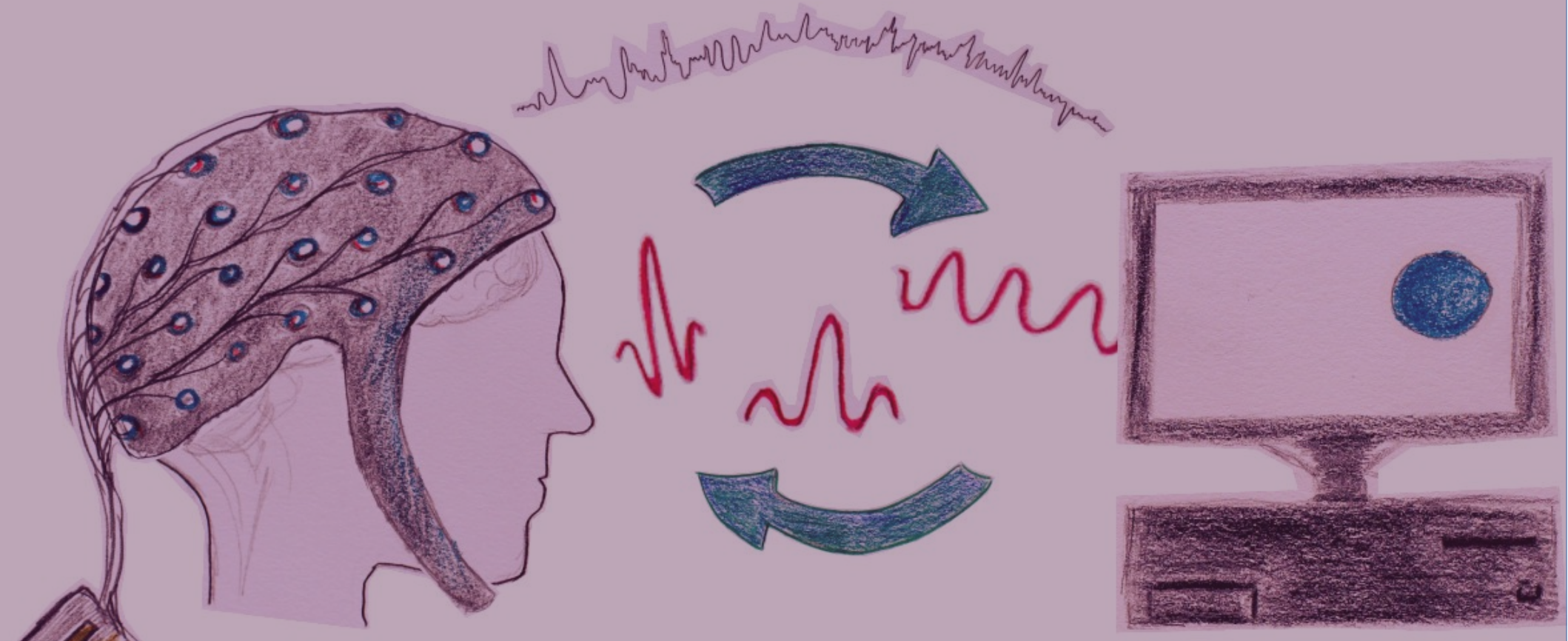
Need for Wearable, Robust, Affordable



Physiological sensors in HCI

Application :

