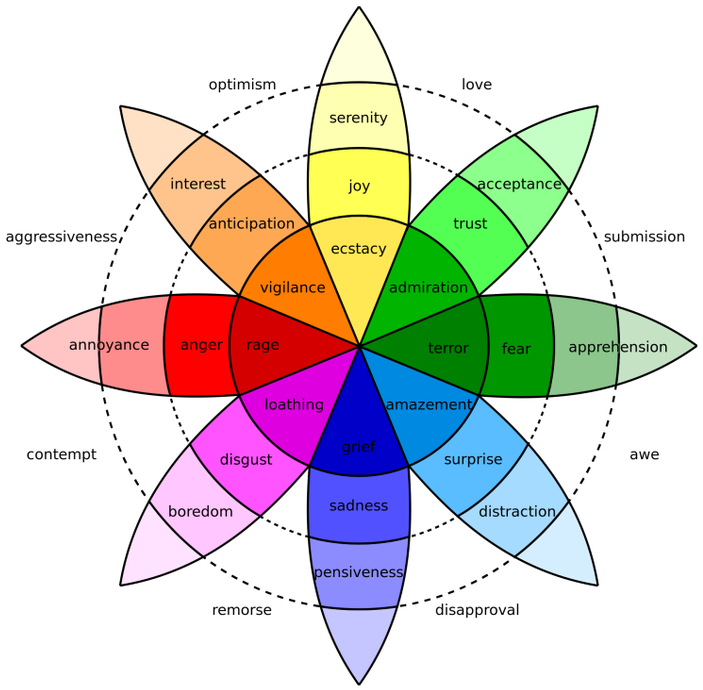
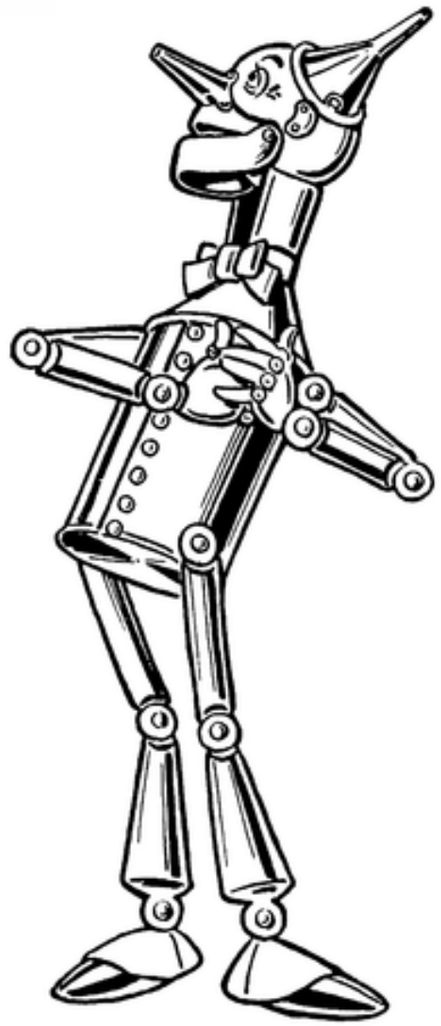


Emotion and AI



School of Games
Hongik University
Bae, Byung-Chull

29 June, 2016

Outline

1. Backgrounds: Models of Emotions

2. Computational Approaches: Affective Computing

3. Computational Emotions in Storytelling

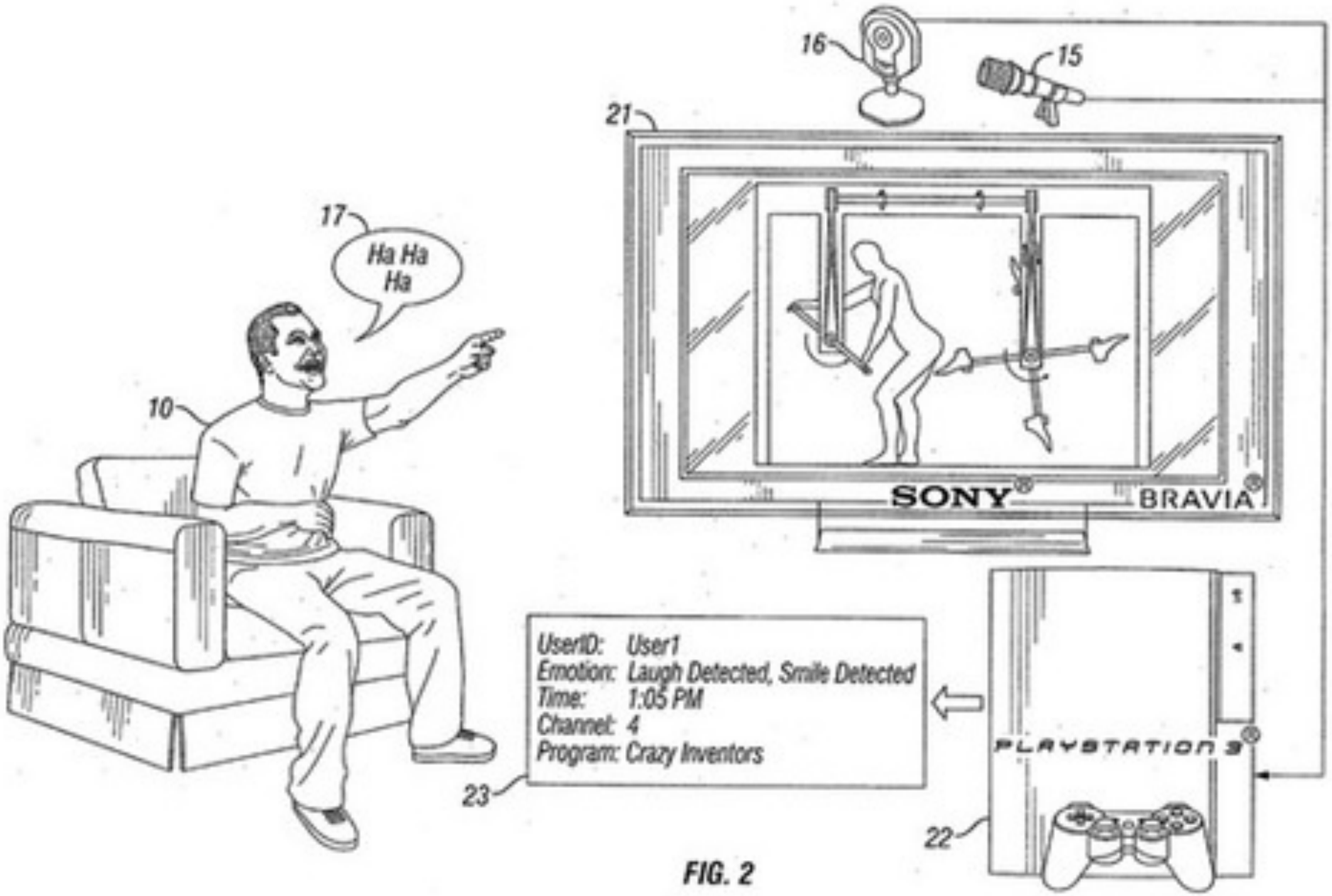


FIG. 2

"Laugh Detector and System and Method for Tracking an Emotional Response to a Media Presentation" US Patent No. 7,889,073B2, Sony Entertainment America (Patented on Feb 15, 2011)

1. Backgrounds: Emotions & Personalities

Q. What is “emotion”?

emotion

noun | emo·tion | \i-ˈmō-shən\

Merriam-Webster

Simple Definition of EMOTION

Popularity: Top 10% of words

: a strong feeling (such as love, anger, joy, hate, or fear)

Full Definition of EMOTION

a : the affective aspect of consciousness : FEELING

b : a state of feeling

c : a conscious mental reaction (as anger or fear) subjectively experienced as strong feeling usually directed toward a specific object and typically accompanied by physiological and behavioral changes in the body

Synonyms for emotion

noun **mental state**

affect
affection
affectivity
agitation
anger
ardor
commotion
concern
desire
despair
despondency
disturbance
drive
ecstasy
elation
empathy
excitability
excitement
feeling
fervor
grief
gut reaction
happiness
inspiration
joy
love
melancholy
passion
perturbation
pride
rage
remorse
responsiveness
sadness
satisfaction
sensation
sensibility
sensitiveness
sentiment
shame
sorrow
sympathy
thrill
tremor
vehemence
vibes
warmth
zeal

