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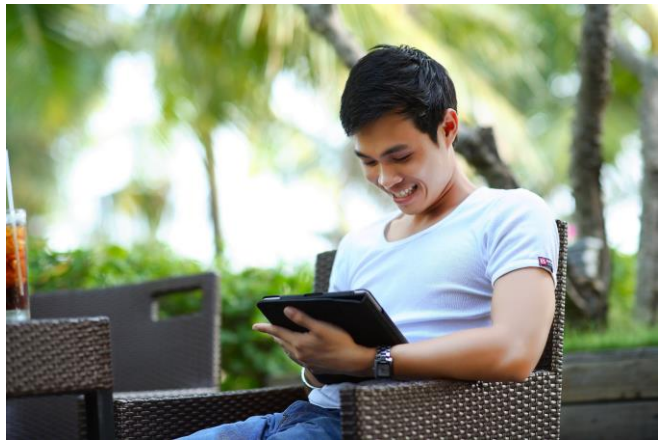
COMP 3647
Human-AI Interaction Design

Topic 4:
Emotion and Affect

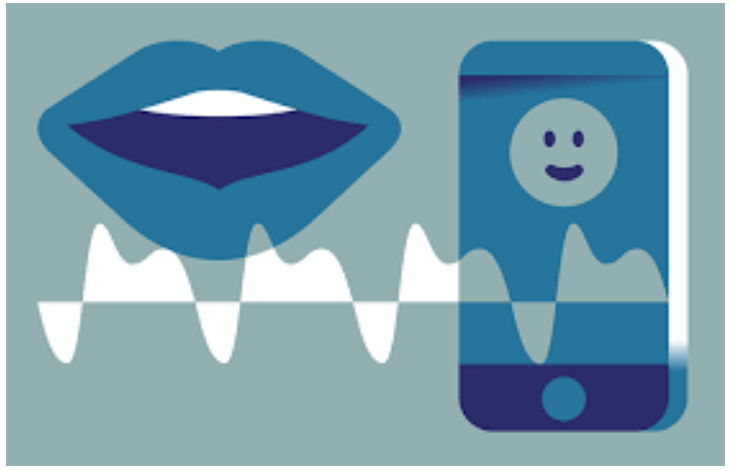
Prof. Effie L-C Law

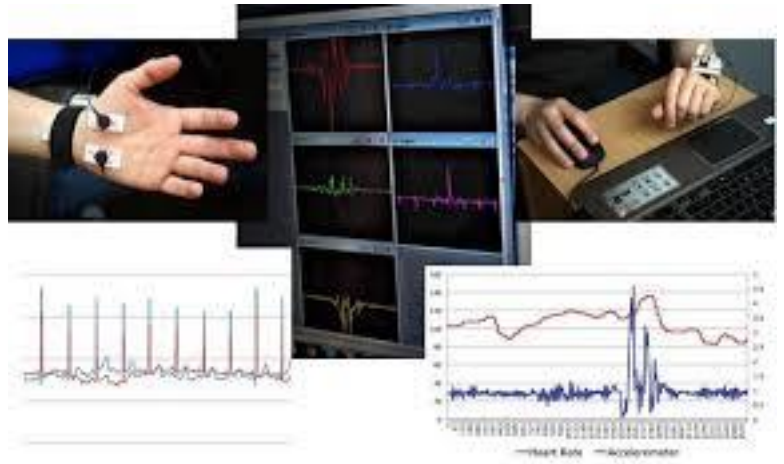
Emotions and Technology

Emotional Responses



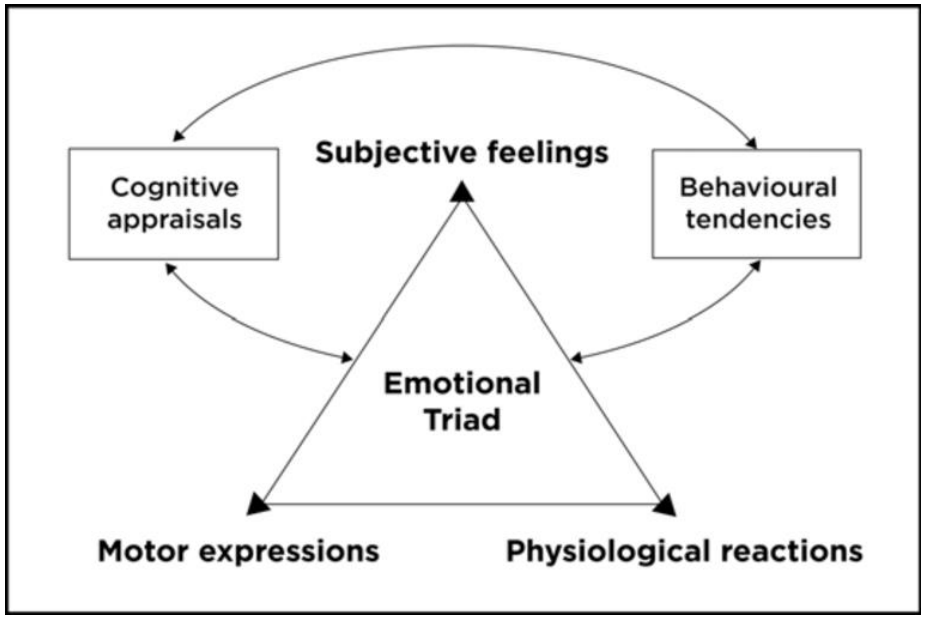
Affective Computing



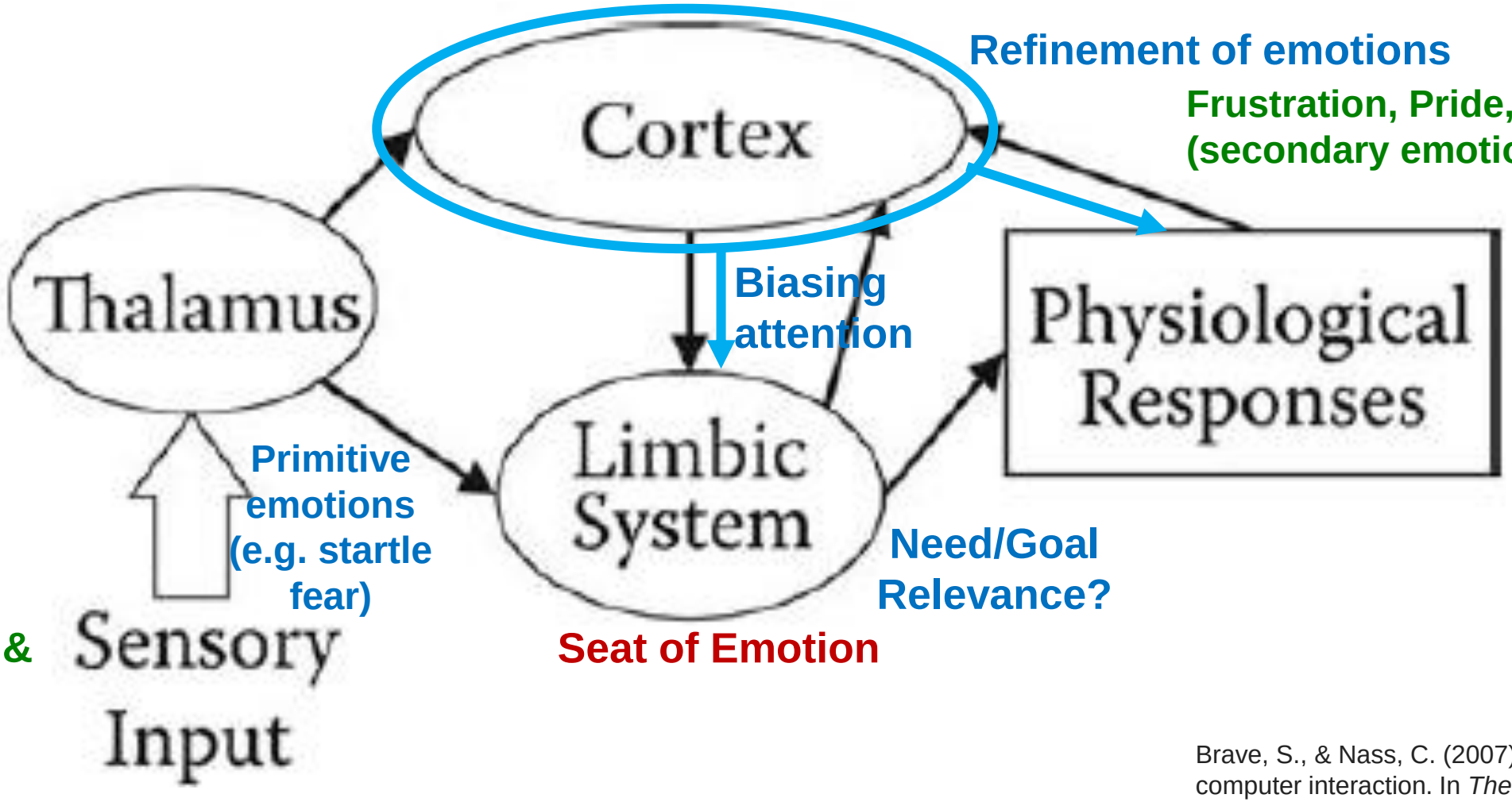


Definitions of Emotion

- Kleinginna, P. R., & Kleinginna, A. M. (1981). A categorized list of emotion definitions, with suggestions for a consensual definition. *Motivation and emotion*, *5*(4), 345-379.
    - 92 definitions
- *Emotion is a reaction to events deemed relevant to the needs, goals or concerns of an individual*
- Component-model of emotion
    - Subjective
    - Behavioural
    - Cognitive
    - Physiological
    - Motor



Neurological Structure & Social Construction of Emotion



Brave, S., & Nass, C. (2007). Emotion in human-computer interaction. In *The human-computer interaction handbook* (pp. 103-118). CRC Press.

Relevance of Neuroscience to AI

DeepMind Google

Head of AI

Demis Hassabis

Human Emotions

Human Consciousness

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Human Consciousness: AGI

"Integrated Information Theory" (IIT) (2004), v.4 (2023),
Giulio Tononi: mathematical formalization of cause-effect

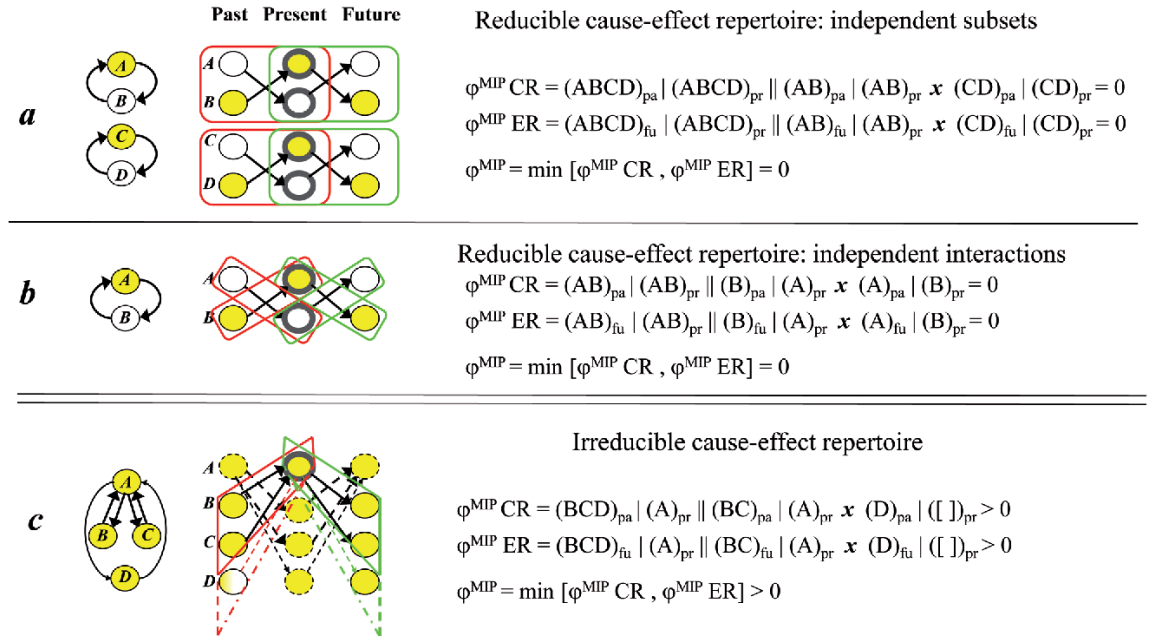
- whether any physical system is conscious, to what degree, and what particular experience it is having;
- why they feel the particular way they do in particular states
- what it would take for other physical systems to be conscious

Φ axioms
postulates

PyPhi – Python software package

Supporters for IIT:

- **Christof Koch** (neuroscientist)
- **David Chalmers** (philosopher "*Hard Problem of Consciousness*")
- **Anil Seth** (neuroscientist)
- **Max Tegmark** (physicist)



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Bet on Consciousness

On 23 June 1998, neuroscientist Christof Koch bet philosopher David Chalmers that

the mechanism by which the brain's neurons produce consciousness would be discovered by 2023.