(i) direct device manipulation – BCI



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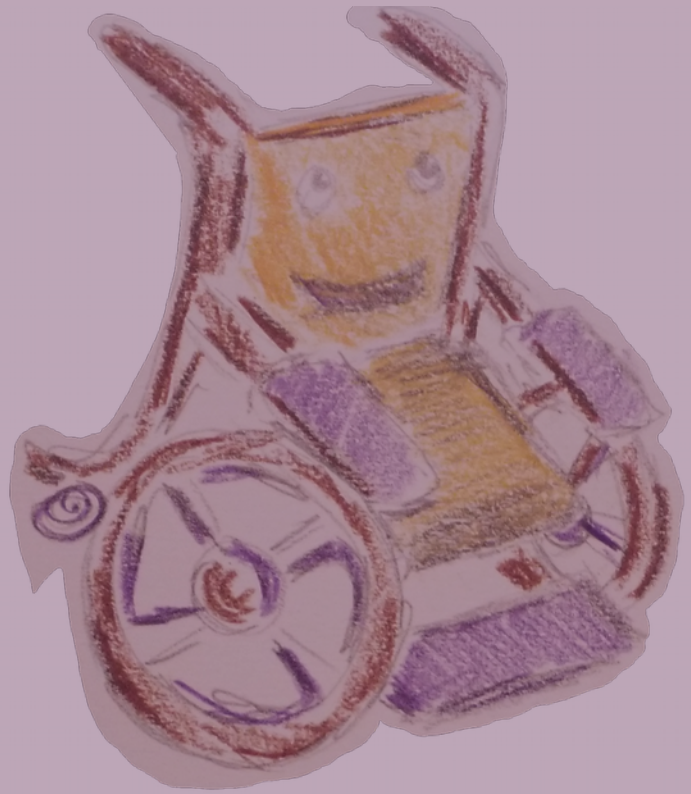
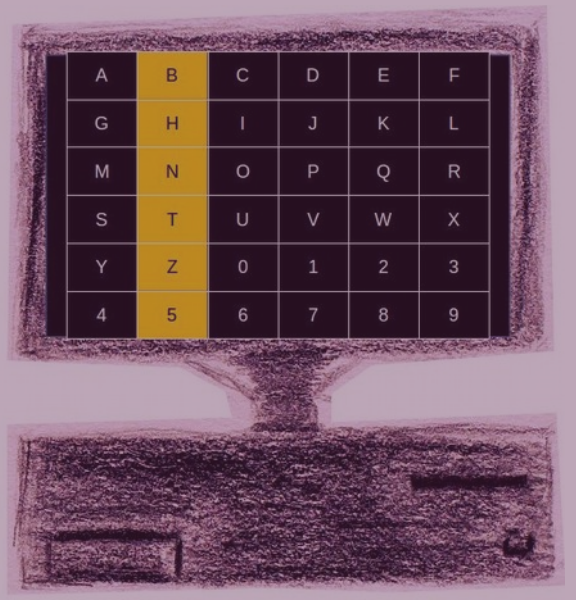
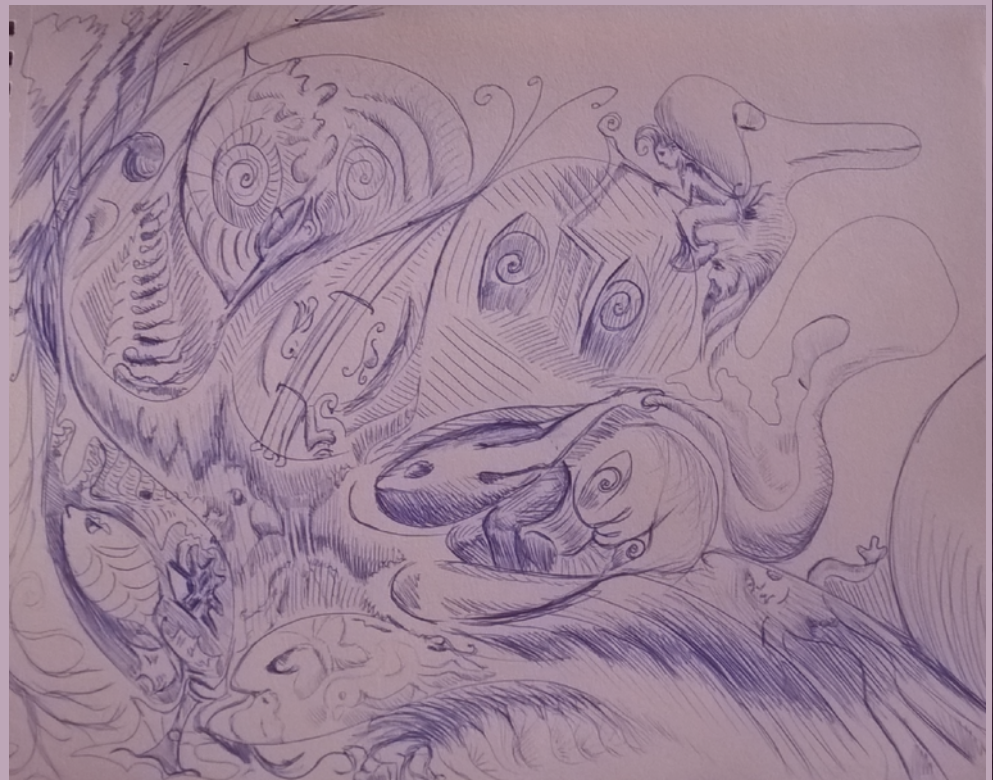
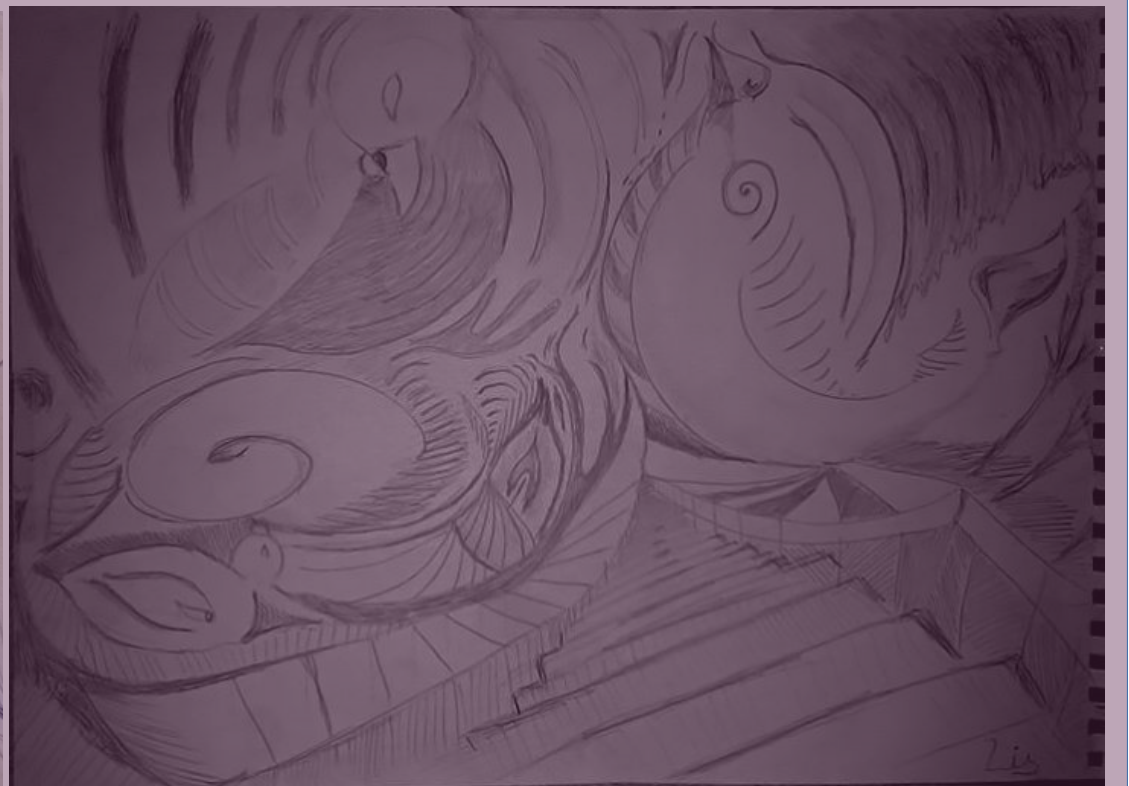




Physiological sensors in HCI

Application :
(ii) implicit task adaptation

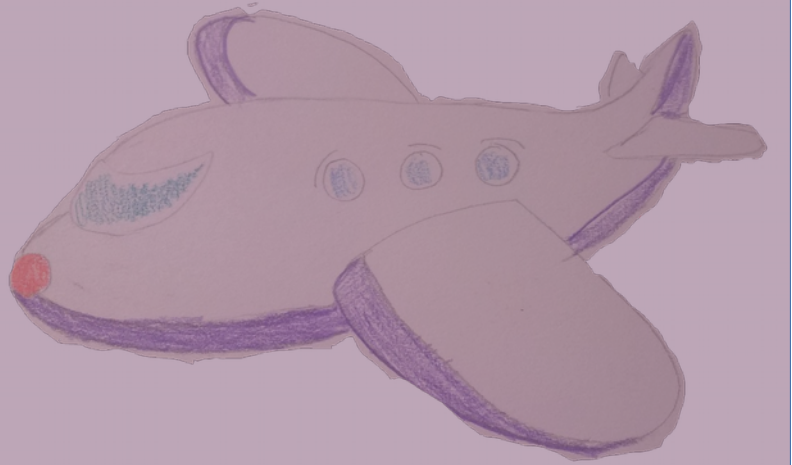




Physiological sensors in HCI

Application :

(ii) implicit task adaptation – immersion, comfort, safety



Dehais F. et al. (2018) EEG-Engagement Index and Auditory Alarm Misperception: An Inattentional Deafness Study in Actual Flight Condition. *Advances in Intelligent Systems and Computing*