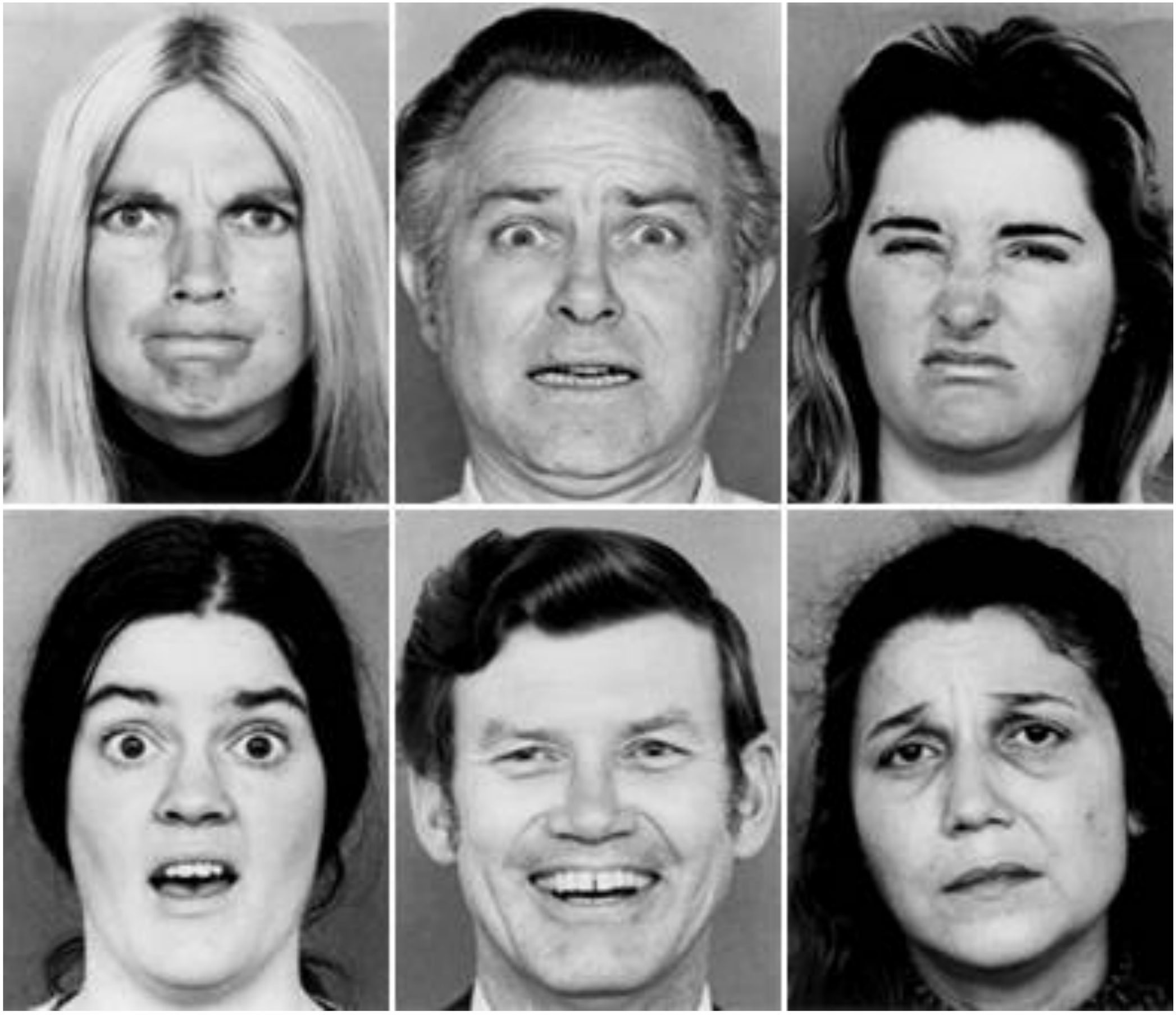
Antonyms for emotion

apathy	hate	quiet
calm	hatred	sadness
calmness	indifference	sorrow
cheer	joy	stillness
depression	lethargy	tranquility
dislike	peace	unhappiness
happiness	physicality	woe

Considerations on Emotion

- Requires a **model** on consciousness or mind
- Involves both **universality** and **subjectivity**
- Directs toward a specific entity (either object or human).
- Some emotions are "***social***" (e.g., love, hate, admiration, contempt, blame, jealousy, ...)

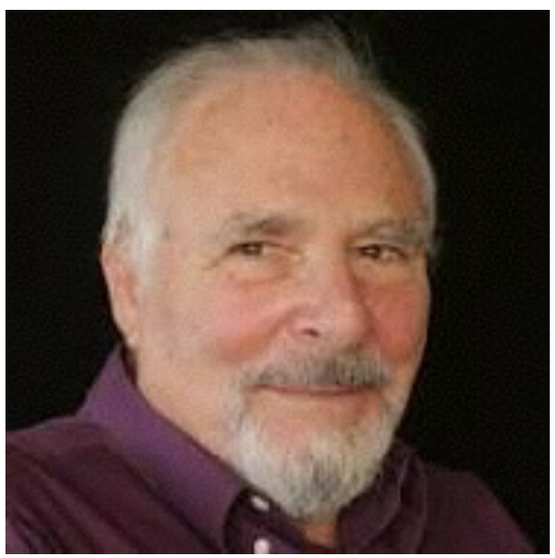
Now, let's look at the models of emotion.



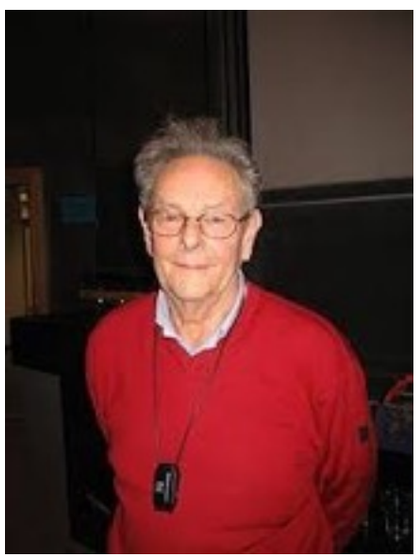
Basic Emotions

- Some emotions are **universally recognised by facial expressions** regardless of gender, age, and race.

- Some emotions involve associated **action tendencies** (e.g. approaching or leaning backward) by nature.



P. Ekman



N. Frijda

M.B. Arnold

Pixar’s Inside out (2015)

Table 1
A Selection of Lists of "Basic" Emotions

Reference	Fundamental emotion	Basis for inclusion
Arnold (1960)	Anger, aversion, courage, dejection, desire, despair, fear, hate, hope, love, sadness	Relation to action tendencies
Ekman, Friesen, & Ellsworth (1982)	Anger, disgust, fear, joy, sadness, surprise	Universal facial expressions
Frijda (personal communication, September 8, 1986)	Desire, happiness, interest, surprise, wonder, sorrow	Forms of action readiness
Gray (1982)	Rage and terror, anxiety, joy	Hardwired
Izard (1971)	Anger, contempt, disgust, distress, fear, guilt, interest, joy, shame, surprise	Hardwired
James (1884)	Fear, grief, love, rage	Bodily involvement
McDougall (1926)	Anger, disgust, elation, fear, subjection, tender-emotion, wonder	Relation to instincts
Mowrer (1960)	Pain, pleasure	Unlearned emotional states
Oatley & Johnson-Laird (1987)	Anger, disgust, anxiety, happiness, sadness	Do not require propositional content
Panksepp (1982)	Expectancy, fear, rage, panic	Hardwired
Plutchik (1980)	Acceptance, anger, anticipation, disgust, joy, fear, sadness, surprise	Relation to adaptive biological processes
Tomkins (1984)	Anger, interest, contempt, disgust, distress, fear, joy, shame, surprise	Density of neural firing
Watson (1930)	Fear, love, rage	Hardwired
Weiner & Graham (1984)	Happiness, sadness	Attribution independent

Note. Not all the theorists represented in this table are equally strong advocates of the idea of basic emotions. For some it is a crucial notion (e.g., Izard, 1977; Panksepp, 1982; Plutchik, 1980; Tomkins, 1984), whereas for others it is of peripheral interest only, and their discussions of basic emotions are hedged (e.g., Mowrer, 1960; Weiner & Graham, 1984).