David Chalmers

Christof Koch

"Decades-long bet on consciousness ends — and it's philosopher 1, neuroscientist 0" *Nature*, 619, 14-15 (2023)
https://doi.org/10.1038/d41586-023-02120-8

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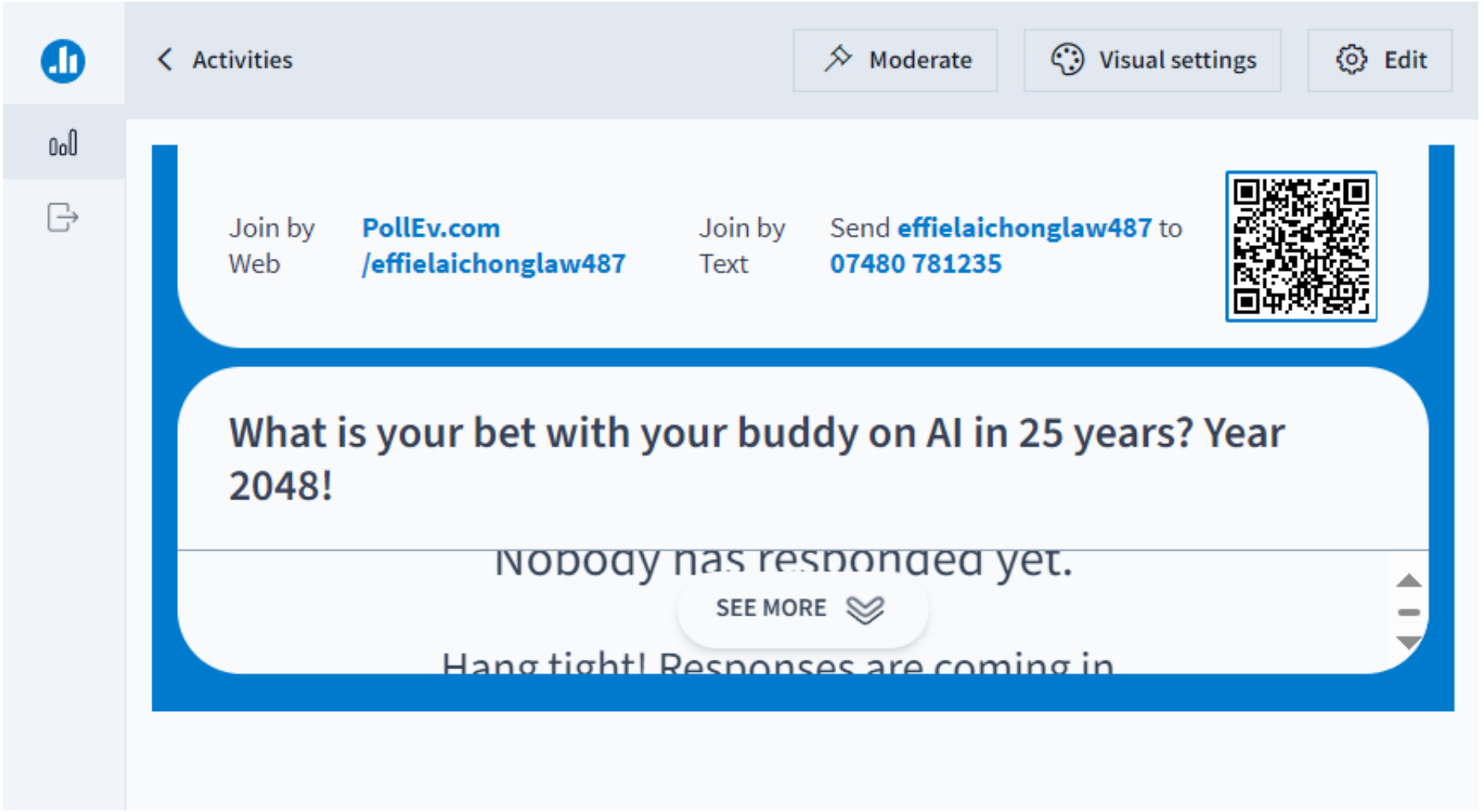
What is your bet with your buddy on AI in 25 years? Year 2048!



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The Singularity is Near (2005)

Ray Kurzweil

"*I set the date for the Singularity—representing a profound and disruptive transformation in human capability—as 2045*"

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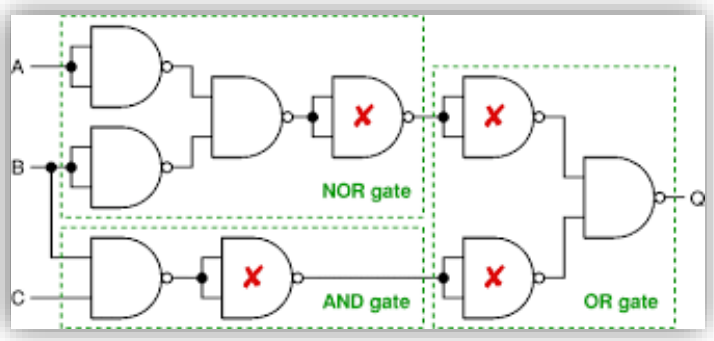
The Quest is still on ….



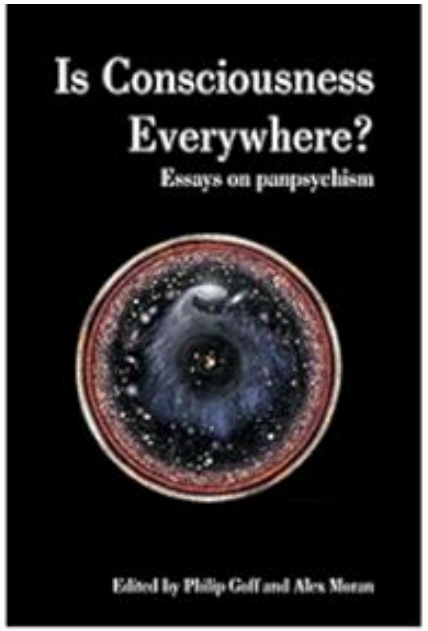
Criticisms against IIT:

- John Searle (philosopher, against panpsychism)
- Scott Aaronson (CS, inactive logic gates more conscious than human beings)
- Group of 124 (mixed background): Fleming, S., Frith, C., Goodale, M., Lau, H., LeDoux, J. E., Lee, A. L., ... & Slagter, H. A. (2023). ***The Integrated Information Theory of Consciousness as Pseudoscience***. https://psyarxiv.com/zsr78/

Competing Theories of Consciousness

Global Work Theory (GWT) → GN(Neural)WT

Analogy to a theatre, stage, attention, spotlight, …



Philip Goff et al. (2022)

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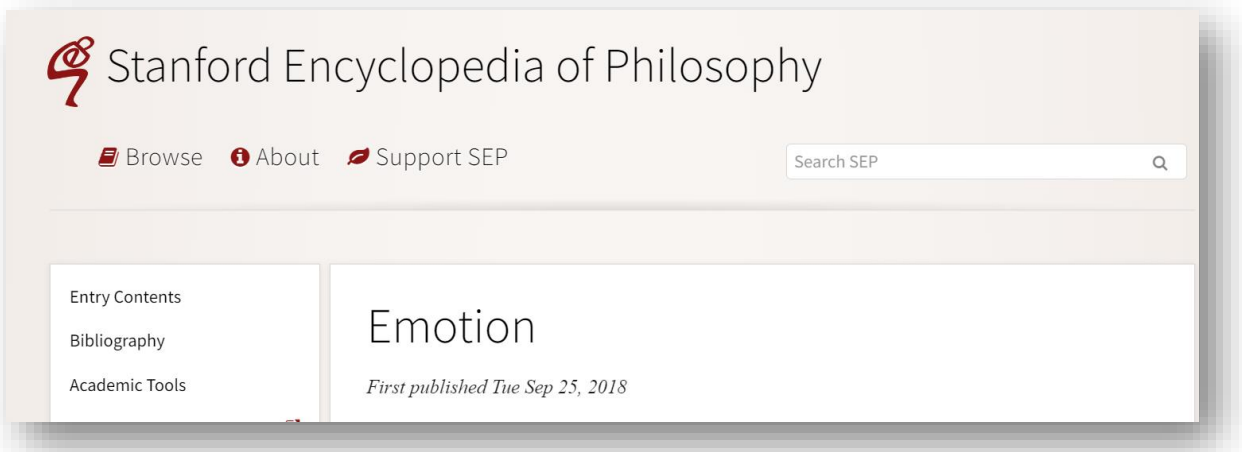
Philosophical Reflections on Emotion

David Hume (1739) argues that emotions drive choice and well-being

"*Reason is and ought only to be the slave of the passions*."

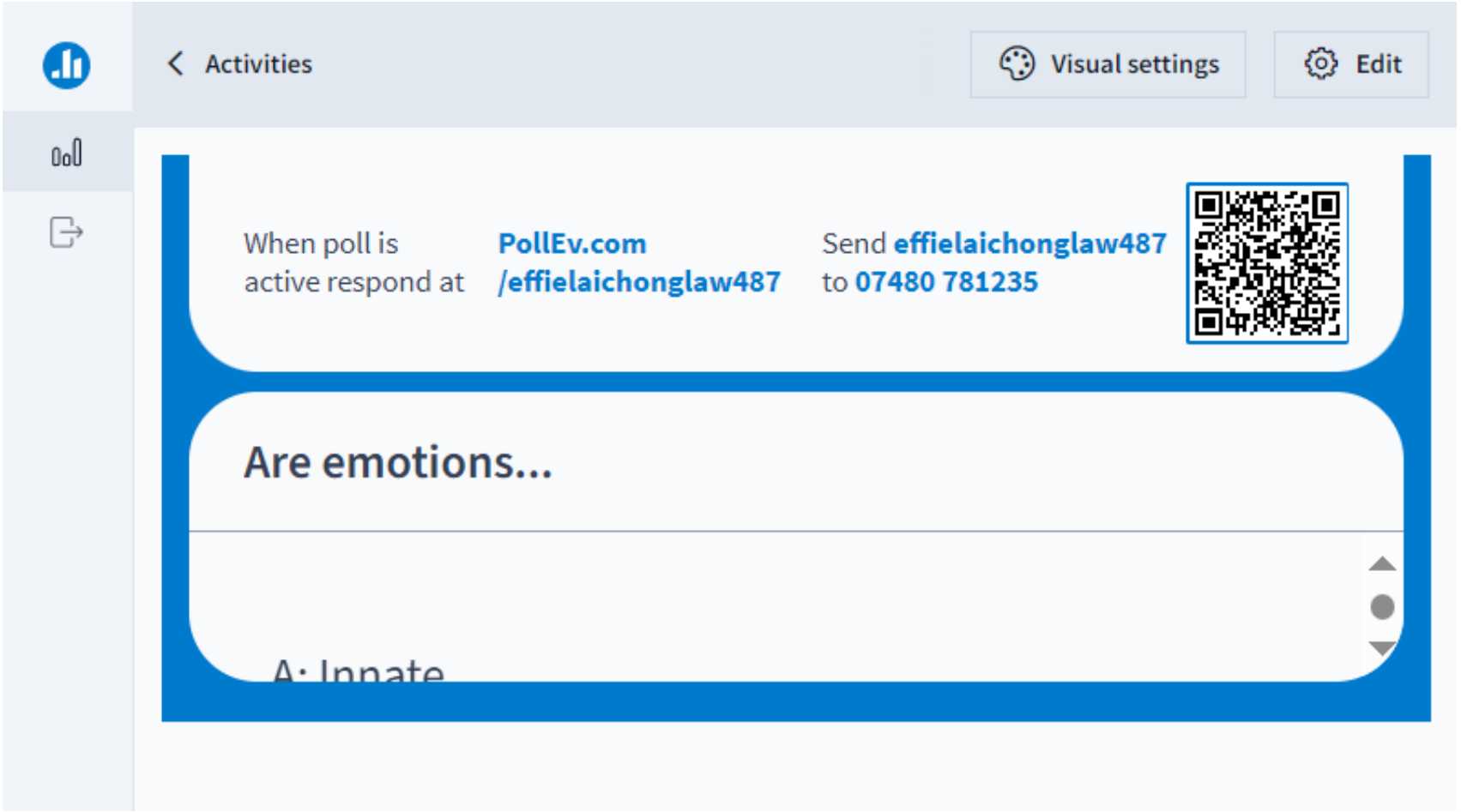
Recognising the need to map out the internal states that animate thought and action, Hume proposed a taxonomy of 16 emotions, but lacked scientific evidence