Physiological sensors in HCI

Application :

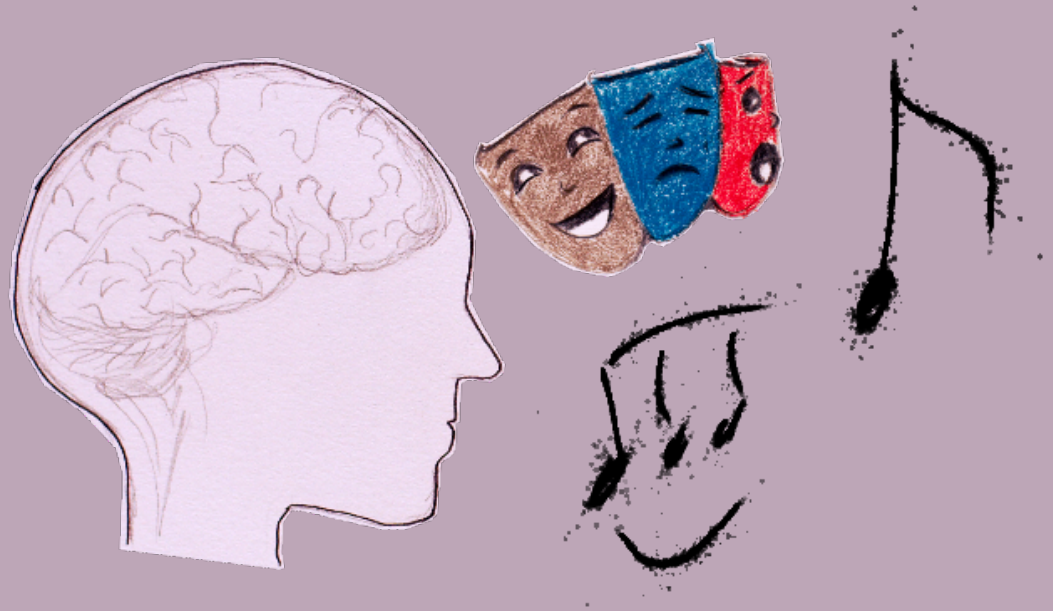
(iii) biofeedback – well-being

Roo, et al. Inner Garden: Connecting Inner States to a Mixed Reality Sandbox for Mindfulness. CHI '17

Physiological sensors in HCI

Application :

(iv) affective computing



Physiological sensors in HCI

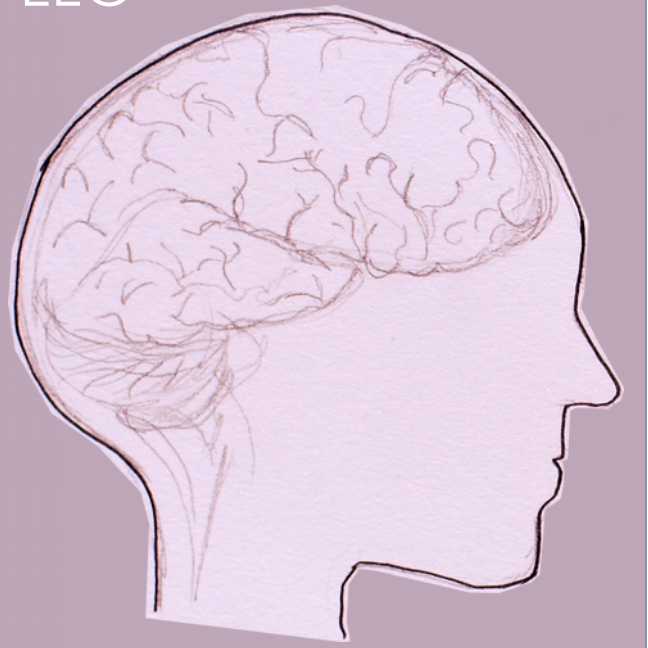
Devices:

EDA,

ECG,

Respiration,

EEG



Physiological sensors in HCI

1. Wearable, Robust, Affordable
2. Application :
   - (i) biofeedback – well-being
   - (ii) implicit task adaptation – immersion, comfort, safety
   - (iii) direct device manipulation – **Emotional** BCI

NO GUT

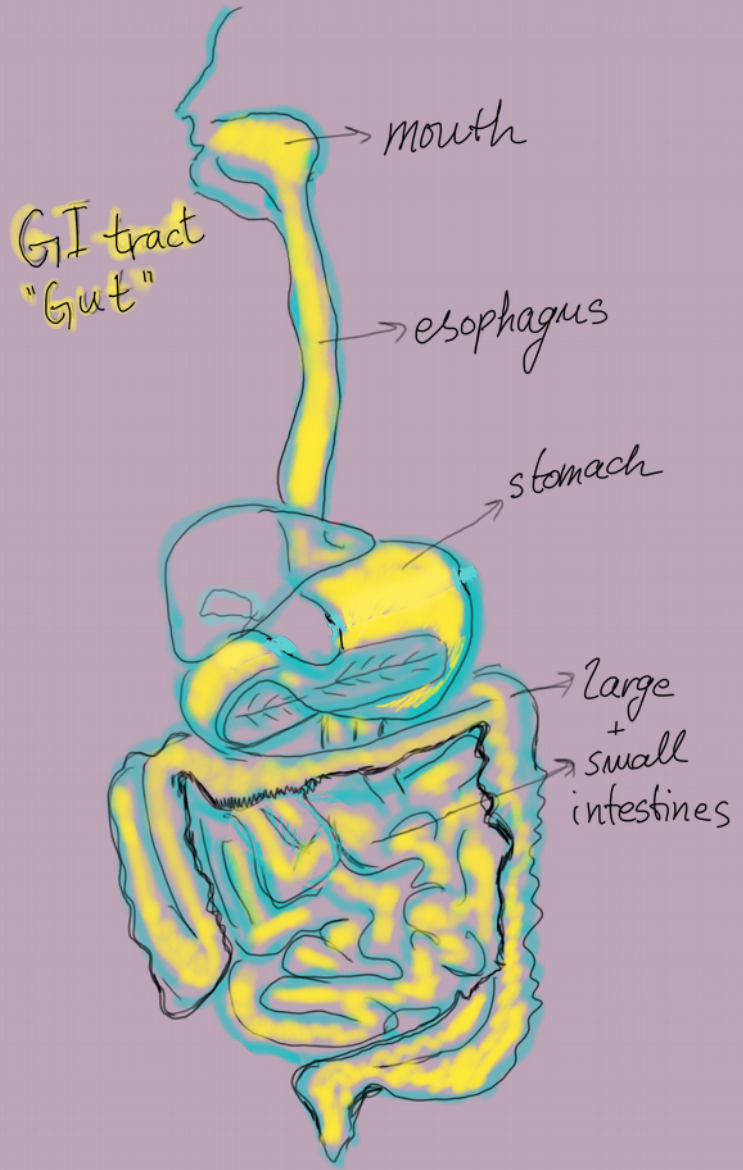
The Gut

Changes in gut influence behavior, mood, motivation…

“Nervous stomach”,
“Butterflies in the stomach”,
“A gut feeling”