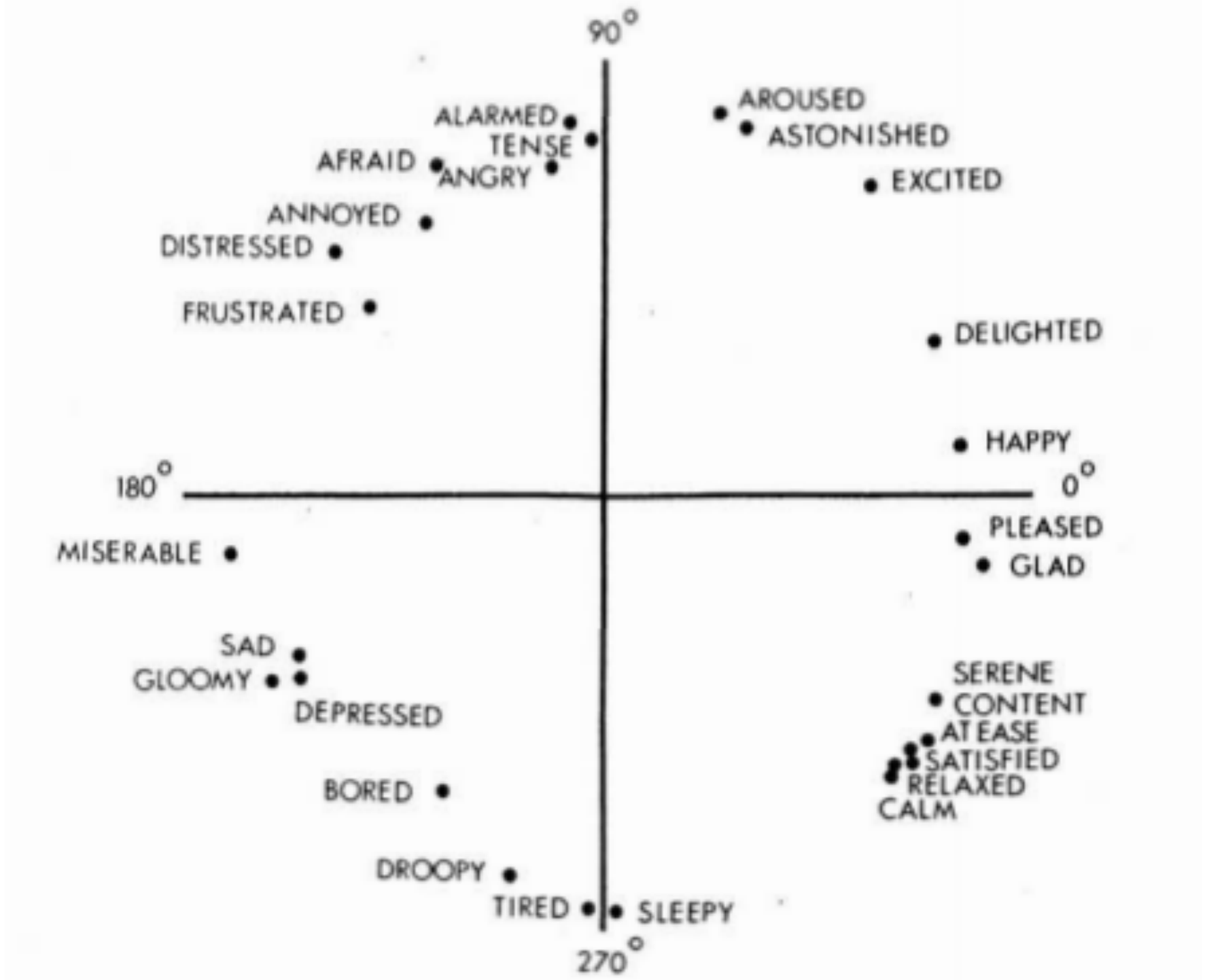


Figure 2. Direct circular scaling coordinates for 28 affect words.

Russell, J.A. A Circumplex Model of Affect. J. Personality and Social Psychology (1980), 39 (6)

Circumplex Model of Emotions

- Represented in two dimensional (arousal-valence) bipolar space.

- Easy to recognise **differences** and **similarities** among various emotions

- Distributed on the *perimeter* of a circle

- Some emotions may need another dimension for differentiation (e.g., *anger* and *fear*)

PAD Emotion Model

- Three-dimensional
  - **Pleasure** (A measure of valence)
  - **Arousal** (The level of activation)
  - ***Dominance*** (A measure of power or control)