https://plato.stanford.edu/entries/emotion/

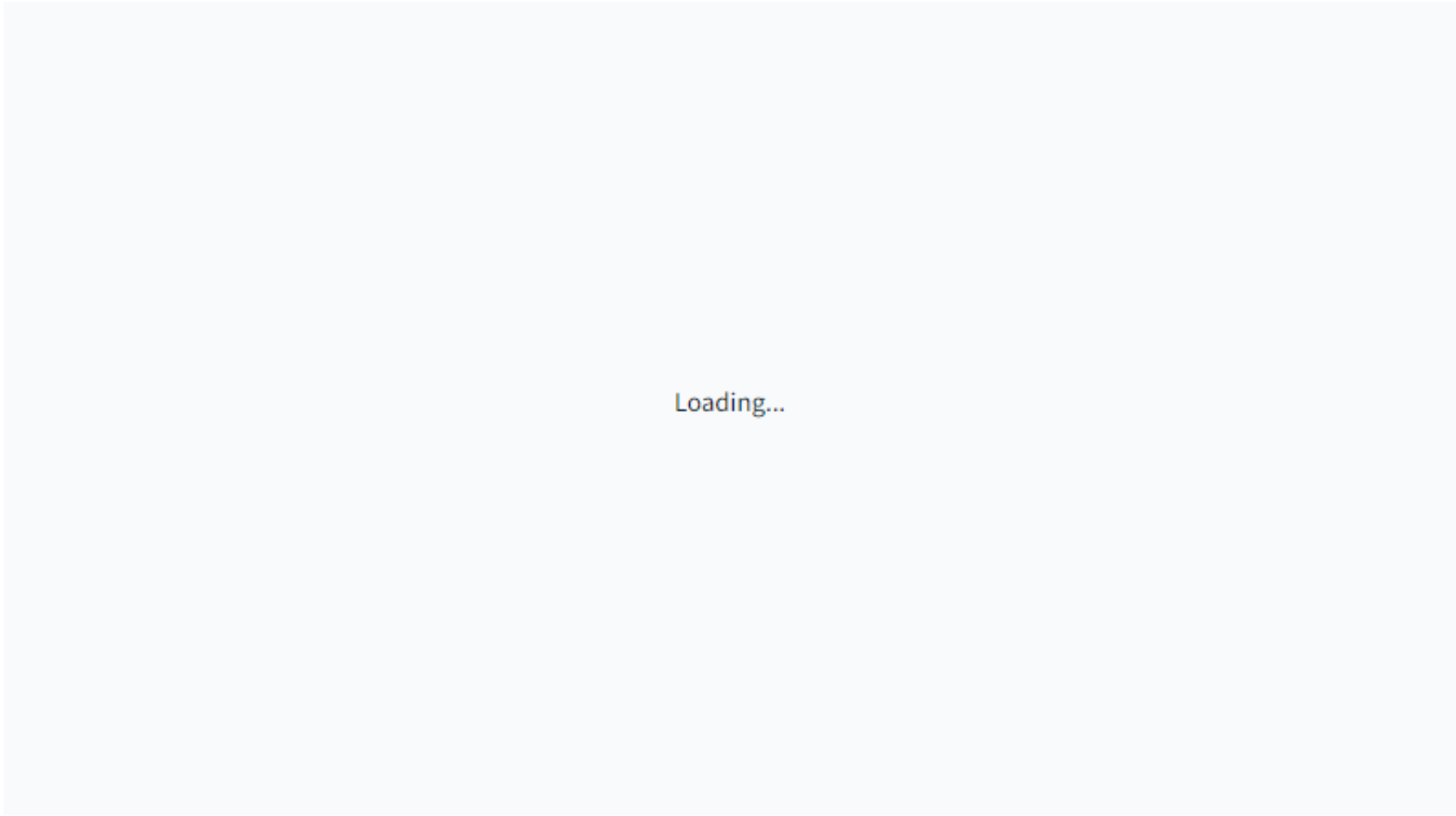
Basic Questions on Emotions

- **Innateness of Emotions**



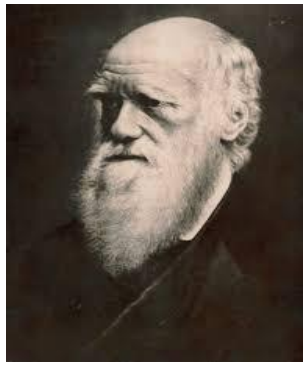
Basic Questions on Emotions

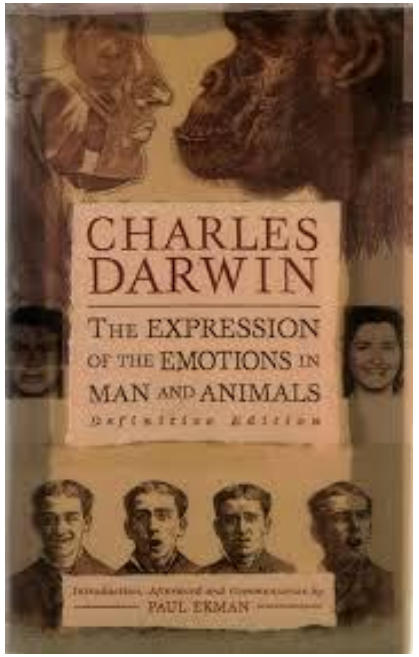
- **Universality of Emotions**



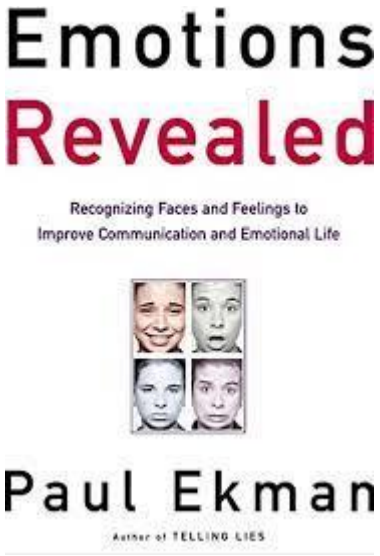
Universality of Emotions

Charles Darwin's evolutionary theory (1872)





Paul Ekman's six universal emotions (1989)