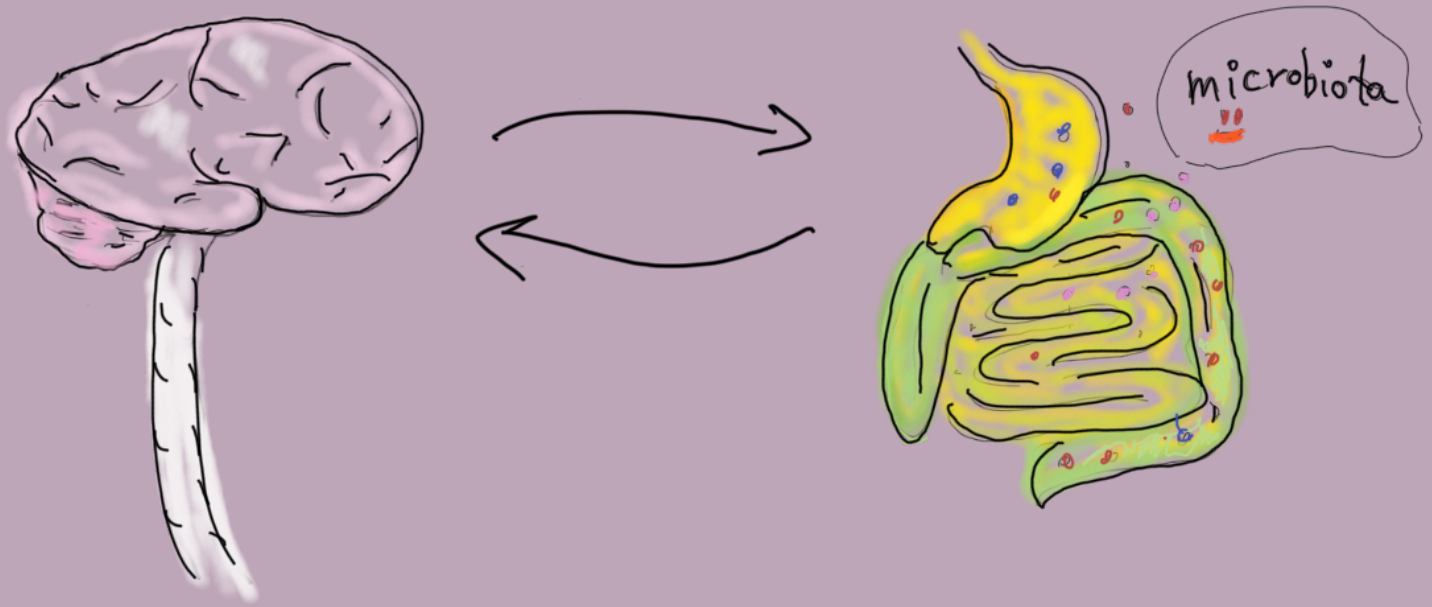
The Gut

Gastro-Intestinal tract (GI) :
mouth, esophagus,
stomach and intestines.



The Gut

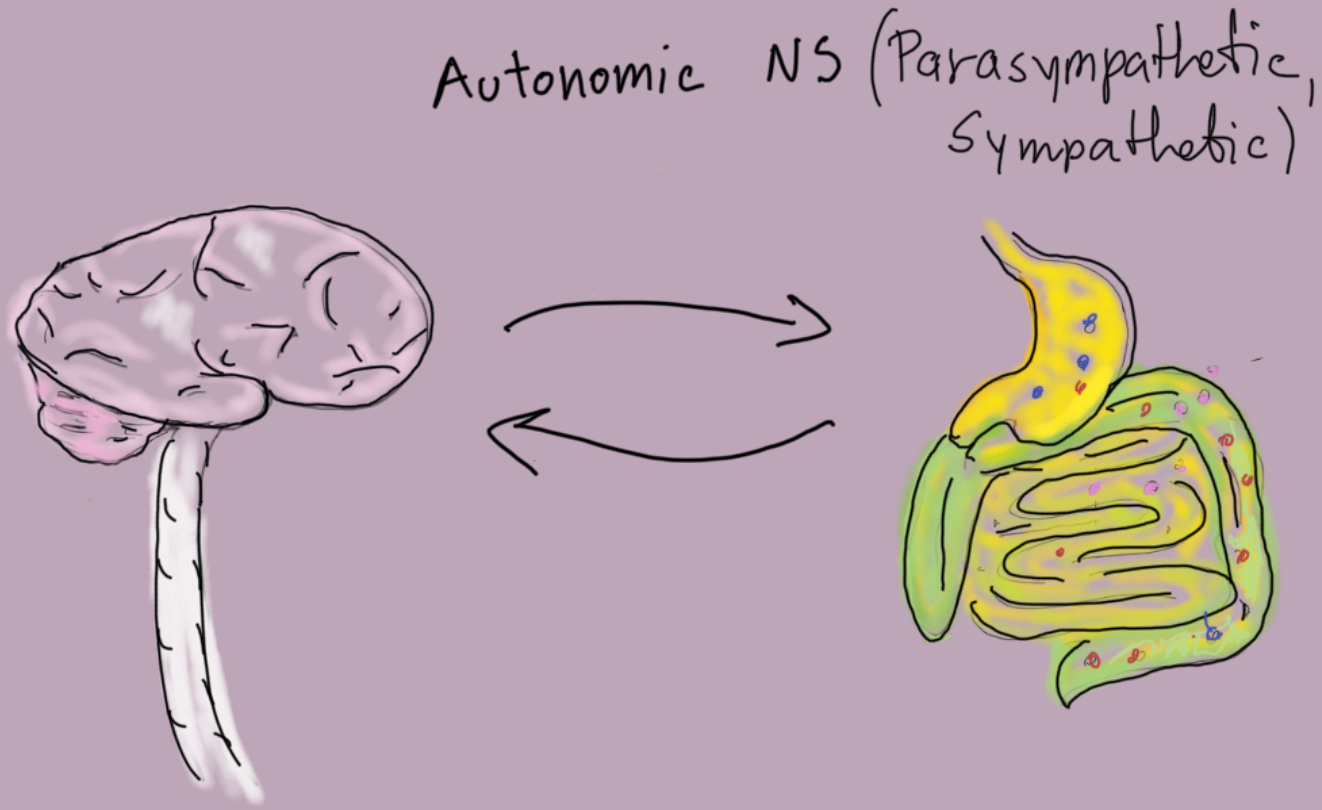
Largest number of microbiome is in the gut,
they Influence behavior