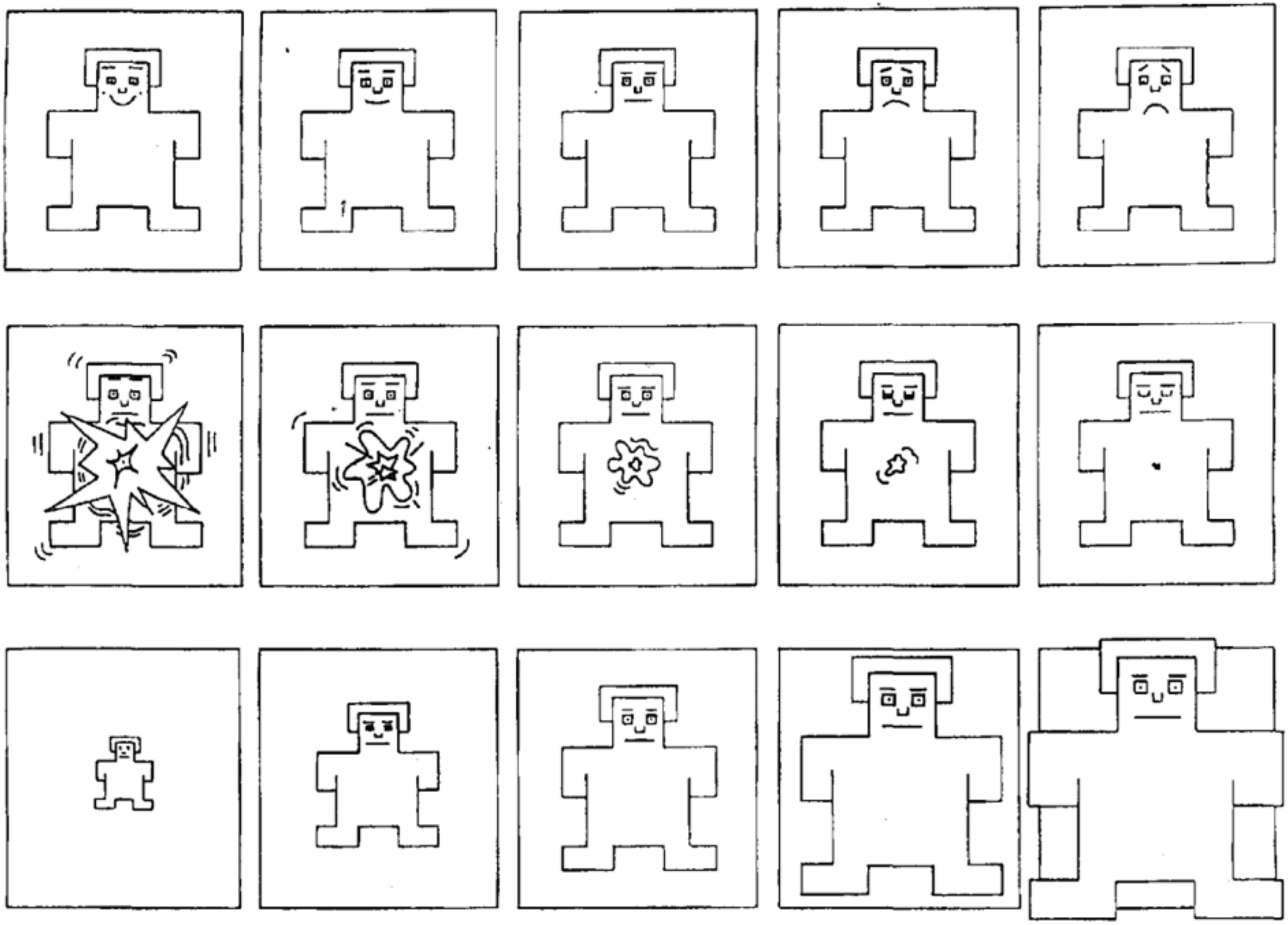
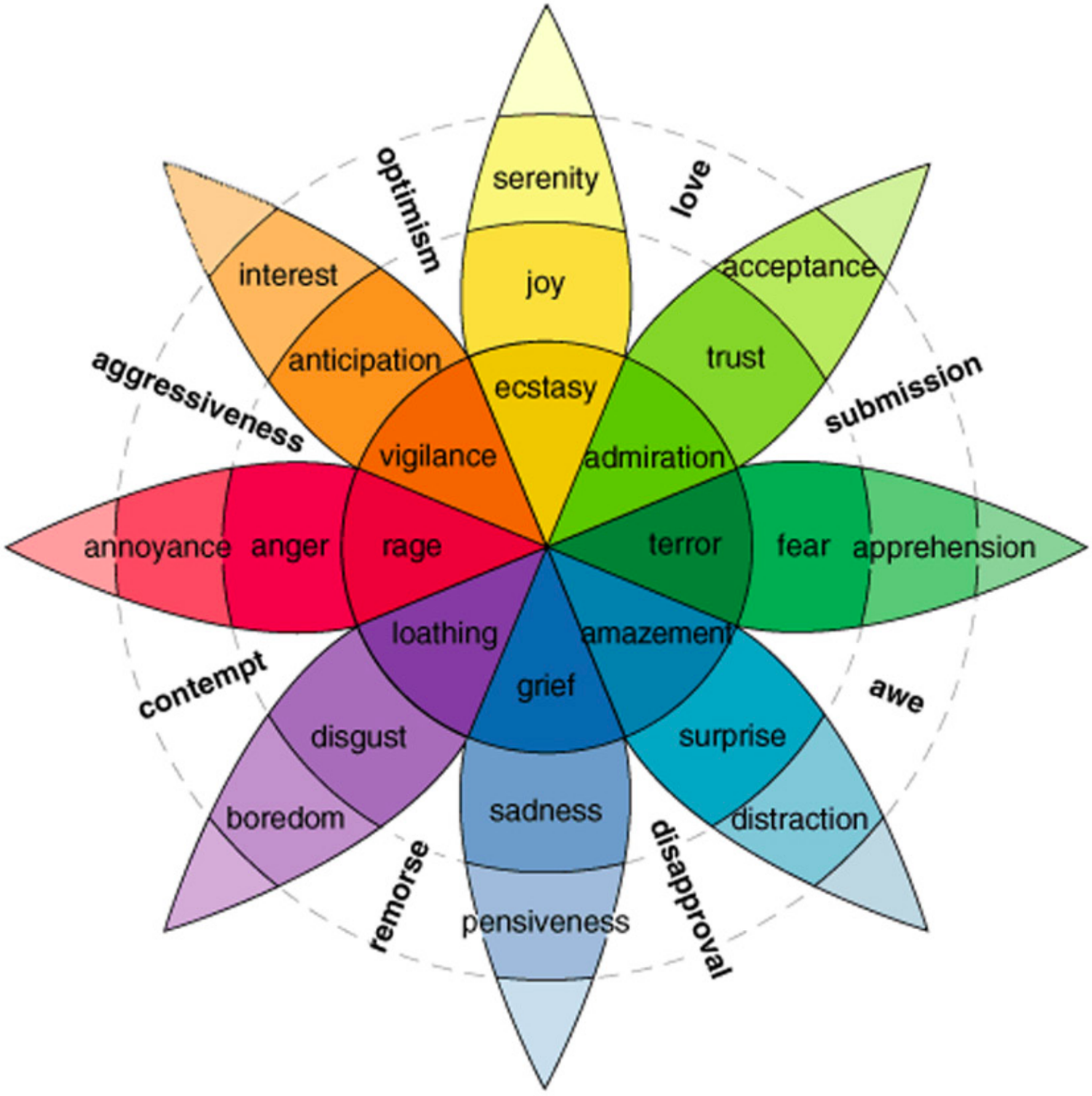


Figure 1. The Self-Assessment Manikin (SAM) used to rate the affective dimensions of valence (top panel), arousal (middle panel), and dominance (bottom panel).

Emotion Wheel by Plutchik

- Color metaphor
- **8 basic emotions** with 3 intensity levels, respectively
- 8 types of ***compound* emotions** induced from the combination of two basic emotions



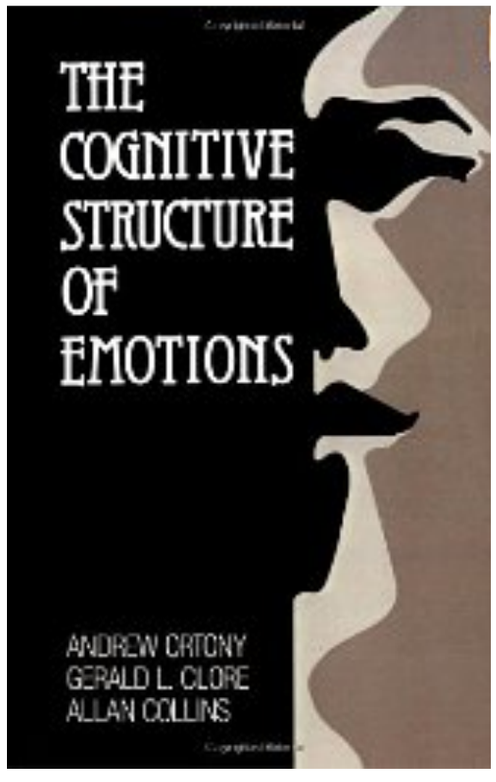
The Plutchik Emotion Circumplex
2D (left) and 3D (above) developed in 1980
by Robert Plutchik.

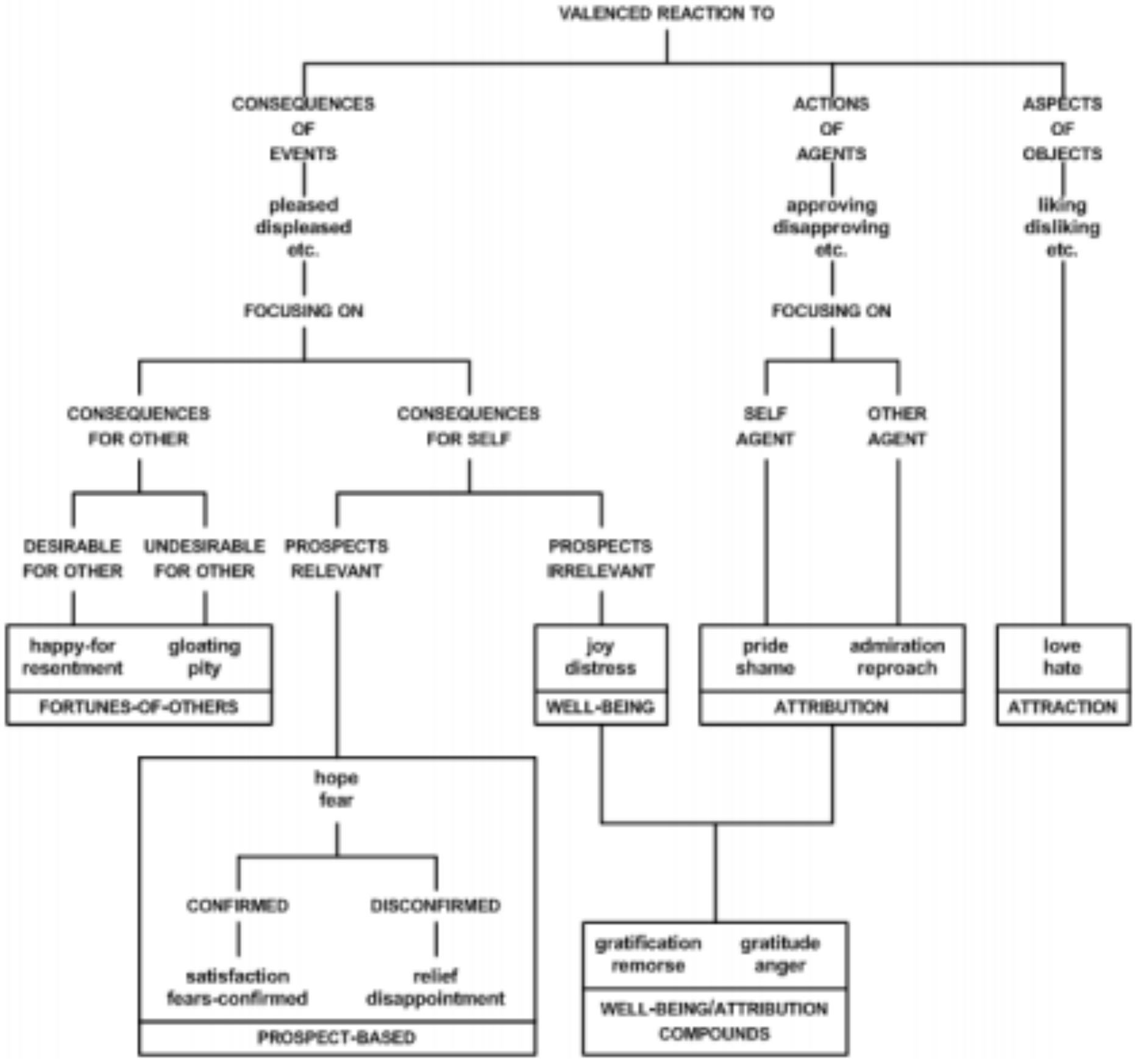
The OCC Model

- A. Ortony, G. Clore, and A. Collins (1988)