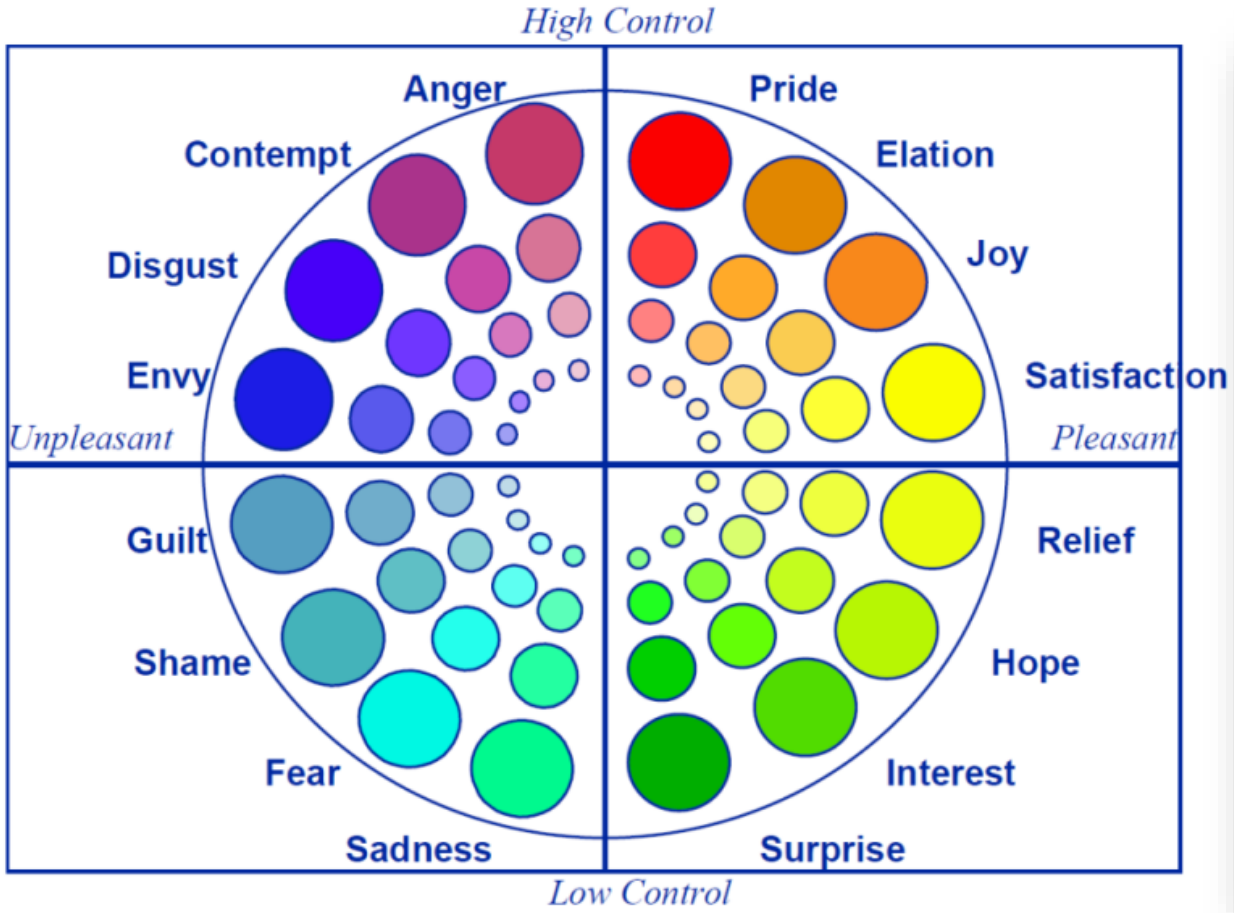
In-between Position

- Basic emotions exist
  - Cross-cultural universals
  - Primate studies

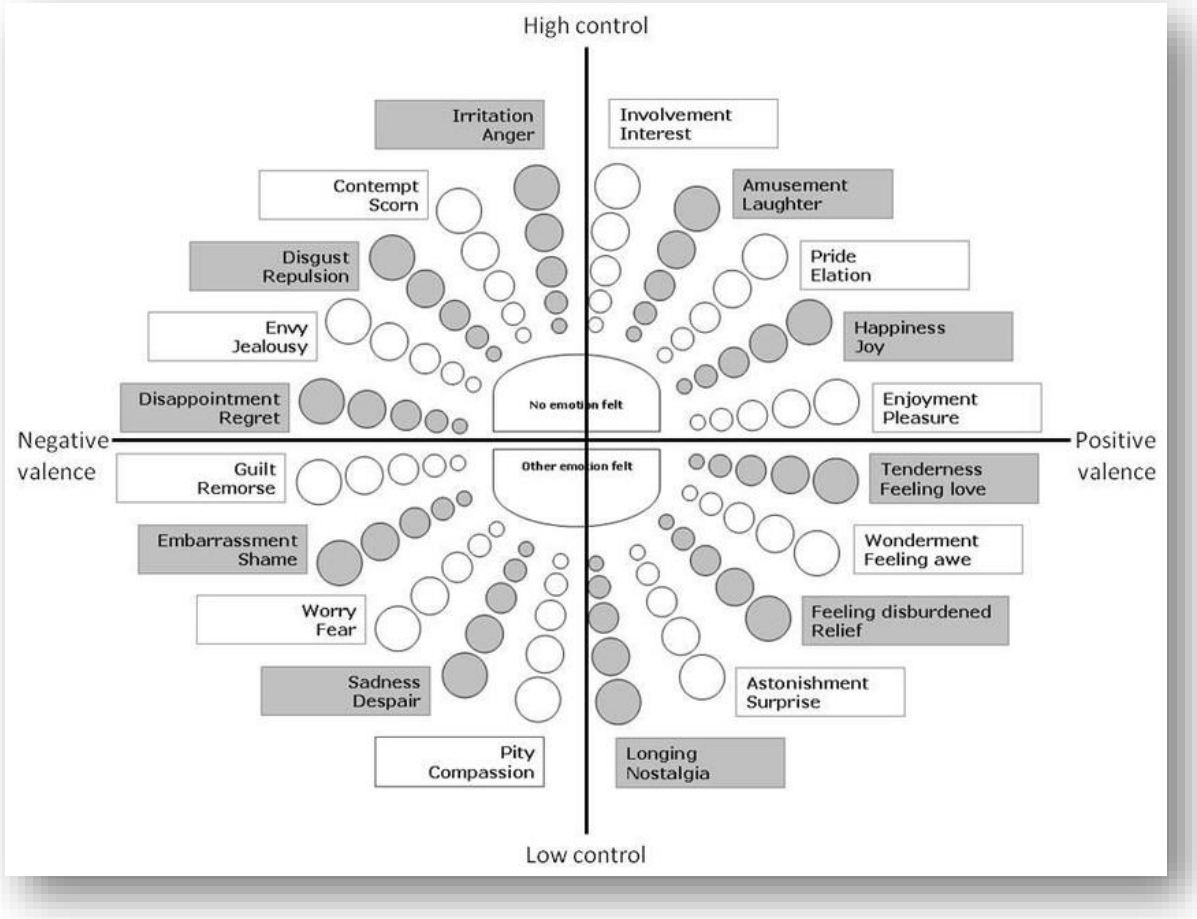
- But which emotions are qualified as *basic* remains debatable
  - Fear
  - Anger
  - Sadness
  - Joy
  - Disgust
  - Surprise

A/B = Aggressive/Threat
C/D = Distressed/Anxious
E = Friendly/Affiliative
F = Neutral

Geneva Emotion Wheel (Klaus Scherer)



Version 1: 16 Emotions



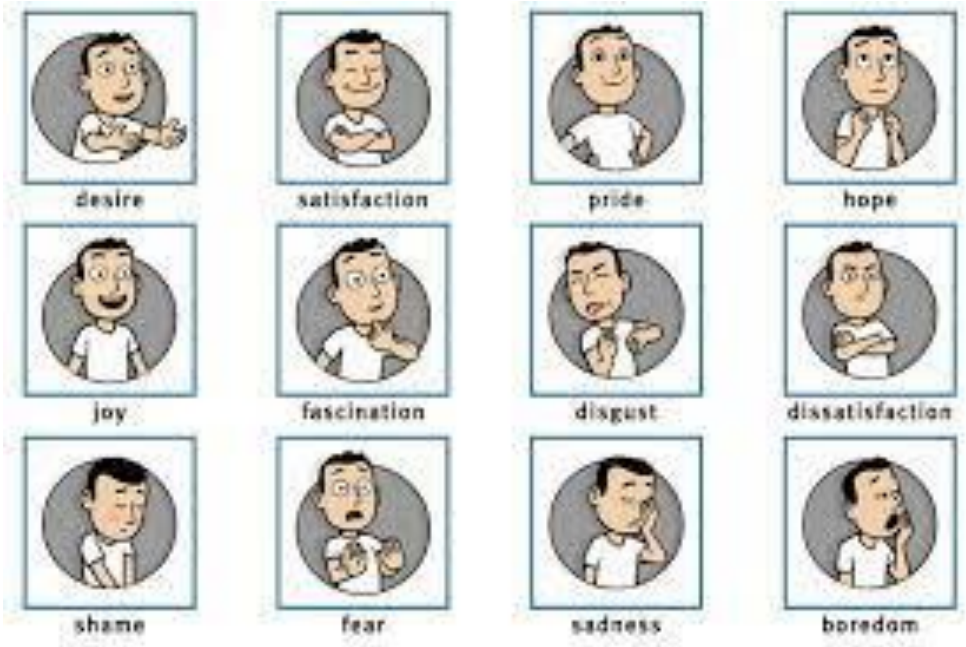
Version 2: 40 Emotions

Implications for Evaluation

Basic categories:

- Distinguishable
- Measurable
- Emotion recognition; Post-interaction evaluation
- Generalizability of emotion evaluation tools

PrEmo

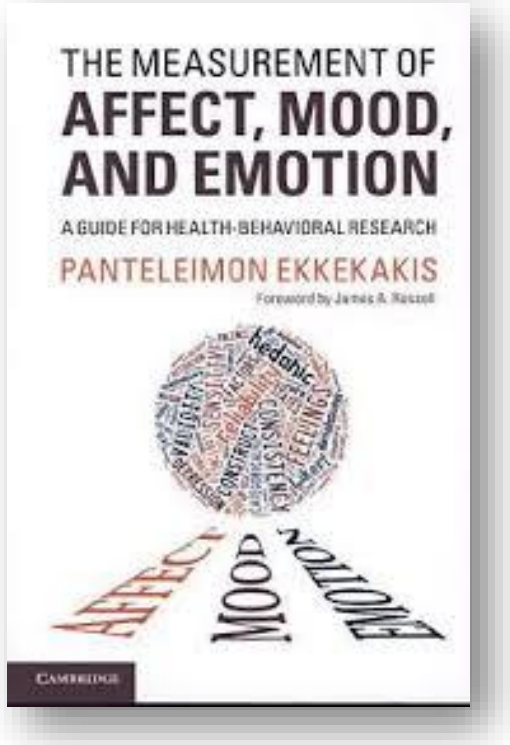


Premo (https://diopd.org/premo/)

Terminology

Core Affect

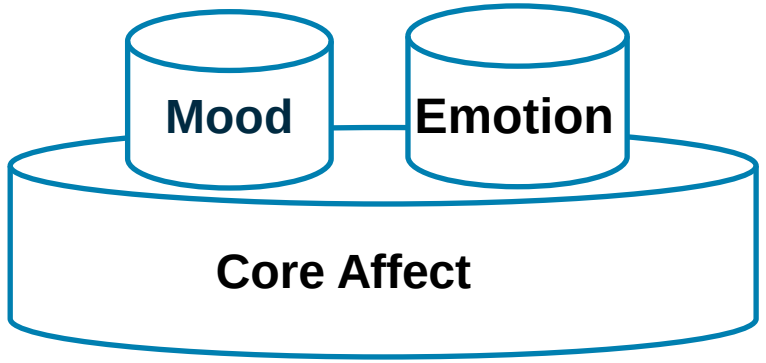
- A neurophysiological state consciously accessible as a single primitive non-reflective feeling most evident in mood and emotion but always available to consciousness …, core affect is mental but not cognitive or reflective (Russell & Feldman Barrett, 2009)
  E.g.: pleasure, displeasure, tiredness, tension, calmness
- Affective states (Klaus Scherer): umbrella term/ feeling



On receiving a gift, Sally feels happy, smiles and hugs the person who gave her the gift.
→ *Emotion episode*

Another time, Sally feels happy for no reason.
→ *Core affect*

Pride = feeling good about oneself → an emotion



Emotion vs. Feeling (Antonio Damasio)

Feeling

- private, mental *experience* of emotion in a body
- state of life regulation (e.g. hungry), emotive process
- continuous readouts of our internal states
- a component of emotion

Emotion

- openly observable; expression
- help prime our bodies to act in a certain way; movement
- the basic mechanisms underlying emotion do NOT require consciousness

Sentiment vs. Emotion

Sentiment

- Mental attitude
- Thought shaped by emotion; emotionally charged opinion
- Cognitive + Physiological Sociological (society & culture); tied to a social object
- Highly organised

Emotion

- Complex psychological state
- Multiple components: physiological, behavioural
- Object-oriented (e.g. angry with someone, excited about something)

Mood vs. Emotion

Mood

- Not object-oriented; Non-intentional: not direct at any object in particular
- Bias cognitive strategies and processing
- Long-lived (hours, days, weeks)

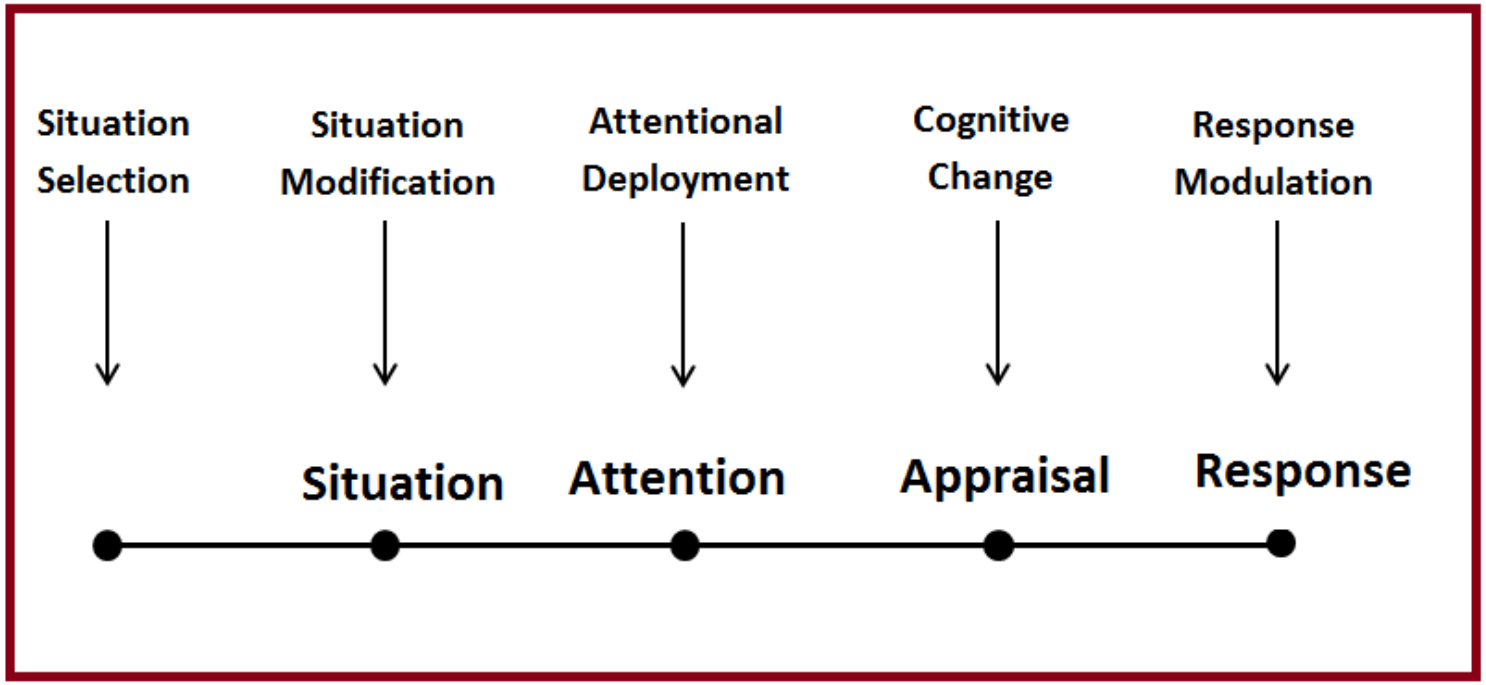
Emotion

- Object-oriented (e.g. angry with someone, excited about something)
- Bias actions
- Short-lived (seconds, minutes)

Emotion and Attention

- Emotions direct attention to relevant objects and situations
  emotion-relevant thoughts → state of flow (total absorption)