The Gut

Gut-brain axis – a bidirectional communication

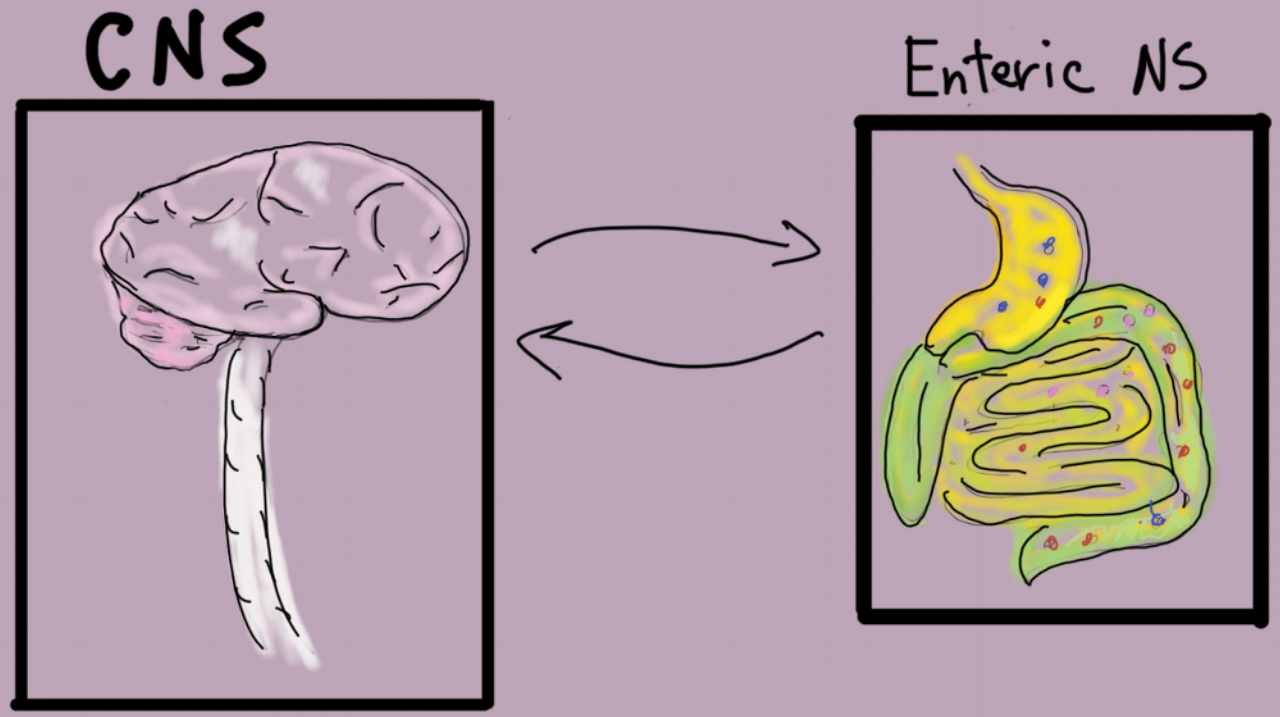
Parasympathetic, Sympathetic NS



The Gut

Gut-brain axis – a bidirectional communication

Enteric system (second brain) – over 500 milion nerves

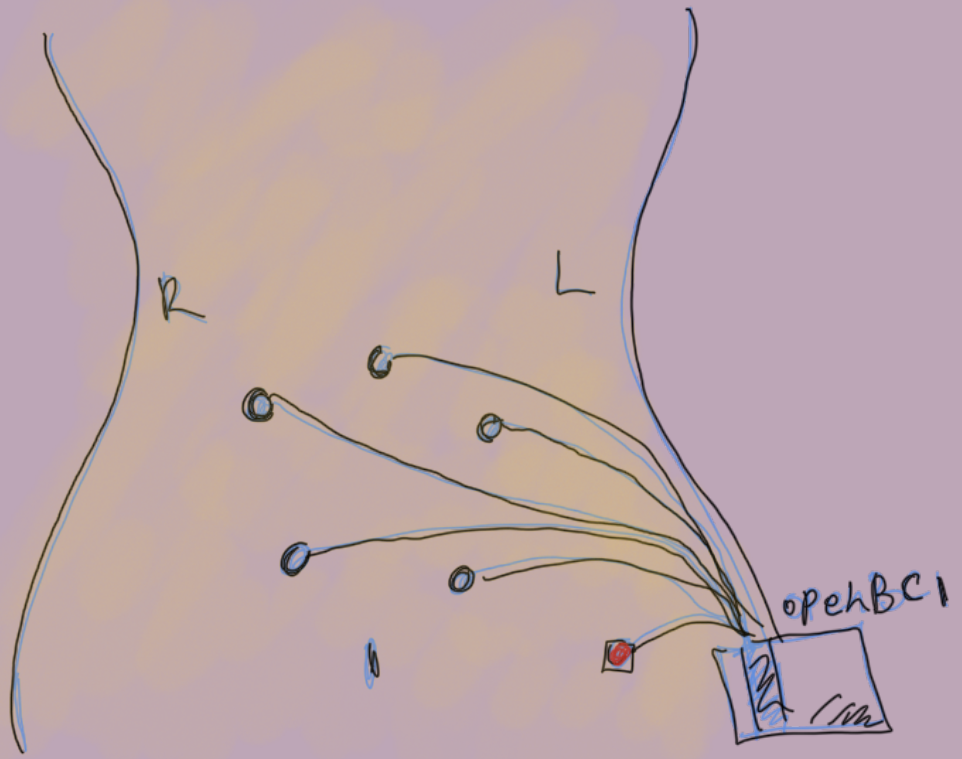



Gut activity
1
2
4
3
per minute
fast lane
1
2
3
per minute
normal
1
2
per minute
slow lane
4-9 = tachygastria,
~ 3 = normogastria,
< 3 = bradigastria
Gastric myo-electrical activity creates gut contractions

The Gut sensor – EGG

Reliable, Non-invasive (as for EEG)

OpenBCI



Gharibans A. ... Coleman, T (2018). Artifact Rejection Methodology Enables Continuous , Noninvasive Measurement of Gastric Myoelectric Activity in Ambulatory Subjects.
Scientific Reports

EGG for emotion

Horror, stress, disgust – tachygastria (fast contractions)

J Yin et al. 2004. Inhibitory effects of stress on postprandial gastric myoelectrical activity and vagal tone in healthy subjects.