- Emotion refers to “a valence reaction to a situation or context” based on **an agent’s cognitive process of appraising a given situation**, where situation can be:

  - Consequences of *events*
  - Actions of *agents*
  - Aspects of *objects*




VALENCED REACTION TO
CONSEQUENCES OF EVENTS
ACTIONS OF AGENTS
ASPECTS OF OBJECTS
pleased displeased etc.
approving disapproving etc.
liking disliking etc.
FOCUSING ON
FOCUSING ON
CONSEQUENCES FOR OTHER
CONSEQUENCES FOR SELF
SELF AGENT
OTHER AGENT
DESIRABLE FOR OTHER
UNDESIRABLE FOR OTHER
PROSPECTS RELEVANT
PROSPECTS IRRELEVANT
happy-for resentment
gloating pity
FORTUNES-OF-OTHERS
joy distress
WELL-BEING
pride shame
admiration reproach
ATTRIBUTION
love hate
ATTRACTION
hope fear
CONFIRMED
DISCONFIRMED
satisfaction fears-confirmed
relief disappointment
PROSPECT-BASED
gratification remorse
gratitude anger
WELL-BEING/ATTRIBUTION COMPOUNDS

Example: Emotion Specification (Fear)

- TYPE SPECIFICATION: (displeased about) the prospect of an undesirable event

- TOKENS: apprehensive, anxious, cowering, dread, fear, fright, nervous, petrified, scared, terrified, timid, worried, etc.

- VARIABLES AFFECTING INTENSITY:

  1. The degree to which the event is undesirable

  2. The likelihood of the event

2. Computational Approaches:

Affective Computing

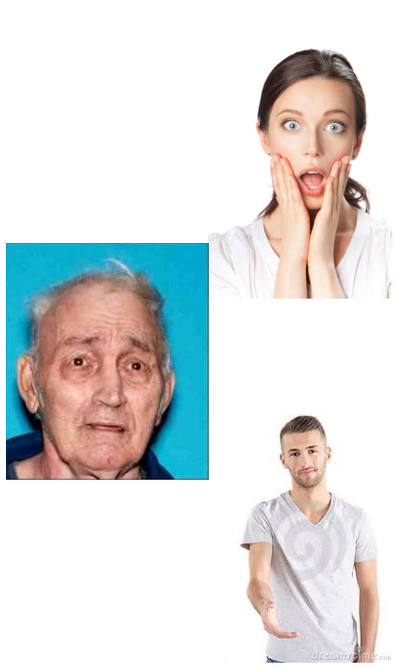
Affective Computing?

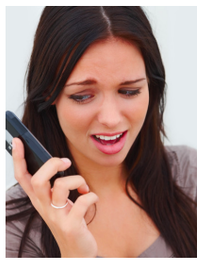
- "Computing that relates to, arise from, or deliberately influences emotion or other affective phenomena"

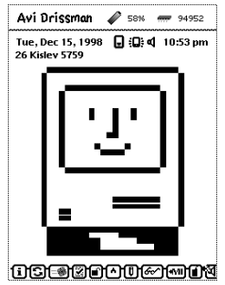
- "***Multidisciplinary*** research combining engineering, computer science, cognitive science, neuroscience, sociology, education, psychophysiology, value-centered design, ethics, and more."

(From http://affect.media.mit.edu/)

Challenges in Affective Computing







1) Sensing
2) Recognition

3) Affect Modeling

4) Expression

5) Ethics in emotion data gathering

6) Utility in HCI

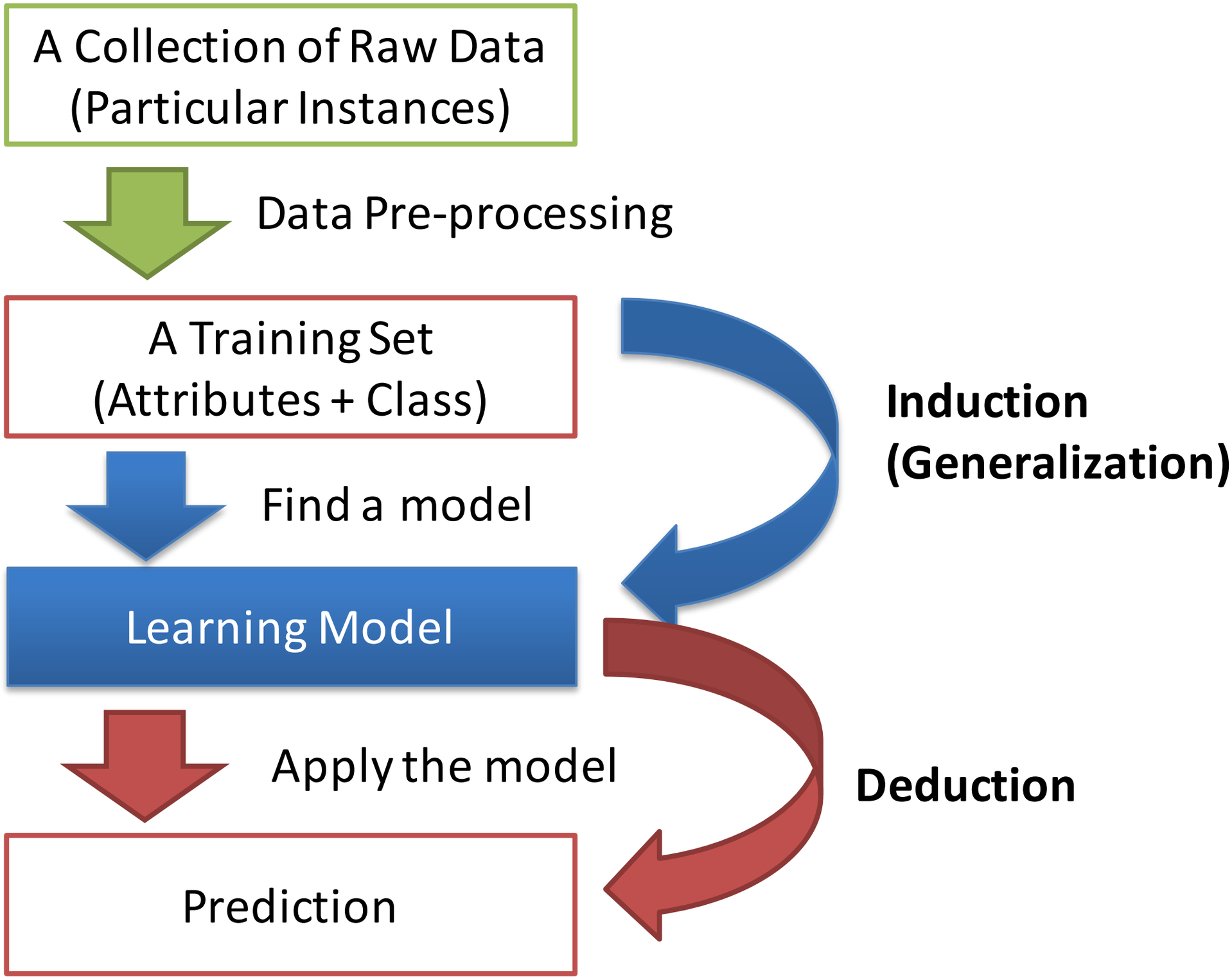
Picard, R. Affective Computing: Challenges, *J. Human-Computer Interaction* (2003), 59 (1-2)

1) Emotion Sensing

- Modality
  - Visual signals (Image & Video): facial expression, behaviour/ gesture/posture pattern; brain imaging/activities, text
  - Audio signals: voice/sound pattern(prosody - intonation, rhythm, stress), verbal language
  - Physiological signal: skin conductivity, heart rate, breathing frequency, etc .
  - Other sensory modalities: smell and taste?
- Issues: Intrusiveness, accuracy, reliability, etc.