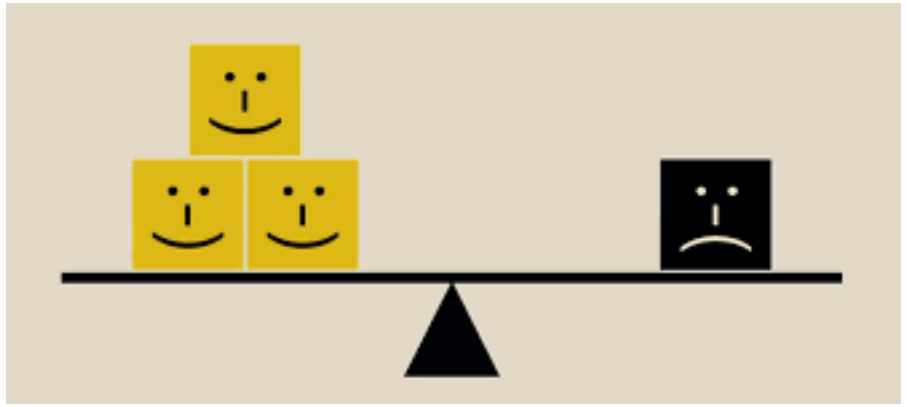
- Emotion regulation
  higher cognitive processes → desirability of emotion → approach/avoidance

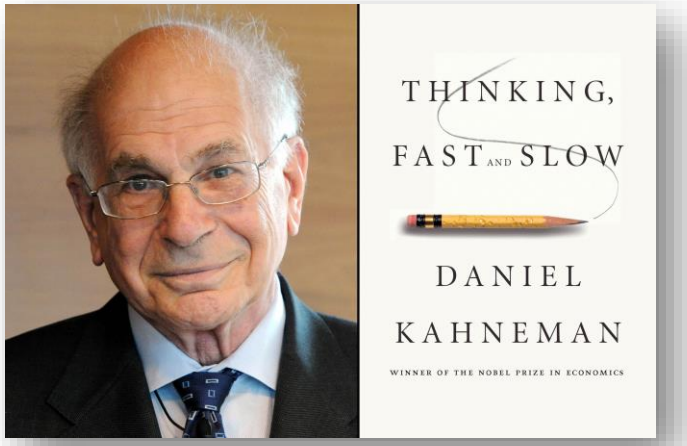


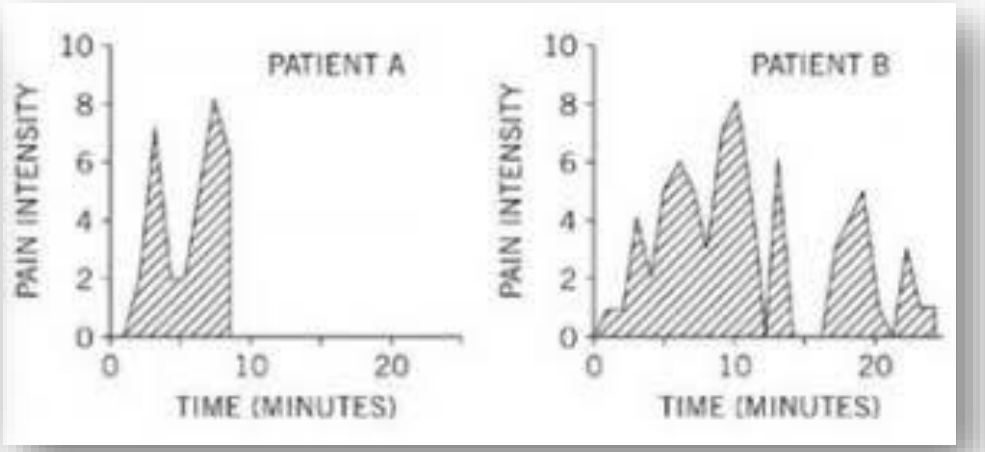
Emotion and Memory

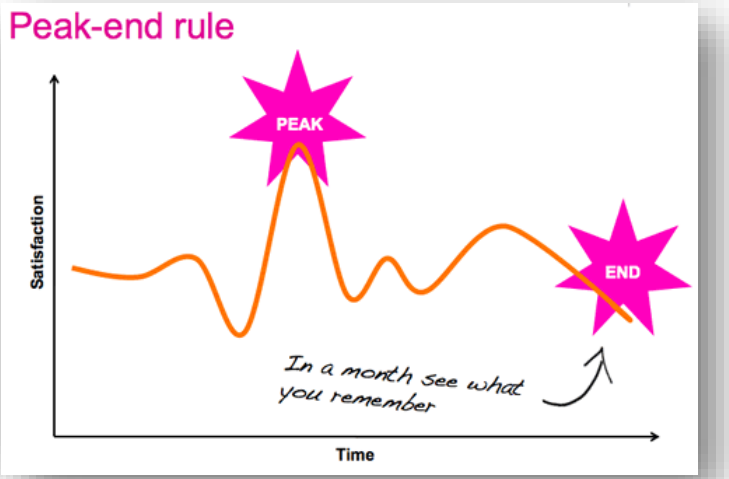
Cognitive biases:

- Negativity bias
- Peak-End rule







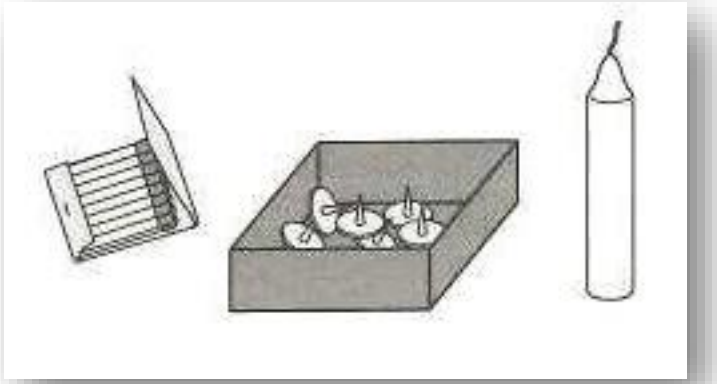


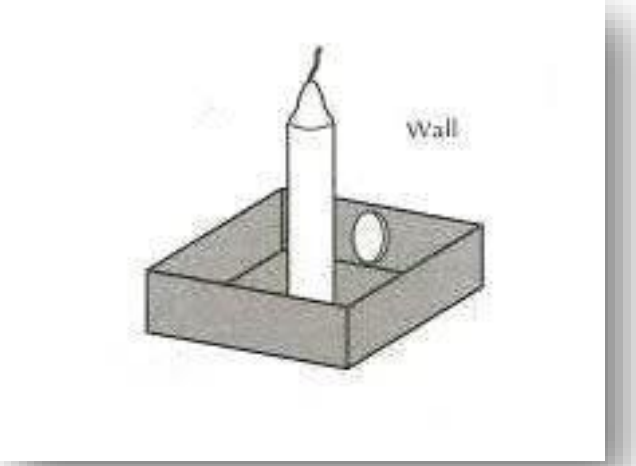
https://www.youtube.com/watch?v=XgRlrBl-7Yg

Emotion and Performance

Mood and Problem-Solving Skills

- Karl Duncker's (1942) candle task
- Participants were given the following materials:
  - A candle
  - A box of tacks
  - Matches
- The task was to attach the candle to the wall so that it does not drip onto the table below
- Participants:
  - ☺ - good mood
    - → Higher success rate!
  - ☹ - bad mood

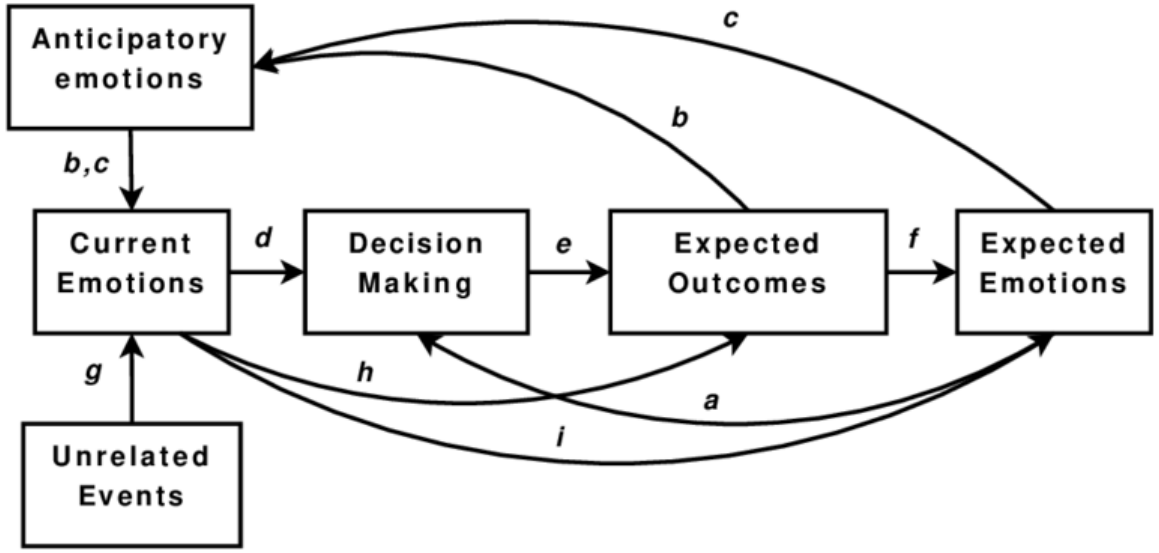




Keeping a user happy may improve satisfaction, efficiency and creativity

Emotion and Assessment

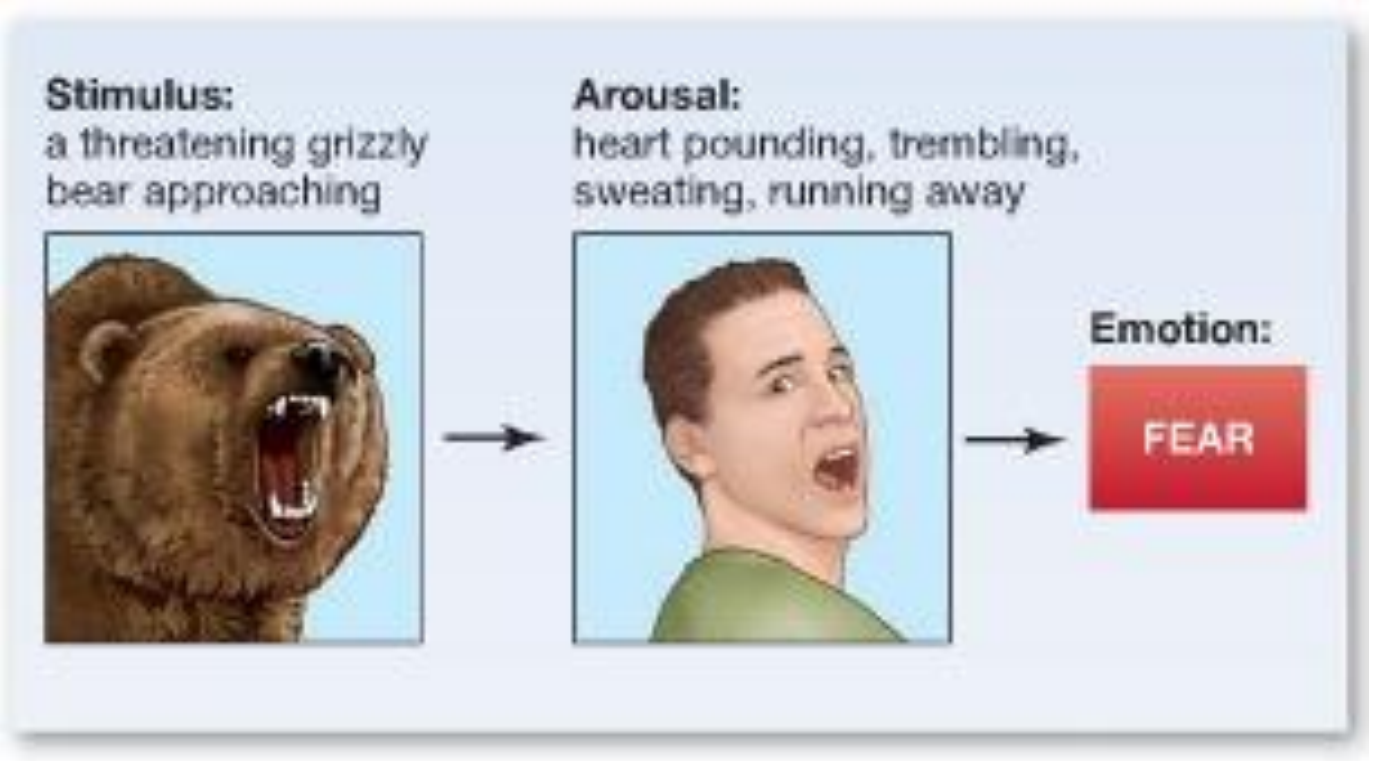
- Filter of mood → Bias thoughts → Evaluation of products and services
- Mood → Risk taking
  - Positive → risk-aversive
  - Negative → more risk-prone



Johansson, A., & Dell'Acqua, P. (2009). Affective states in behavior networks. In *Intelligent Computer Graphics 2009* (pp. 19-39). Springer, Berlin, Heidelberg.