Neurogastroenterology & Motility.

EGG for emotion

J Yin et al. 2004. Inhibitory effects of stress on postprandial gastric myoelectrical activity and vagal tone in healthy subjects.

Neurogastroenterology & Motility.

Relax – slower gut contractions

Biofeedback

Externalize internal body activity

Biofeedback

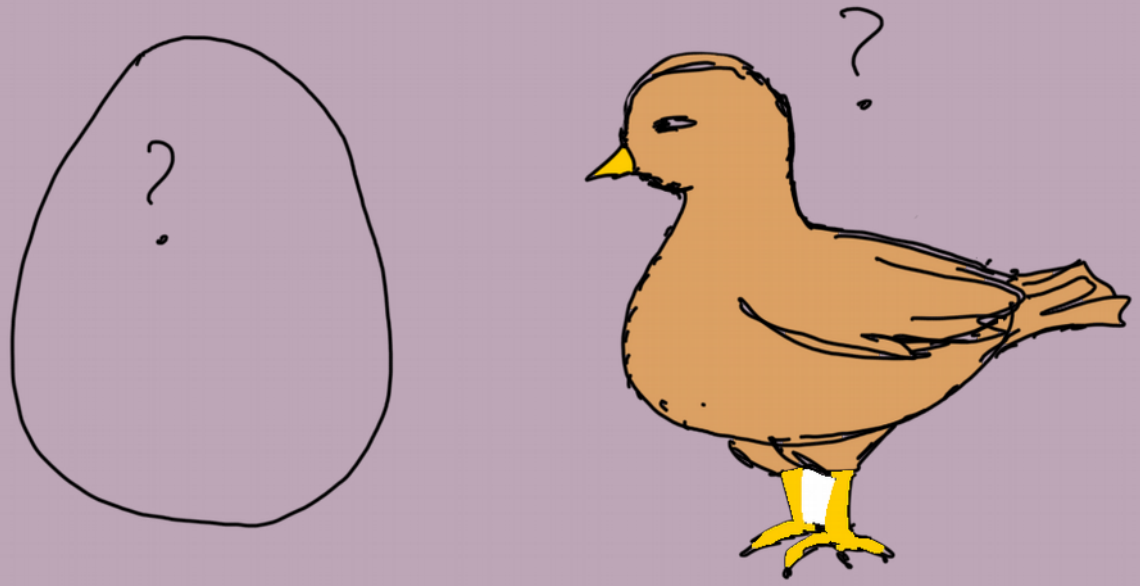
Breathing exercises with tangible, ambient biofeedback

Mladenovic, Frey, Cauchard.
Dišimo: Anchoring Our Breath.
CHI '18 Interactivity

Biofeedback

Assumption :

- physiological changes interpreted as emotion.
- regulating physiology regulates emotion.



Emotion and physiology

James Lang theory – there is no emotion without physiology

William James. 1884. What is an emotion? Mind

Emotion and physiology

Emotion is critical for decision making;

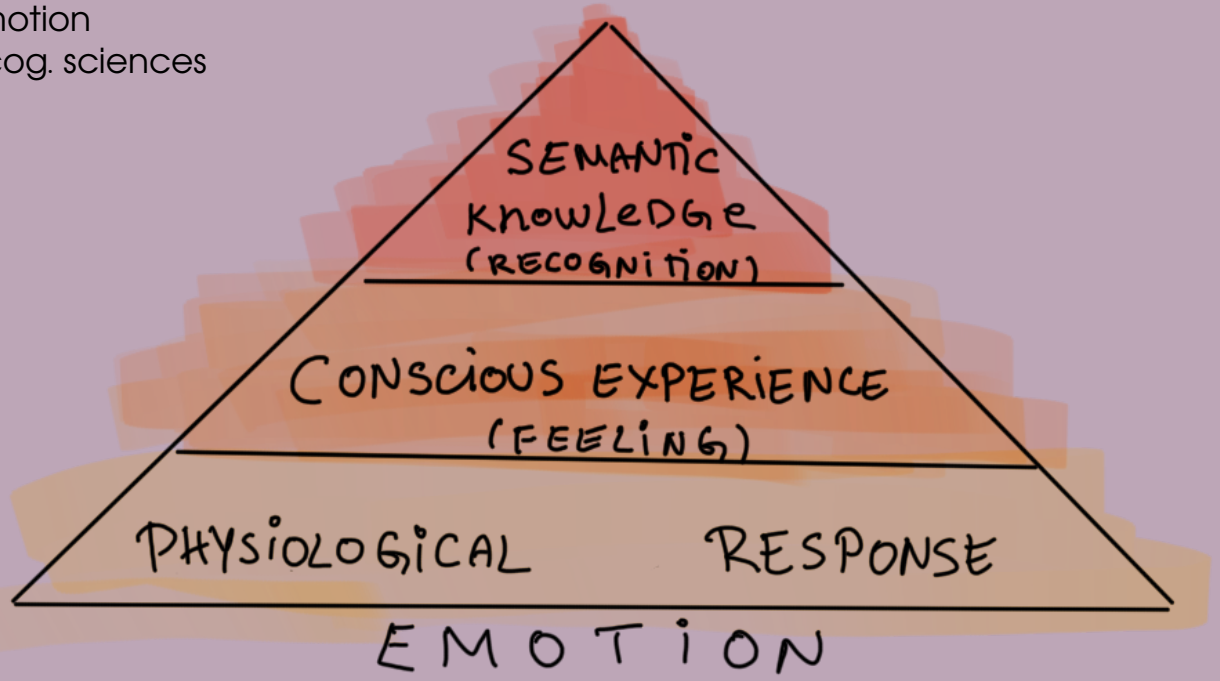
"For us, then, in the beginning it was being, and only later was it thinking."

