Lecture 7 - Psychological Theories III (Dimensional)

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Readings:

- James A. Russell Core Affect and the Psychological Construction of Emotion. Psychological Review, Vol 110 (1), pp145-172, 2003.
- Christian Becker-Asano and Ipke Wachsmuth Affective computing with primary and secondary emotions in a virtual human Autonomous Agents and Multi-Agent Systems Vol 20(1), pp. 32-49, 2010.

Supplementary:

- Johnny R.J. Fontaine, Klaus R. Scherer, Etienne B. Roesch, and Phoebe C. Ellsworth. The World of Emotions is not Two-Dimensional. Psychological Science December 2007 18: 1050-1057.
- Lisa Feldman Barrett. Are Emotions Natural Kinds? Perspectives on Psychological Science. 2006;1(1):28-58.
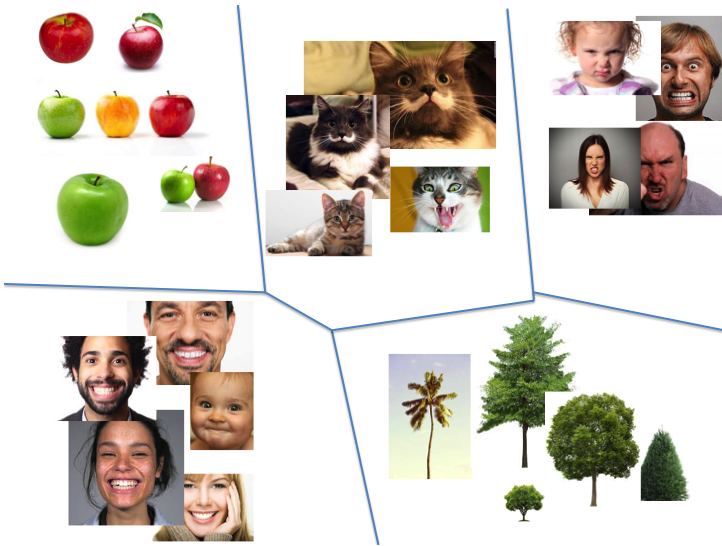
Models of Emotion used in Affective Computing
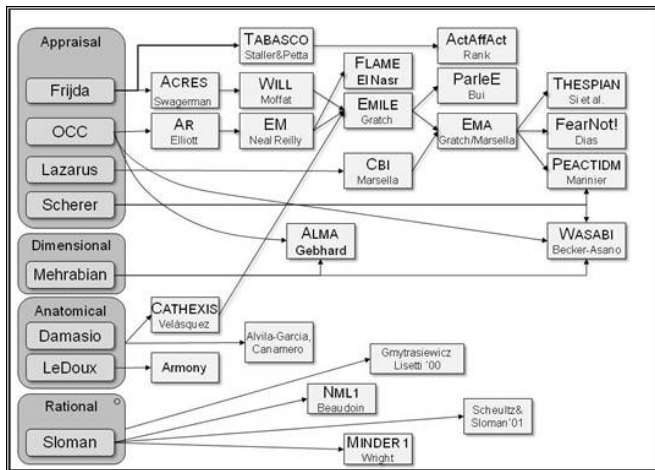
This lecture: we study dimensional theories and the WASABI system
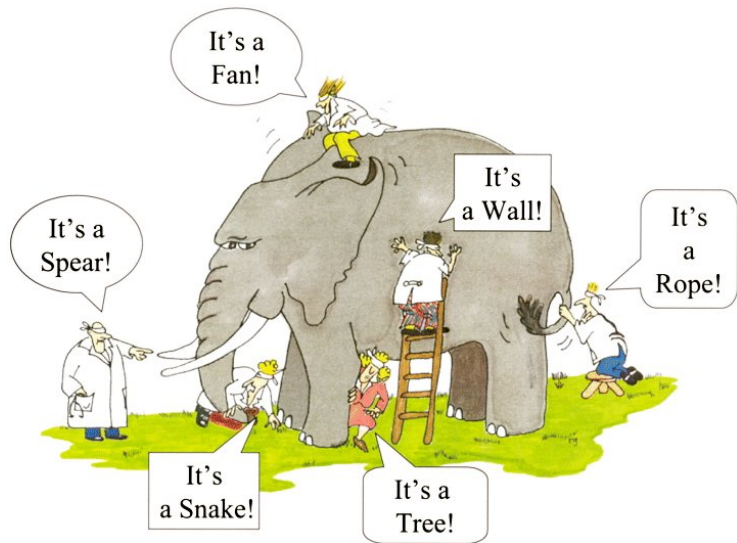
As many definitions as there are psychologists of emotion!

"Phenomena that exist independent of our perception of them"

Barrett 2006

> "It is not only the basic-emotion approaches that rely on the assumption of projectable property clusters. The idea of privileged kinds of emotion defined by a set of specific and bounded responses can also be observed in some appraisal models of discrete emotions. Unlike the basic-emotion approach, however, the appraisal approach does not assume that particular emotions are biologically basic in the sense that objects or situations trigger prescribed emotional responses in an unmediated or reflexive way. Instead, appraisal models posit that cognitive processes mediate emotion elicitation, and some models attempt to account for the same kinds of emotional responses as the basic-emotion approaches."