2) Emotion Recognition

- Interpretation of collected (sensing) data
- Convert emotion recognition problems to **classification** problems in machine learning


A Collection of Raw Data
(Particular Instances)
Data Pre-processing
A Training Set
(Attributes + Class)
Find a model
Learning Model
Apply the model
Prediction
Induction
(Generalization)
Deduction

FACS (Facial Action Coding System)

AU1	AU2	AU4	AU5	AU6
				
Inner brow raiser	Outer brow raiser	Brow Lowerer	Upper lid raiser	Cheek raiser
AU7	**AU9**	**AU12**	**AU15**	**AU17**
				
Lid tighten	Nose wrinkle	Lip corner puller	Lip corner depressor	Chin raiser
AU23	**AU24**	**AU25**	**AU26**	**AU27**
				
Lip tighten	Lip presser	Lips part	Jaw drop	Mouth stretch

3) Affect Modeling

- Modeling an agent's mental process both from *emotional* and *cognitive* viewpoint
- Many computational models are often based on **the appraisal theories**

The Appraisal Theories

- Most (but not all) emotions are elicited by a cognitive evaluation of antecedent situations and events (Scherer, K.R. 2010)

- The most predominant theory among psychological perspectives on emotion, and (arguably) the most effective source for building computational emotion systems (Marsella, Gratch, & Petta, 2010, Computational Models of Emotion)

Four Appraisal Objectives in Stimulus Evaluation Checks (SECs)

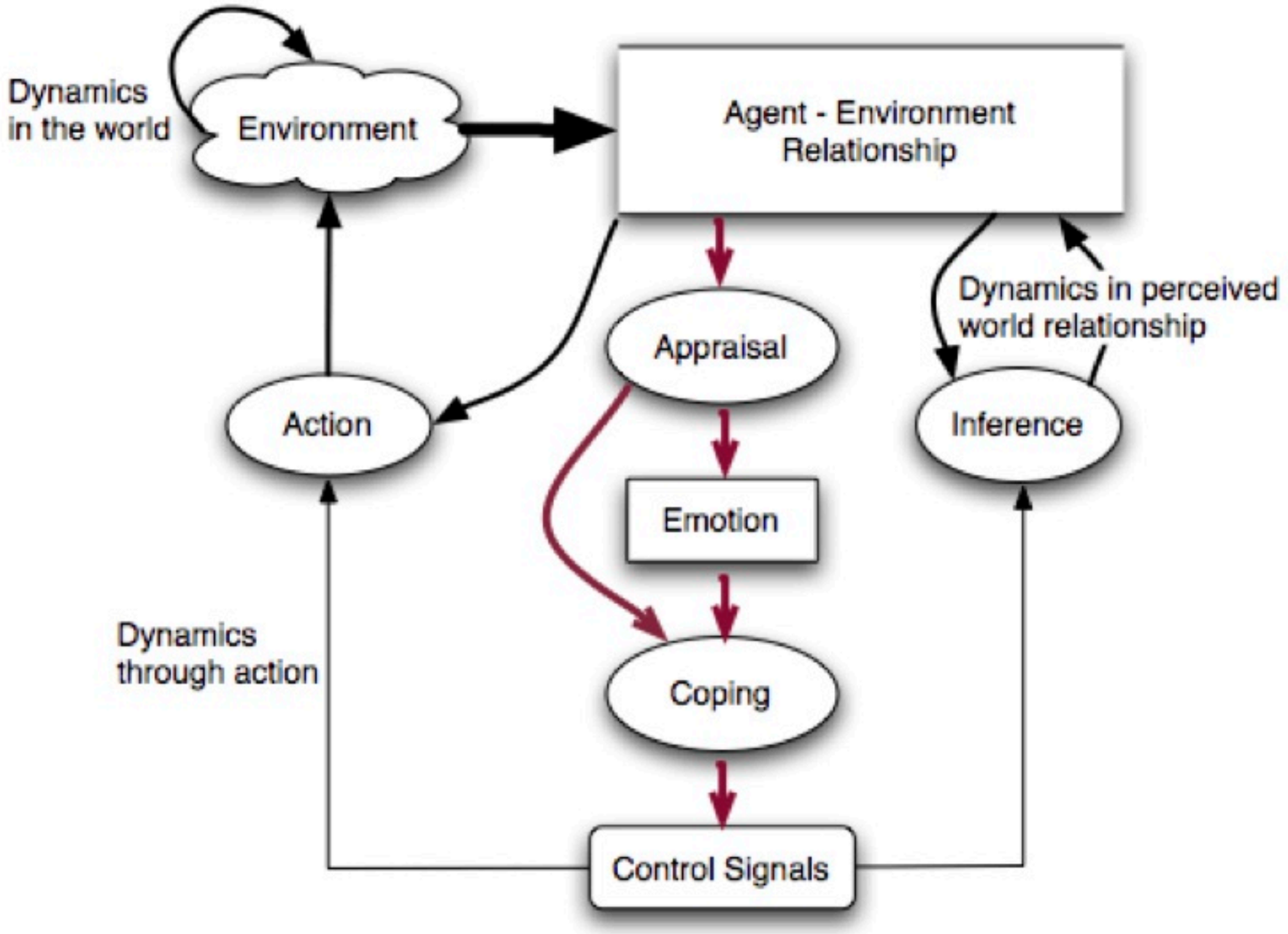
- **Relevance**: How relevant is this event for me? Does it directly affect me?
- **Implications**: How do the consequences of this event affect my well-being and my immediate/long-term goals?
- **Coping potential**: How well can I cope with these consequences?
- **Normative significance**: What is the significance of this event with respect to my self-concept and to social norms and values?
- For each objective, evaluation variables are defined as: Novelty, Intrinsic pleasantness, Goal relevance; Causal attribution, Outcome probability; Control, Power, etc.