Damasio, A. R. (1994). Descartes' error: emotion, reason, and the human brain. *Putnam Publishing*

Emotion and physiology

1. physiological changes = response
2. conscious experience of emotions = feelings
3. semantic knowledge = recognition

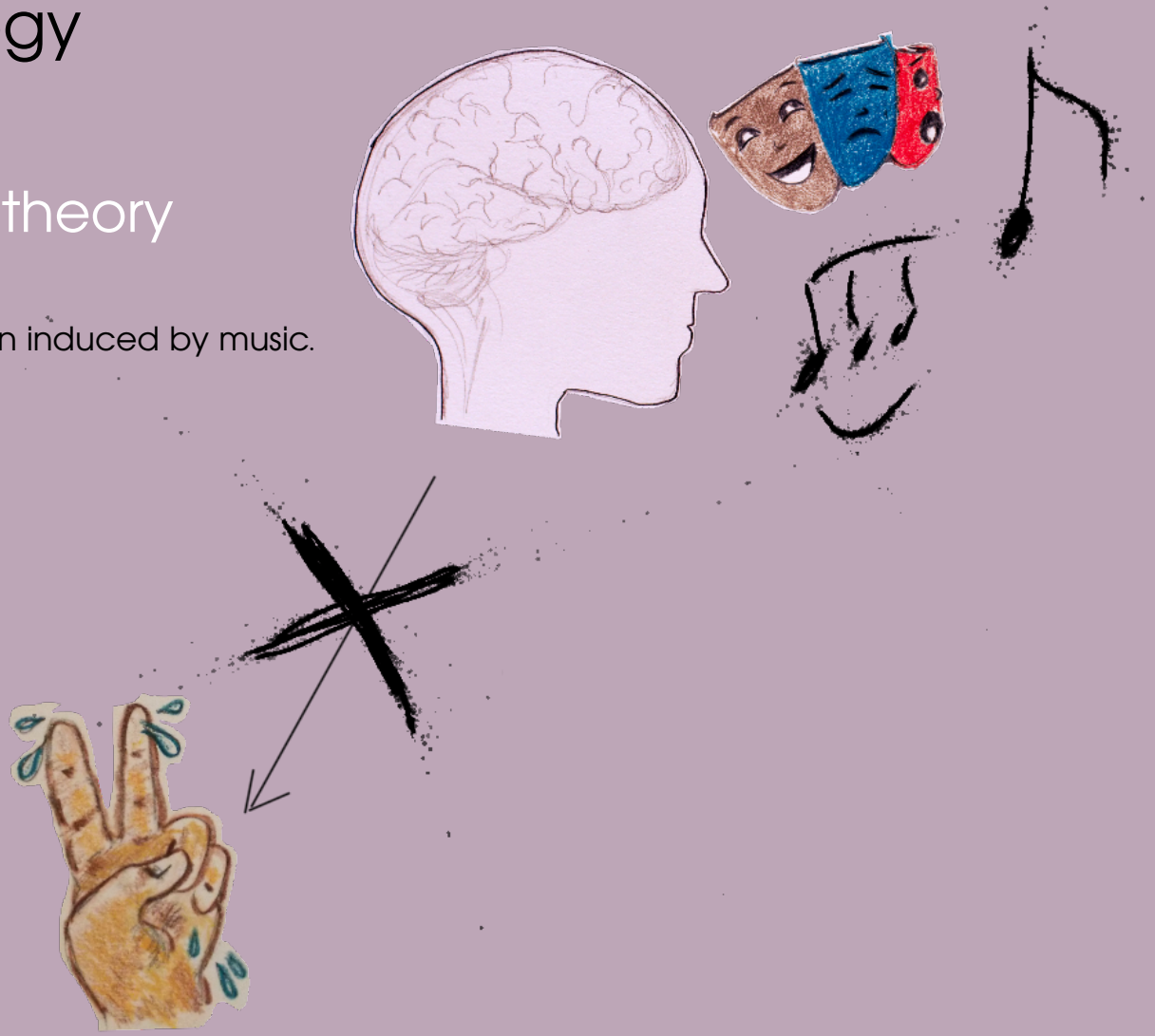
Tsuchiya and Adolphs. 2007. Emotion and consciousness. Trends in cog. sciences



Emotion and physiology

Experiment disproving JL theory

Johnsen, Tranel, ... Adolphs. 2009.
A neuroanatomical dissociation for emotion induced by music.
International Journal of Psychophysiology