James-Lange Theory of Emotion

Physiological arousal instigates the experience of emotion. Instead of feeling an emotion and subsequent physiological (bodily) response, the theory proposes that the physiological change is primary, and emotion is then experienced when the brain reacts to the information received via the body's nervous system. (Wikipedia)

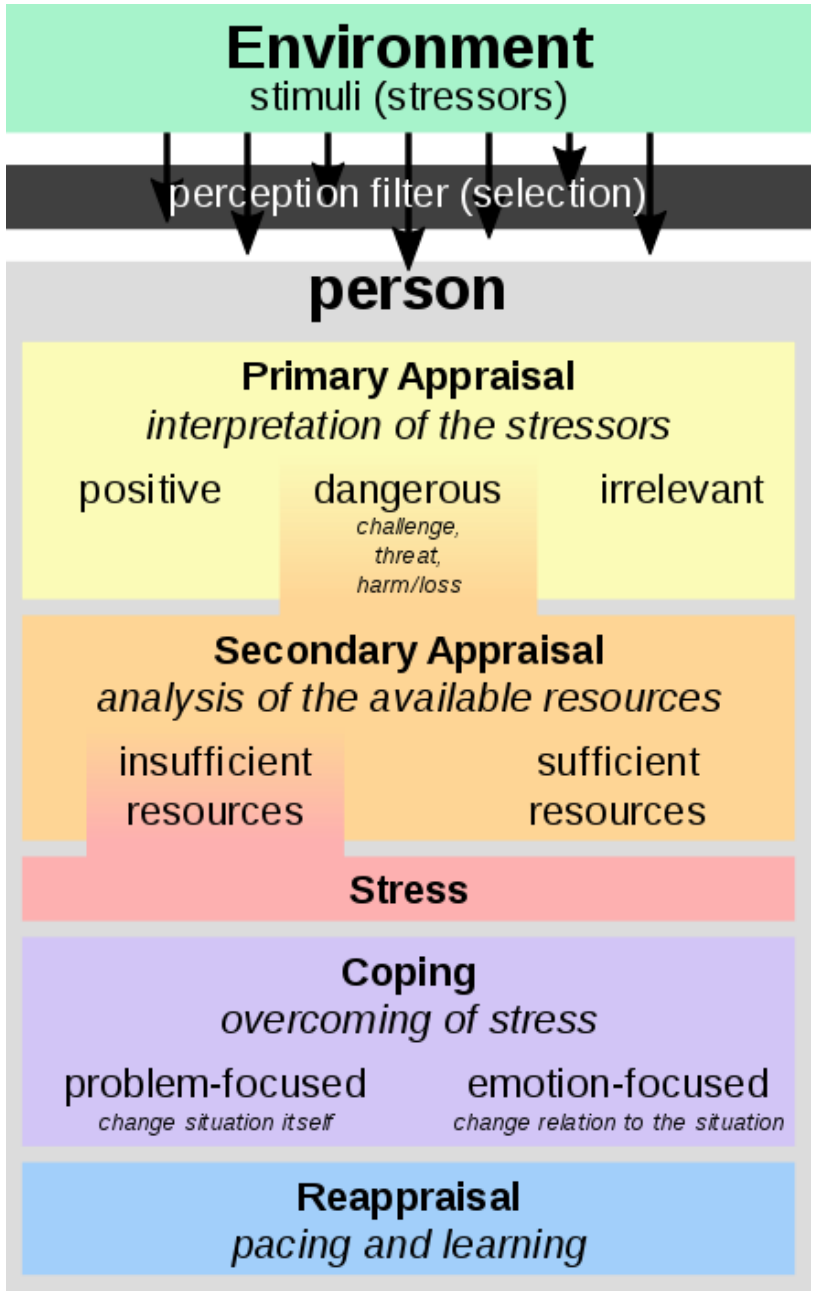


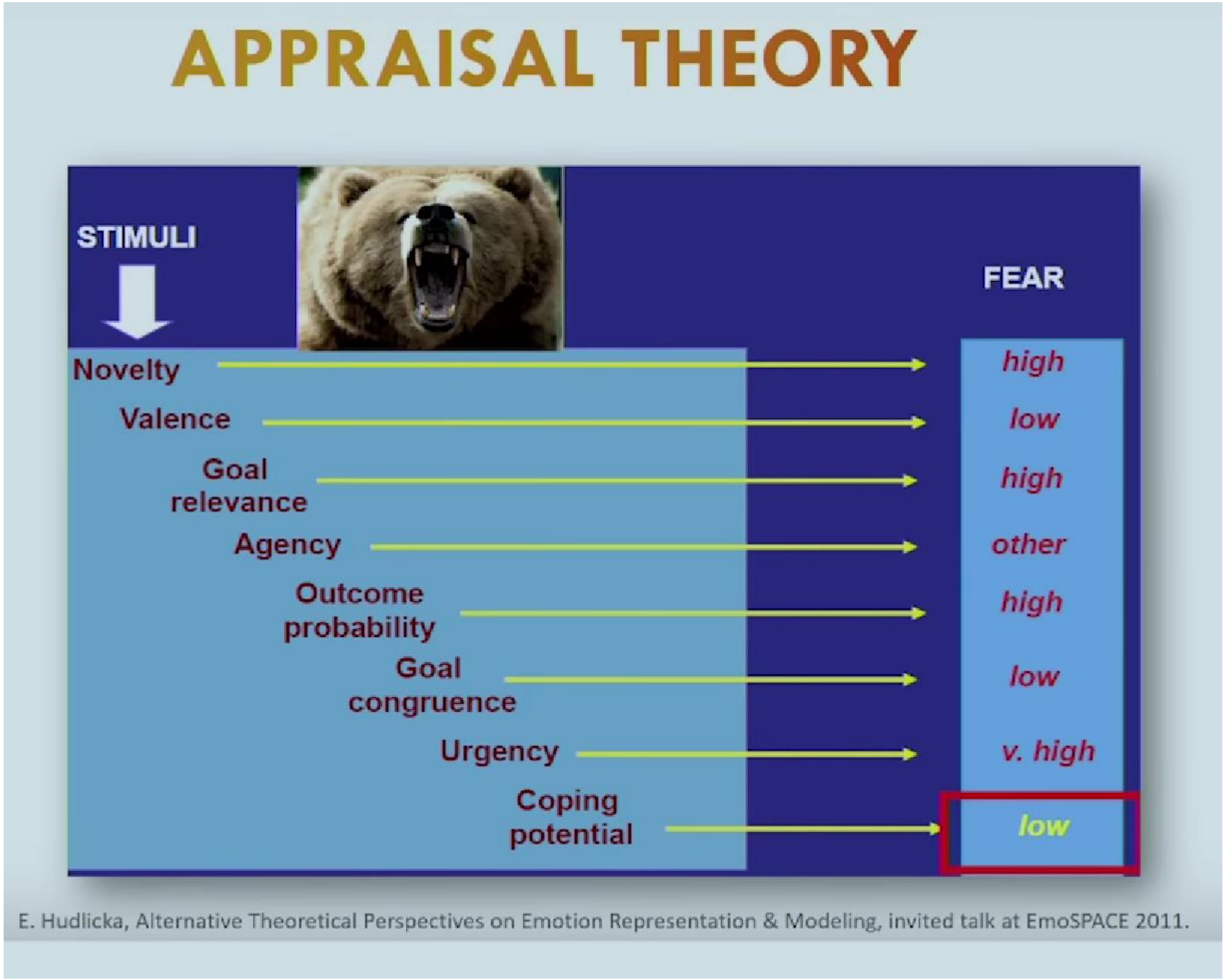
Appraisal Theories

Structural Model of Appraisal

- Lazarus (1991)
- Emotion involves a relational aspect (one's interaction with the environment), a motivational aspect (fulfilment of one's need and goal), and a cognitive aspect (relevance to one's life)
- different emotions are elicited when situations are evaluated differently according to these three categories

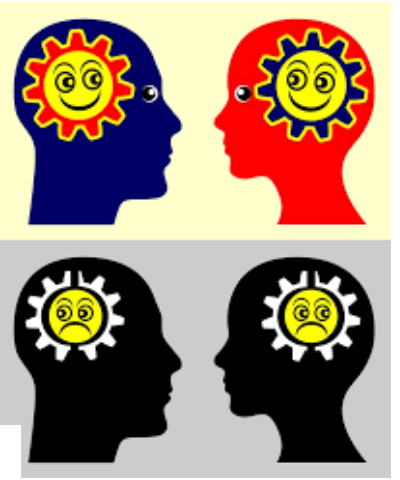
- It fails to account for the often rapid or automatic nature of emotional responses