K. R. Scherer, (2001) Appraisal considered as a process of multilevel sequential checking

Computational Models of Human Emotion

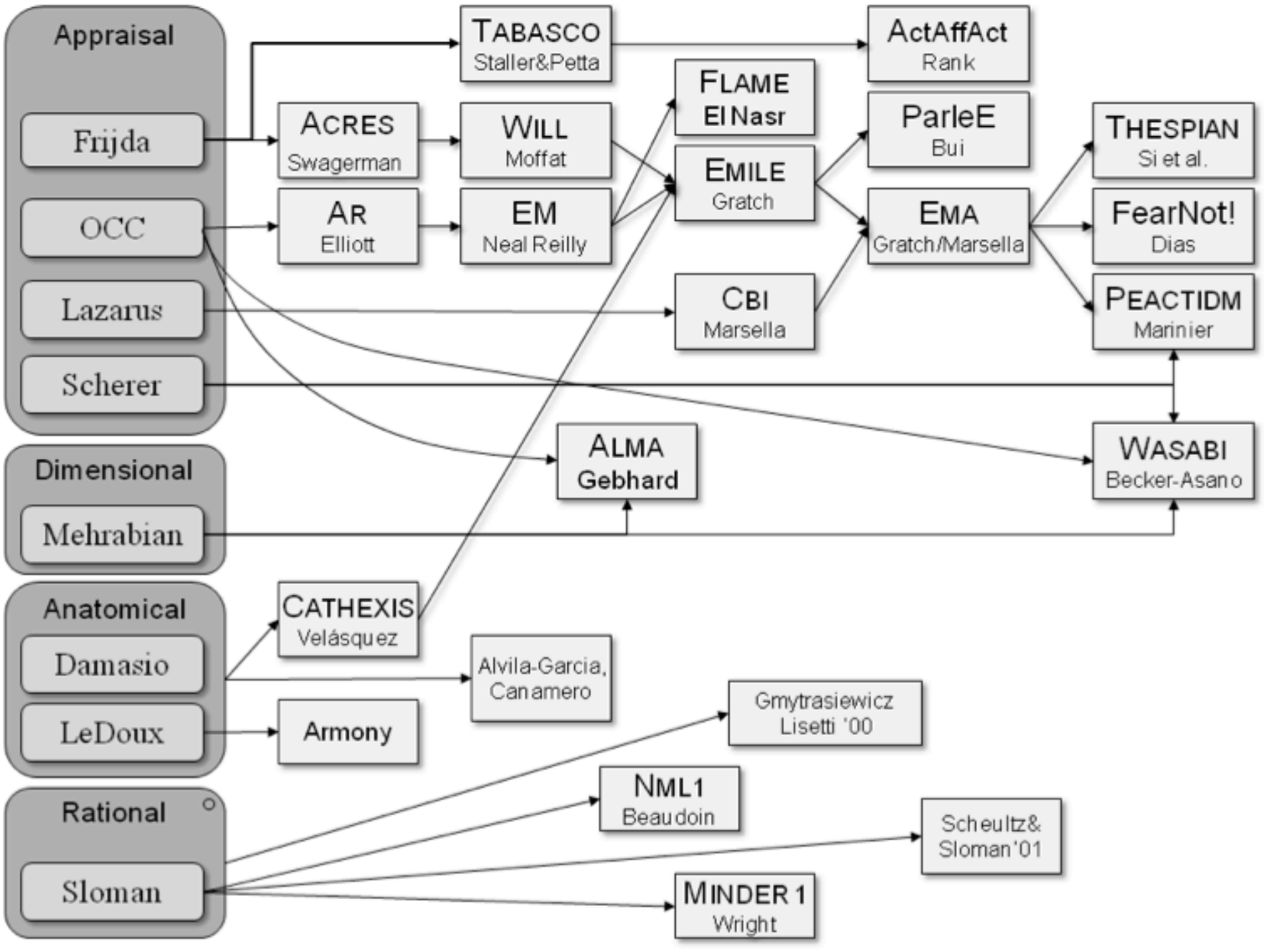
- Goal
  - Build a model dealing with antecedents (i.e., stimulus) and consequences (i.e., responses) of emotion in a logical, cognitive, and computational way
- Benefits
  - Create **believable agents** that can behave emotionally so we can suspend the disbelief that it is not real
  - Simulate **social interactions** or hard **decision-making** situations for training

Appraisal Dynamics and Coping



(Marsella & Gratch (2009) EMA: A Process Model of Appraisal Dynamics

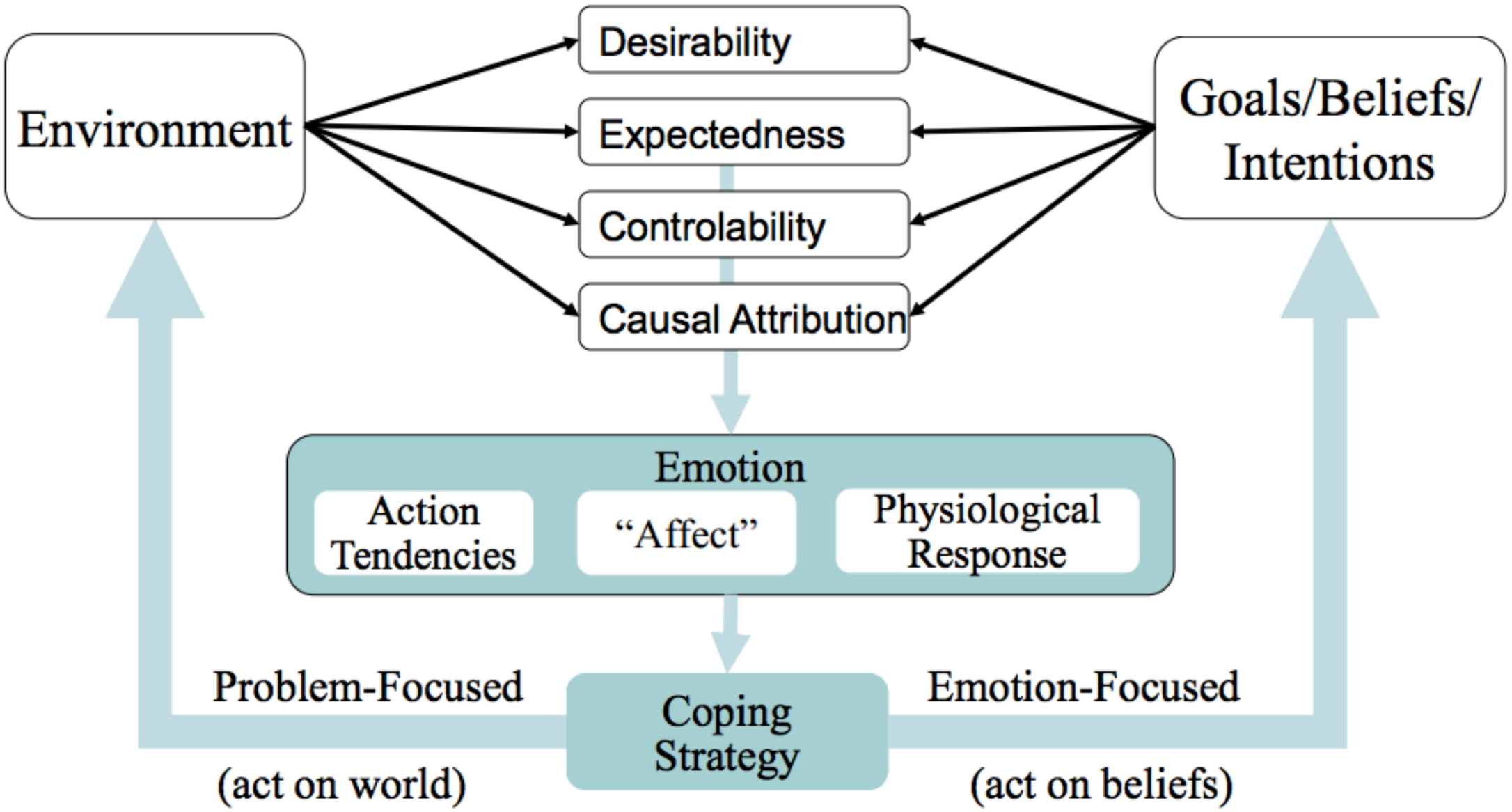
A Brief History of Computational Emotion Models



(Figure from Marsella, Gratch, & Petta (2010) Computational Models of Emotion)

Theoretical Framework: Appraisal Theory

(Arnold, Lazarus, Frijda, Scherer, Ortony et al.)