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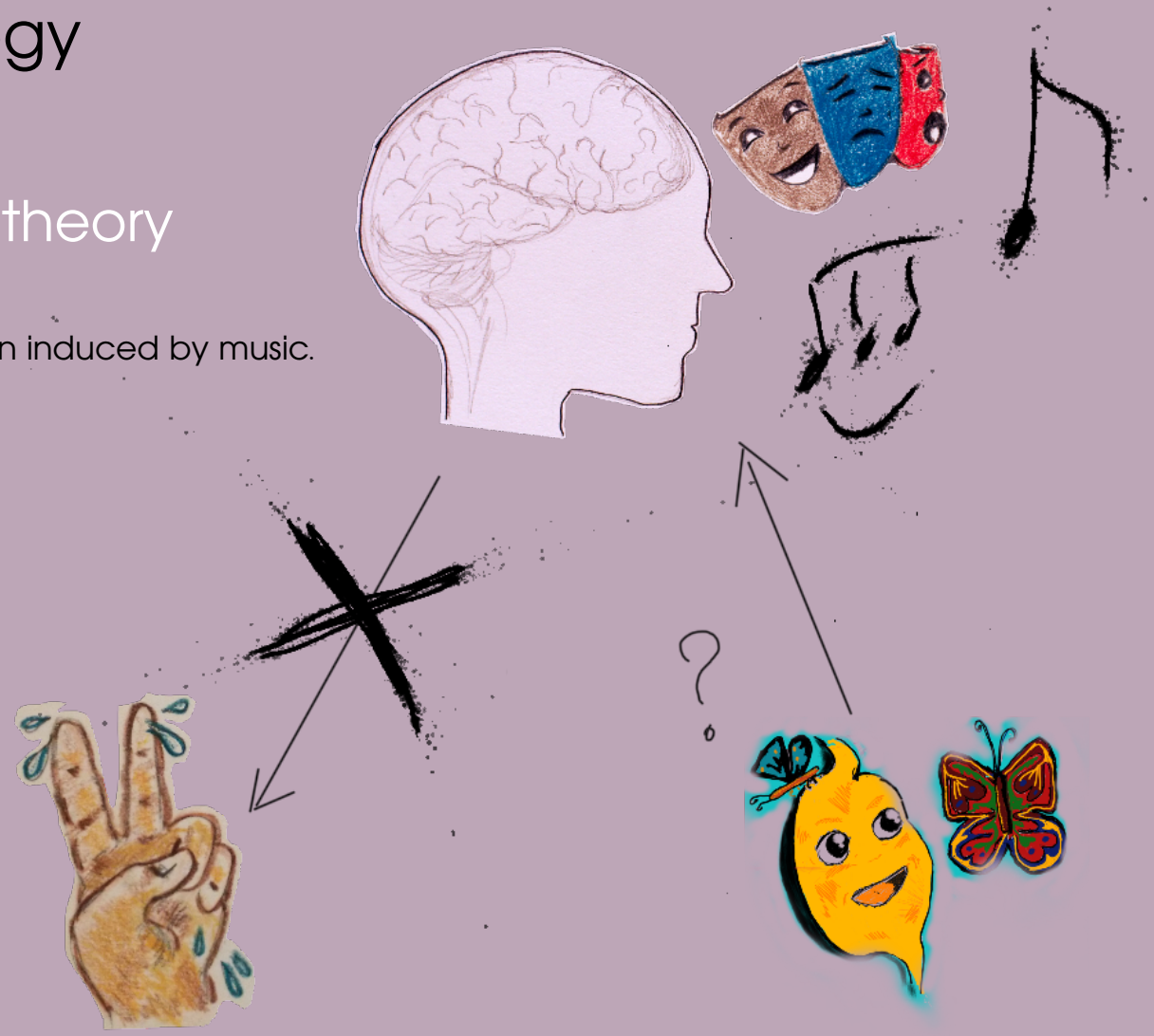
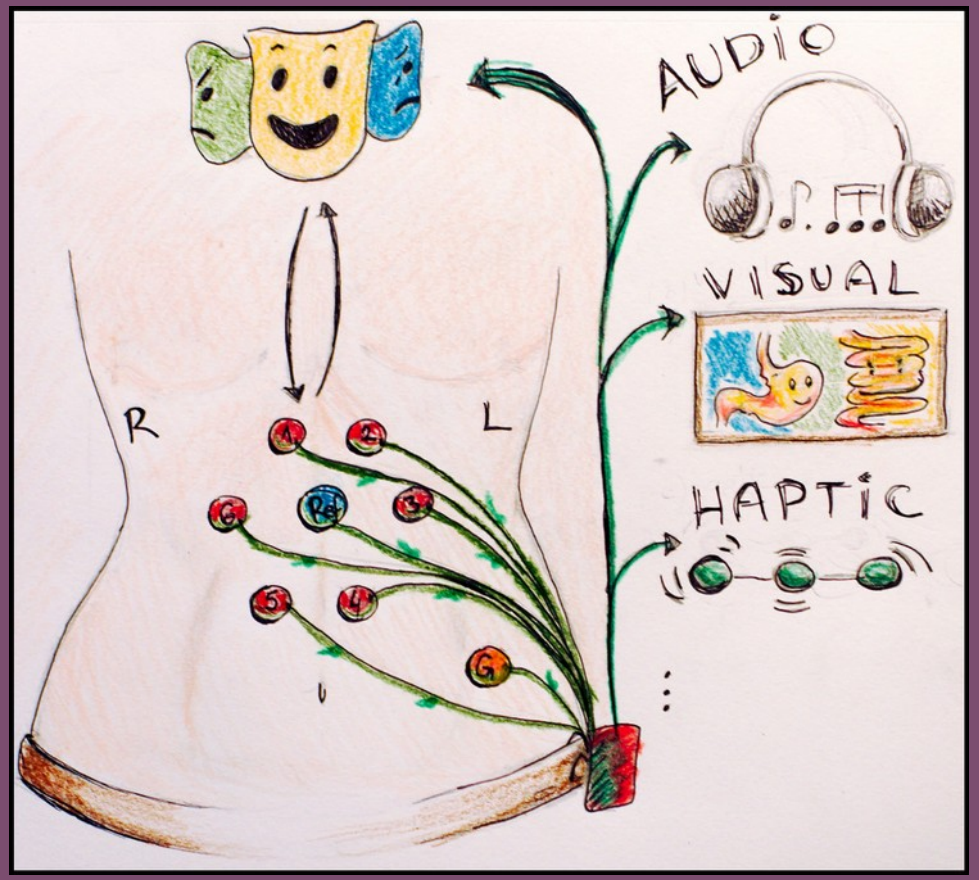
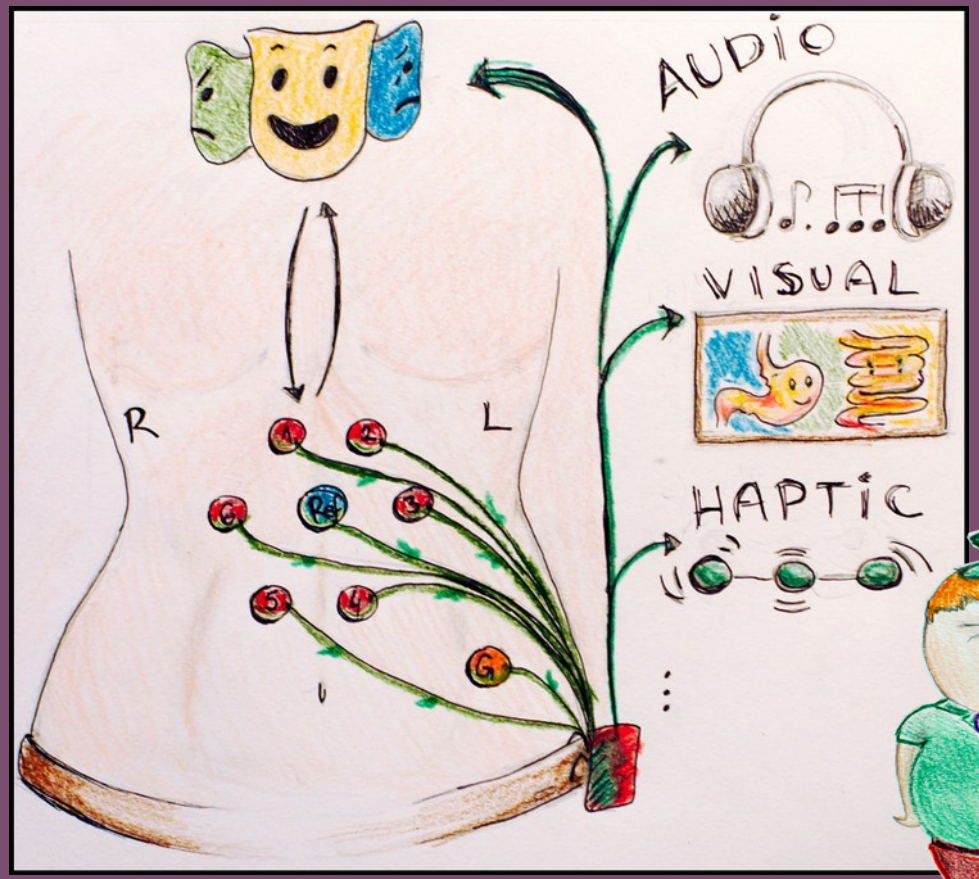


Considering Gut Biofeedback as Emotion Regulation



- Physiology is often used in HCI, but still no Gut
- Gut = GI tract, measure with EGG
- Biofeedback
- Emotion and Physiology, debate

Considering Gut Biofeedback as Emotion Regulation



- Physiology is often used in HCI, but Gut is neglected
- Gut = GI tract, measure with EGG
- Biofeedback
- Emotion and Physiology, debate

THANK YOU.

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website: http://jmladeno.net