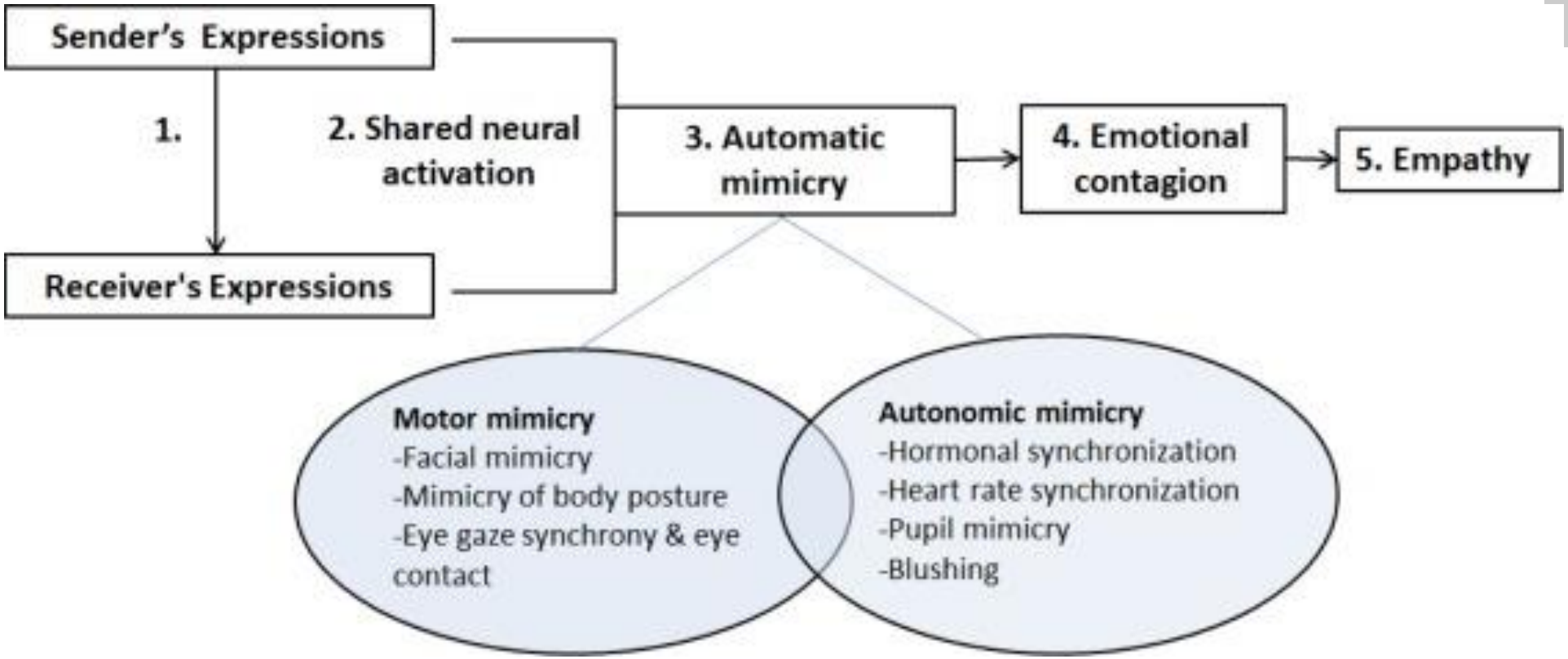


Source: Hatice Gunes https://www.youtube.com/watch?v=ddv91MZyLPQ

Contagion of Emotion

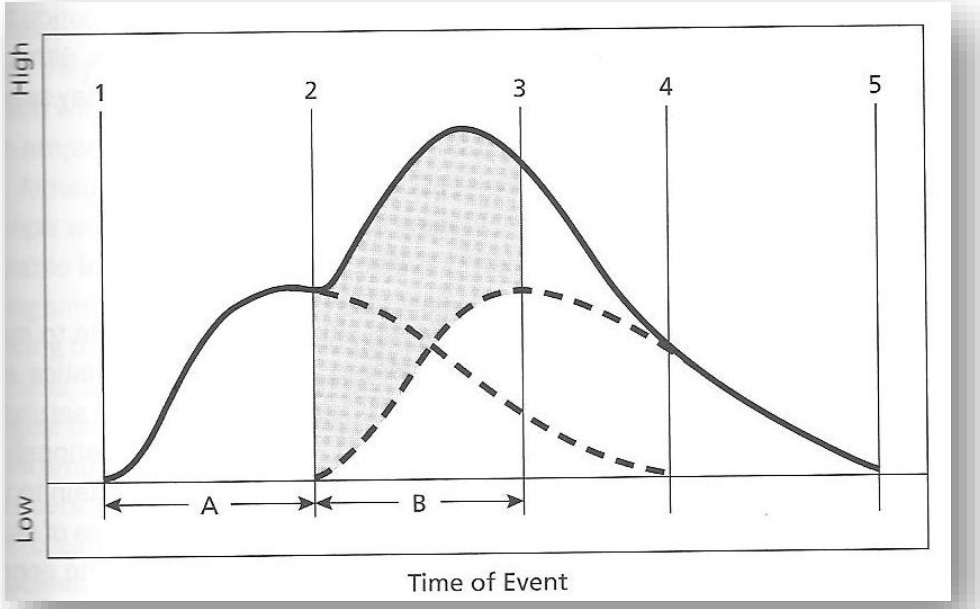


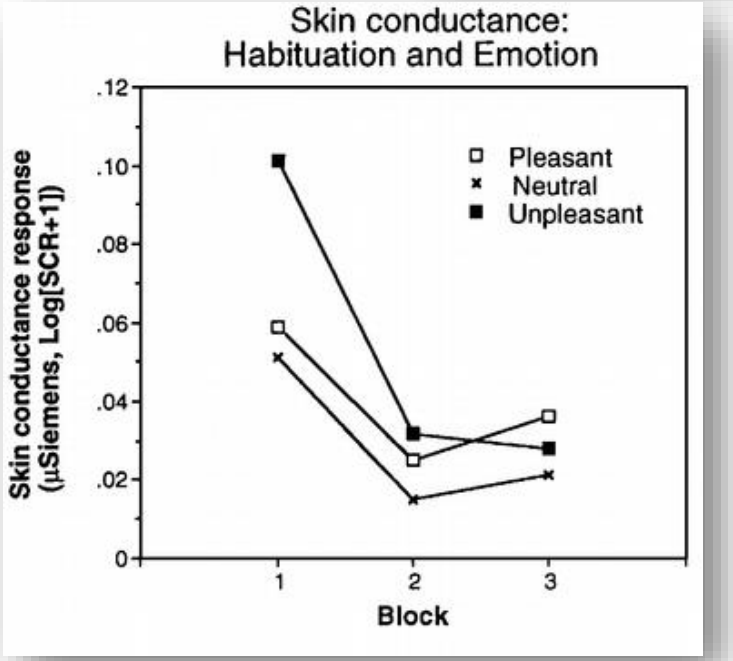
- Empathy
- Mirror neurons

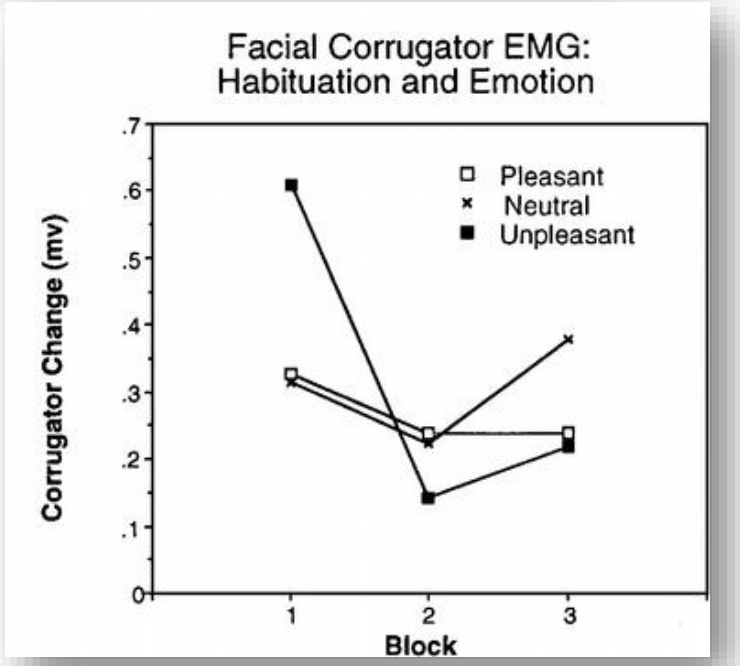


Excitation & Habituation

- Excitation transfer
  - Carryover of the previous emotion
  - Residuals intensify the present
- Habituation
  - Repeated exposures
  - Intensity decreases
  - Actual vs. expected experience







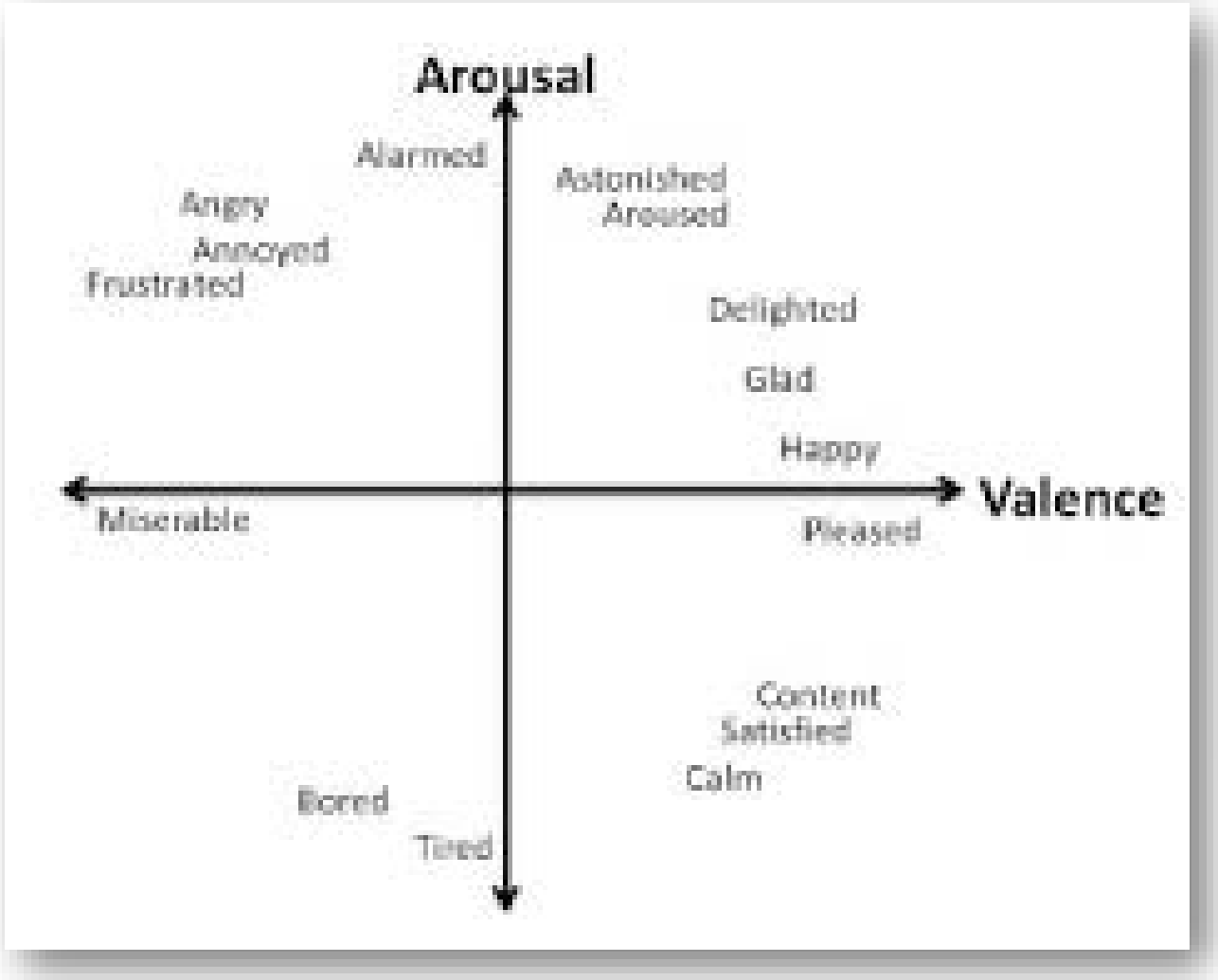
Emotion: Interactional vs. Interpretive

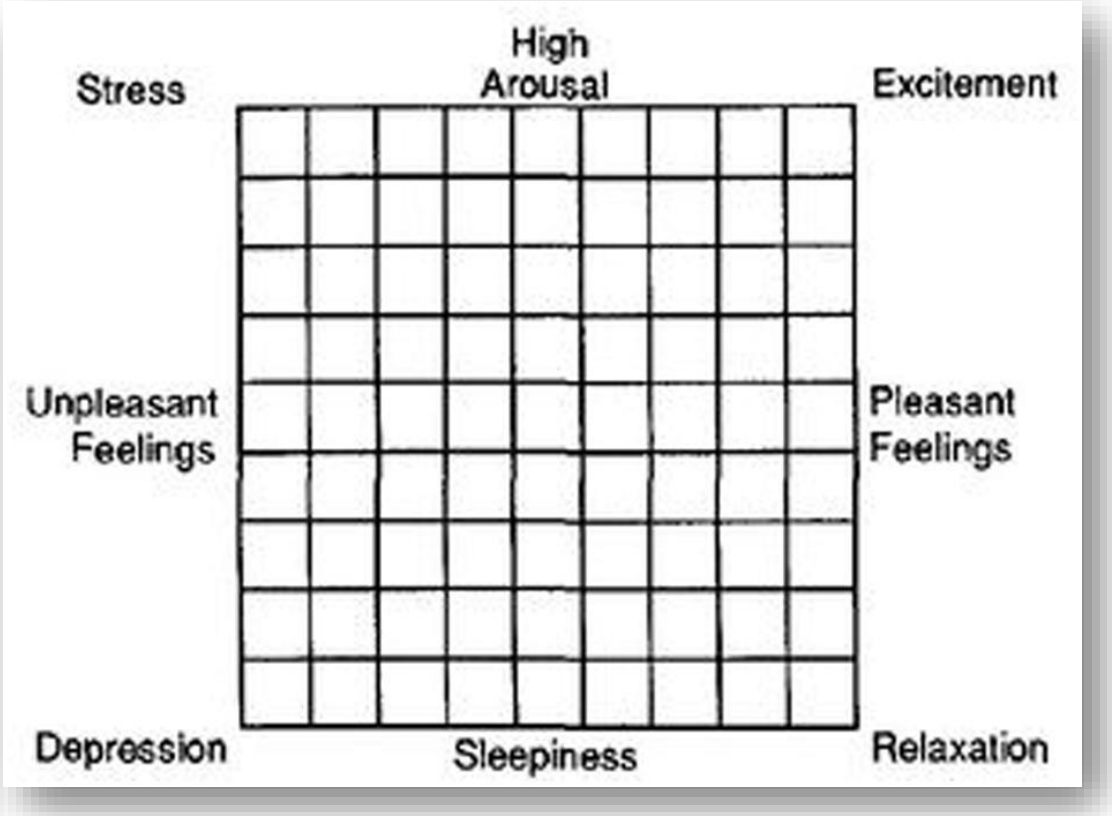
(Boehner et al. 2007, p.280)

- Emotion is **objective, internal, private** and **mechanistic** (cf. cognition – Informational perspective)
- Emotion is interactionally and culturally shaped (i.e. cultural perspective)
    - hot emotion/burning heart vs. cold cognition/cool head
- Subjective, social, dynamic and interpretive
- Emotions are bio-physiological events manifest themselves as things that are recognizable, witnessable, and collectively negotiable.
- Emotions are constructed and experienced as individuals act in and through their culture and social interactions (i.e. intersubjective phenomenon)
- What we feel is NOT simply a pre-existing fact, but something that develops over the course of conversations and interactions with one another.