http://people.ict.usc.edu/~gratch/presentations/ACII09-appraisal.pdf

4) Emotion Expression

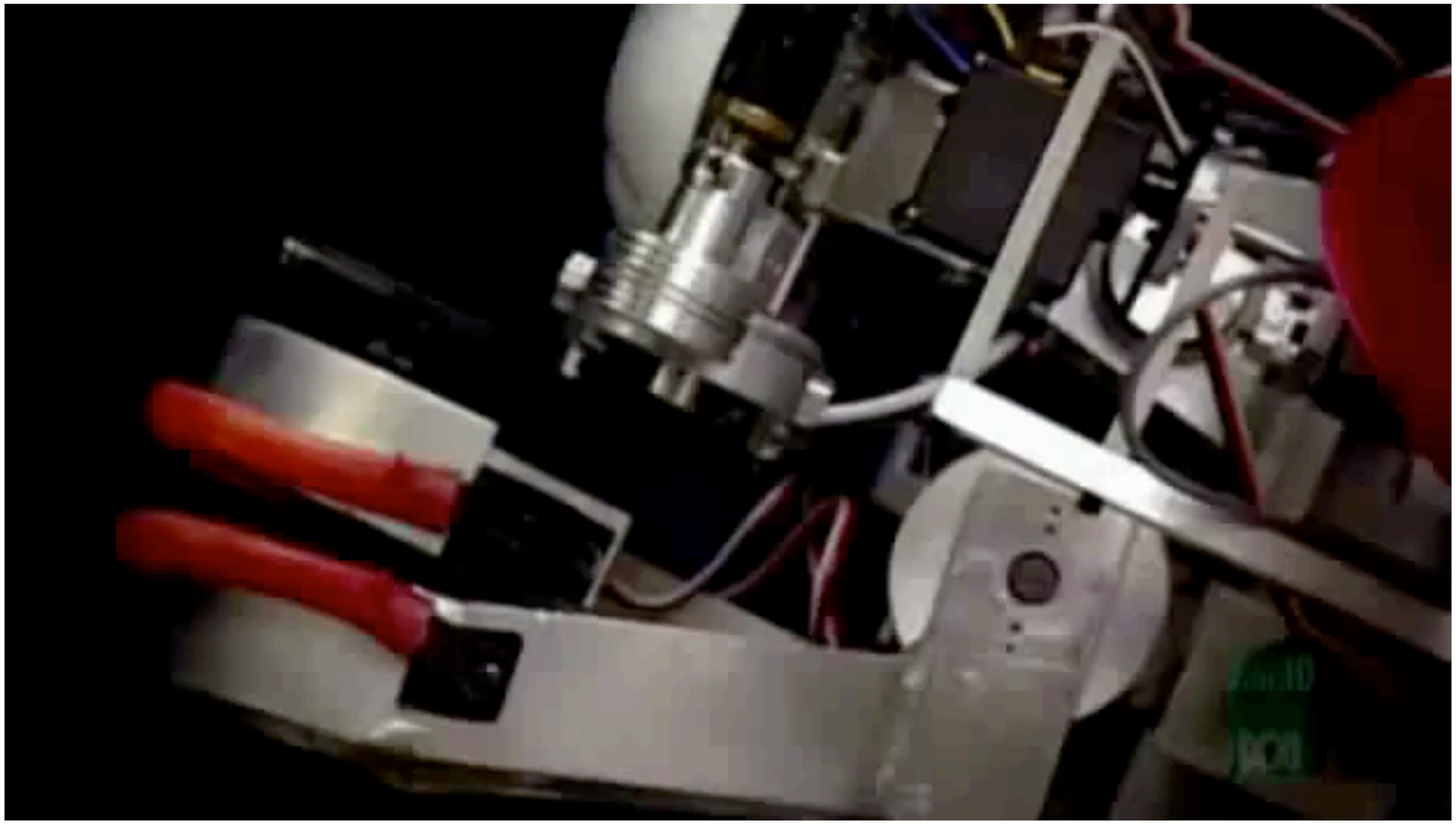
- “The physical body is essential to express emotion **reliably** and **believably**. Existing attempts at expressing emotions in (embodied) robots are unrealistic and unconvincing.”

5) Ethics Issue

- “Emotions are ultimately **personal** and **private**. Any attempts to detect, recognize, not to mention manipulate, a user’s emotions thus constitutes the ultimate breach of ethics and will never be acceptable to computer users.”

6) Utility Issue

- “Airplanes do not flap their wings. Just because humans have emotional abilities and use them in human-human interaction, computers don’t need to aspire to emulate them. Emotions and passions tend to be more problematic than helpful in human-human interaction. So, ***why contaminate purely logical computers with emotional reactiveness?***”



Kismet (1997 ~ 2002)

Jibo (Coming soon) : https://www.jibo.com/

3. Computational Emotions in Storytelling

Q. Why do we love stories? Btw, what is a story?

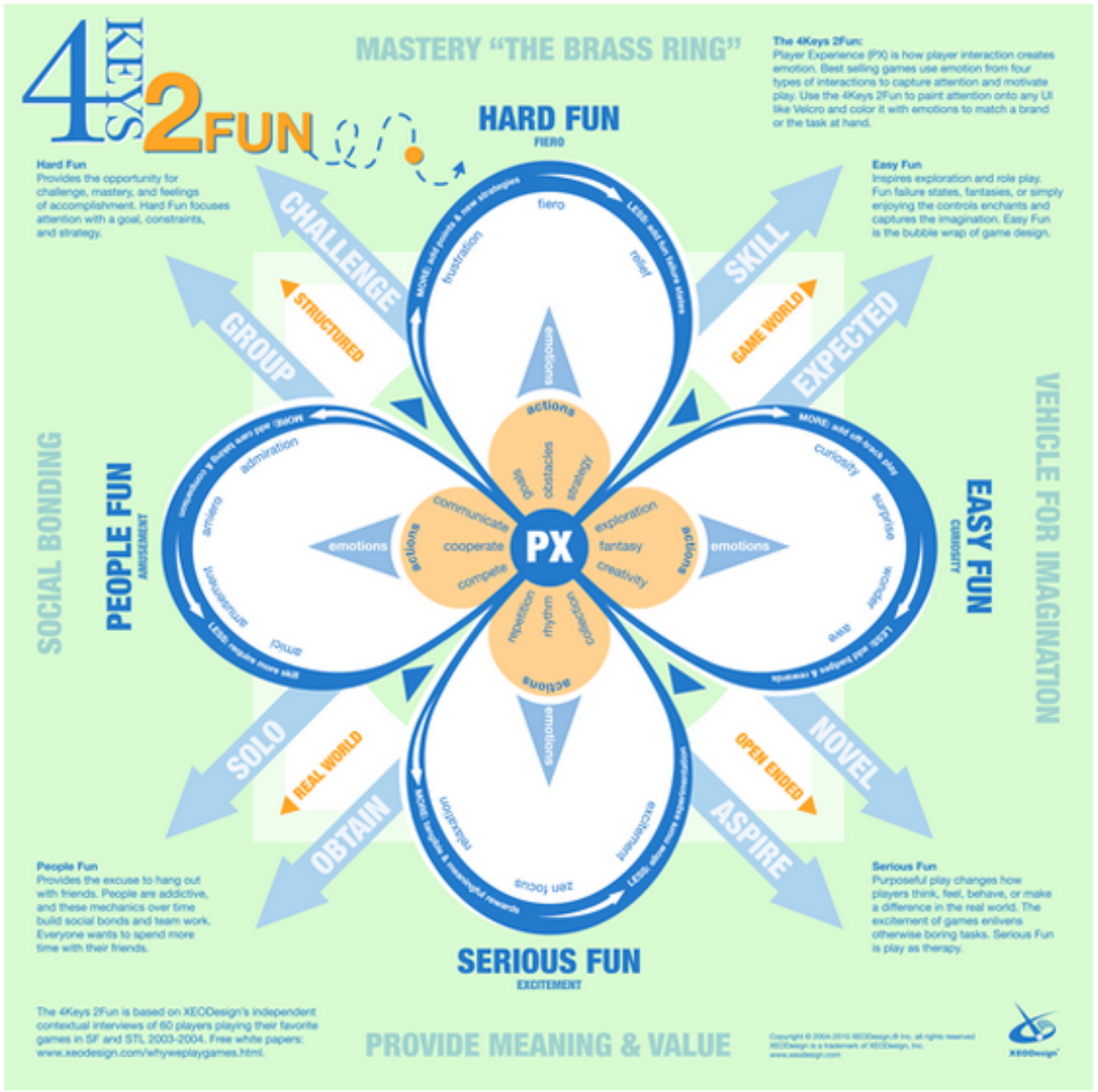
Non-story Vs. Story

1. “Today I cooked dinner”

2. “Today I cooked dinner for my wife for the first time.”

- Above two, which is more like a story? Why?

We play games for fun



http://www.xeodesign.com/assets/images/4k2f.jpg

N. Lazzaro

We love stories for interest

- Cognitive Interest
    - Interest obtaining from narrative structure (suspense, surprise, curiosity)
- Emotional Interest
    - Interest obtaining from the characters of the story world (empathy, a sense of identification, memory, …)

Oatley, K. (1994). A taxonomy of literary response and a theory of identification in fictional narrative

Cognitive Interest Vs. Emotional Interest

Issues of Computational Emotion in Storytelling

- Modeling the reader's cognitive and affective state (**Understanding** Vs. **Interest**)

- Emotional Story Generation (Story with **suspense**, Story with **surprise/twisted ending**, …)

- Evaluation of **Story Quality**

- (AI) virtual actor's emotion modelling and expression

Summary

- **Emotion Models**: 2-Dimensional Emotion Model (**Arousal-Valence**), **The Appraisal Theories**, The OCC Emotion Model

- **6 Issues in Affective Computing**: Sensing/ Recognition/ Modeling/ Expression; **Ethics**, **Utility**

- **Computational Emotions in Storytelling**: Player's cognitive and emotional state in terms of **interest**

Q & A

- Thank you for your attention!