Measurement of Emotions

Categorical vs. Dimensional

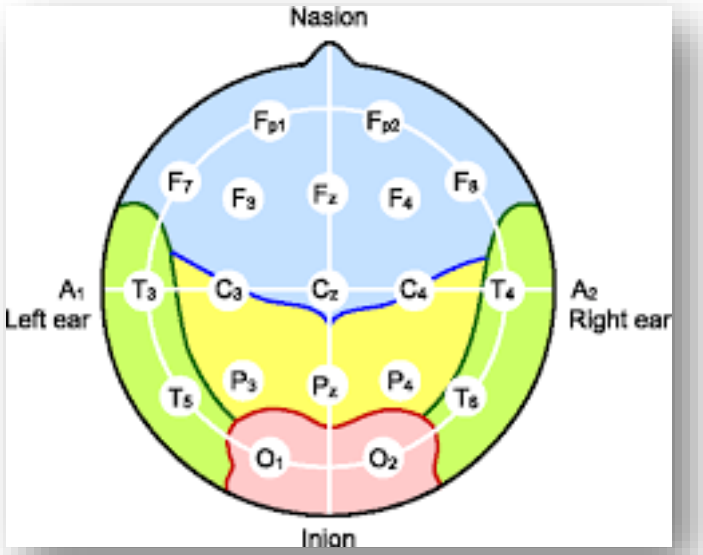


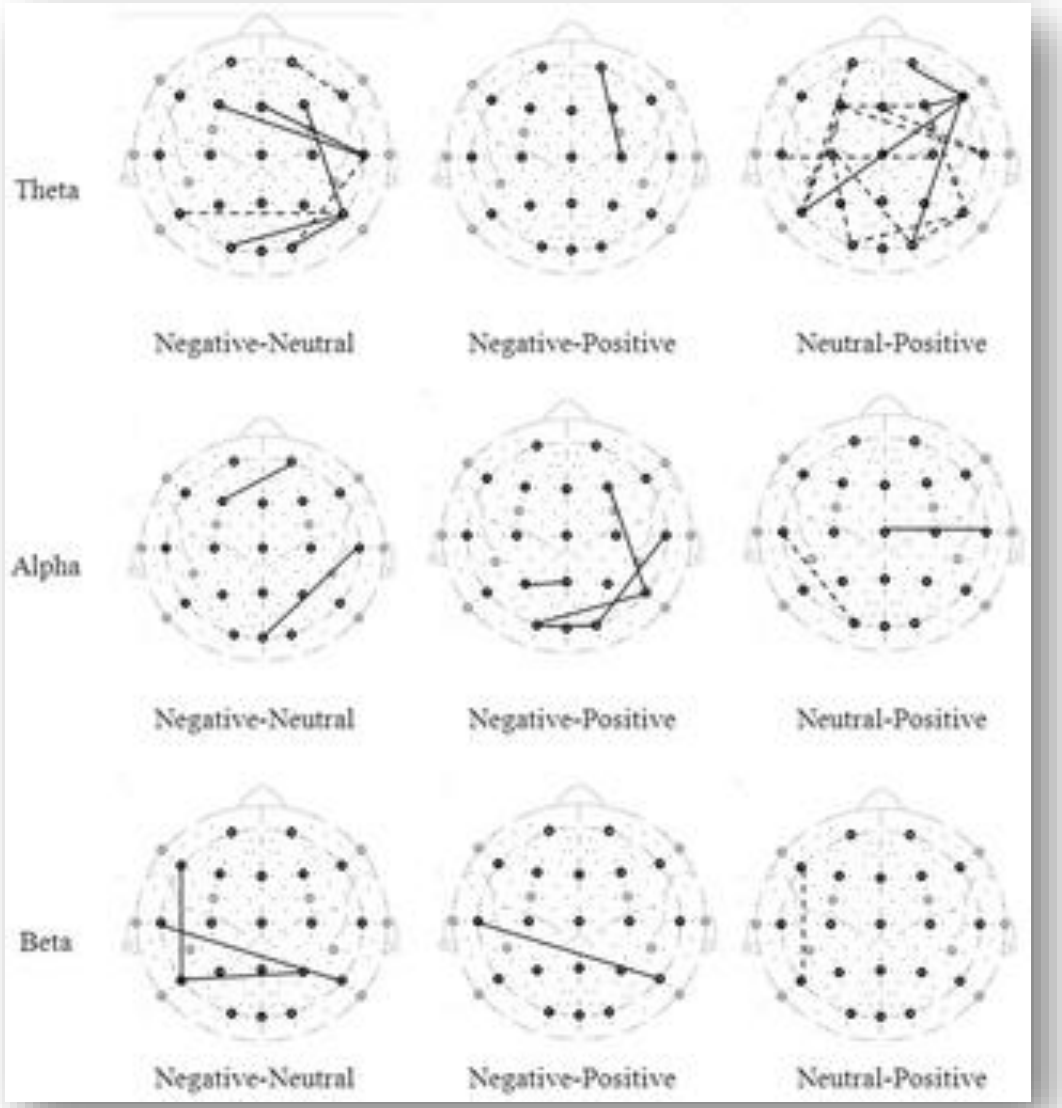


Russell's Affect Grid

Neurological Responses: EEG

Encephalogram





Autonomic Activity

- Galvanic Skin Response (GSR)
- Heart Rate (HR)/Electrocardiogram (ECG)
- Blood Pressure Volume (BPV)
- Electromyography (EMG)
- Hotly debate issue:
  - Specific: Each emotion has a unique autonomic signature; distinct biological basis (nature)
  - Non-specific: All emotions are accompanied by the same state of nonspecific autonomic arousal, varying only in magnitude; social learning (nurture)
  - Do we need to know fine-grained emotional states?

Facial Expressions

AU = Action Unit

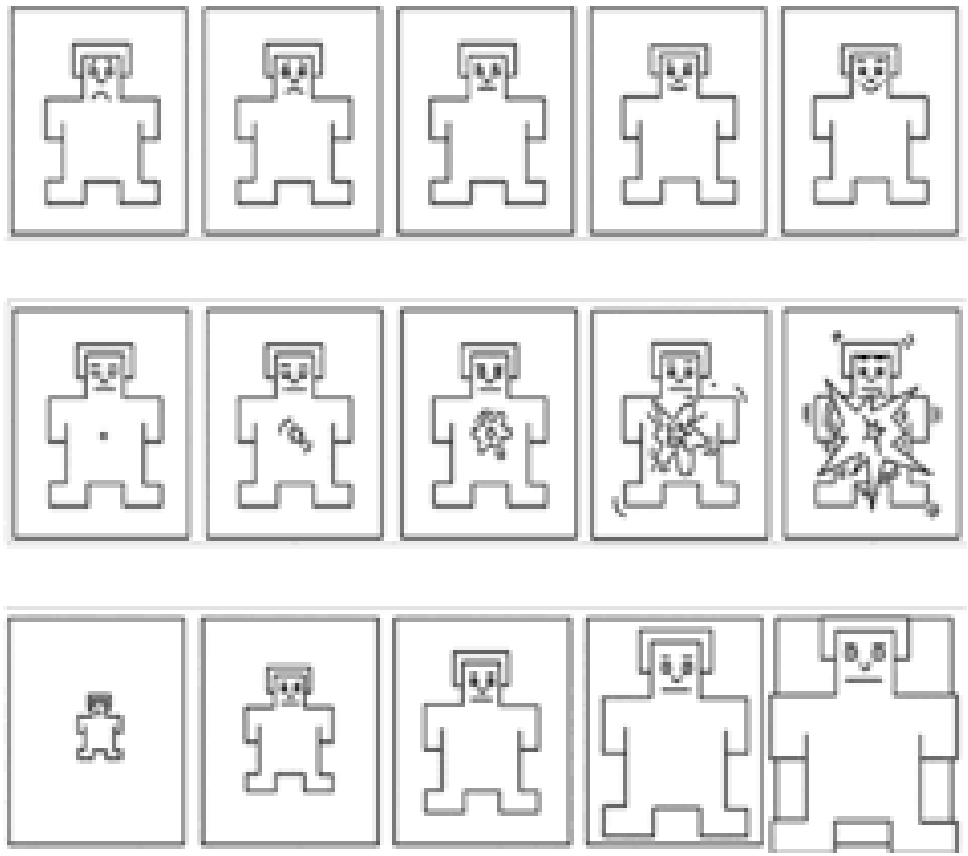
FaceReader

Emotion	Observed Facial Cues
Surprise	Brows raised (curved and high) Skin below brow stretched Horizontal wrinkles across forehead Eyelids opened and more of the white of the eye is visible Jaw drops open without tension or stretching of the mouth

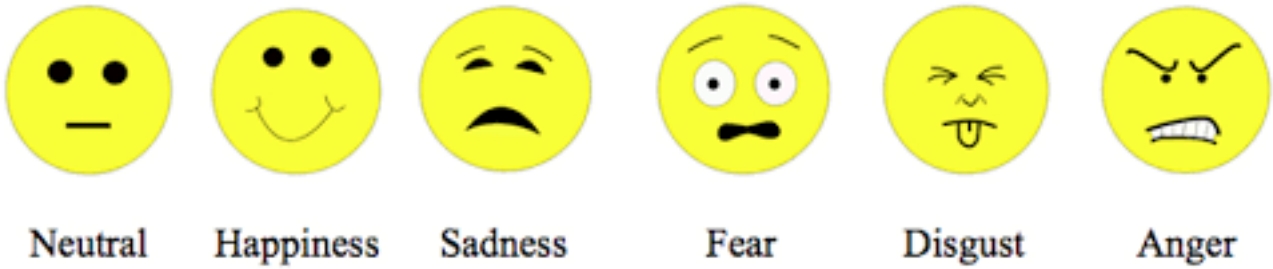
Voice

	Fear	Anger	Sadness	Happiness
Speech rate	Much faster	Slightly faster	Slightly slower	Faster or slower
Pitch average	Very much higher	Very much higher	Slightly lower	Much higher
Pitch range	Much wider	Much wider	Slightly narrower	Much wider
Intensity	Normal	Higher	Lower	Higher
Voice quality	Irregular voicing	Breathy chest tone	Resonant	Breathy blaring
Pitch changes	Normal	Abrupt on stressed syllables	Downward inflections	Smooth upward inflections
Articulation	Precise	Tense	Slurring	Normal

Self-reported Questionnaires: Pictorial



Self-Assessment Manikin (SAM)



Self-reported Questionnaires: Verbal

PANAS = Positive Affect Negative Affect Scale

1	2	3	4	5
Very Slightly or Not at all	A Little	Moderately	Quite a Bit	Extremely

_____ 1. Interested	_____ 11. Irritable
_____ 2. Distressed	_____ 12. Alert
_____ 3. Excited	_____ 13. Ashamed
_____ 4. Upset	_____ 14. Inspired
_____ 5. Strong	_____ 15. Nervous
_____ 6. Guilty	_____ 16. Determined
_____ 7. Scared	_____ 17. Attentive
_____ 8. Hostile	_____ 18. Jittery
_____ 9. Enthusiastic	_____ 19. Active
_____ 10. Proud	_____ 20. Afraid

Differential Emotions Scale

	Never				Very often
Interest					
Enjoyment					
Surprise					
Distress					
Anger					
Disgust					
Contempt					
Shame					
Fear					
Guilt					

Exercise

Exercise

1. With which emotion should HAII designers be most concerned?
2. When and how should interfaces attempt to directly address users' emotions and basic needs (i.e. avoid manipulation)?
3. How accurate must emotion recognition be to be useful as an interface technique?
4. When and how should users be informed that their affective states are being monitored and adapted to (i.e. disclosure)?