> "The primary assumption that unites all appraisal accounts is that a person's interpretation of a stimulus situation evokes an emotion"

Emotions as "Natural Kinds"

- traditionally emotions were seen as a property of the world
- happy, angry: categories of things defined by nature , like apples, cats, trees,
- Started by Darwin in The Expression of the Emotions in Man and Animals (1872)
- Appraisal theories do not see emotions as natural kinds : they are situational
- Russell argues against this view
- what is natural are two dimensions valence and arousal
- emotions are classification schemes that people impose on their world during perception.
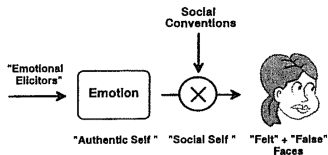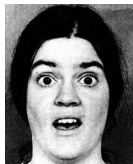
Paul Ekman's Facial Expression *Program*

Figure 5.1. The Emotions View of facial expression.

J.A.Russell *The Psychology of Facial Expression*

explaining Ekman's theory

six emotions: Anger, Fear, Surprise, Disgust, Happiness, Sadness
Ekman's theory is based on emotions being a <mark>natural kind</mark>.

Core Affect

- folk knowledge → biases in questions and answers in psychology
- Russell: develop a theory of emotion that doesn't need the labels
- "fear" does not exist on its own - "fear of something"
- replace emotion with : pleasure and arousal CORE affect
- also: perception of affective quality
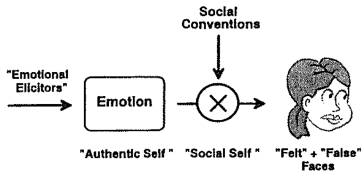- Essentially: affect comes before cognitive appraisal as emotion

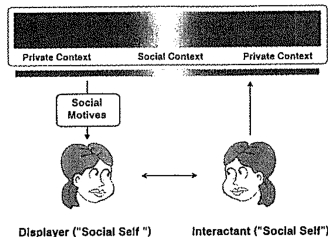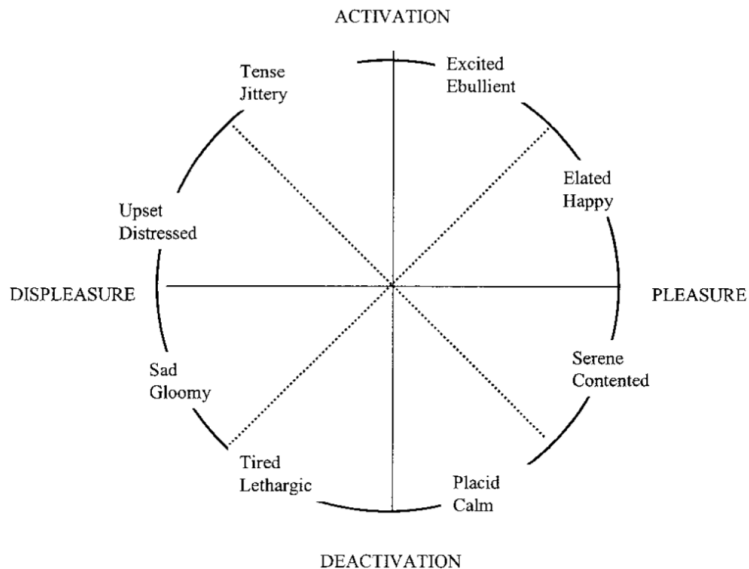Figure 5.1. The Emotions View of facial expression.

Figure 5.2. The Behavioral Ecology View of facial displays

J.A.Russell *The Psychology of Facial Expression* Ekman view and Ecological view

Core Affect

Primitives:

Core Affect:

- is primitive , universal , and simple
- exists without being labeled, interpreted or causally attributed
- is not "about" anything - exists in free form
- is "pushed around" by stimuli (internal or external)
- unconscious (not directly accessible)
- facilitates attention : guides cognition towards like-valenced material
- depends on all information: sensory to cognitive processing

Affective Quality:

- affective state of an object
- exists in the world, not in the agent
- is perceived by agents
- changes core affect

Key Concepts of Dimensional Theory

Primitives:

- **core affect** : neurophysiological state *"feeling"*
- **affective quality** : affective state of a stimulus

Derived concepts:

- **mood** : prolonged core affect without an object.
- **affect regulation** : Action aimed at changing core affect directly
- **object** : cause of a change in core affect
- **attributed affect** :
  - ▶ change in core affect attributed to an object
  - ▶ recognition of causal effects
  - ▶ can be cultural or individual
  - ▶ guides attention and behaviour to object
  - ▶ "main route" to affective quality

Timeline of an Emotional Episode

1. <mark>Antecedent Event</mark> - something happens
2. <mark>Affective Quality</mark> - perception
3. <mark>Core Affect changes</mark> - pre-consciously and then consciously
4. <mark>Attribution</mark> of core affect change - what did this to me?
5. <mark>Appraisal</mark> - what does this object have to do with me?: interpretations consistent with core affect are more accessible
6. <mark>Instrumental Action</mark> - directed at object (approach/withdrawal, etc): planning, goals
7. <mark>Physiological Changes</mark> - as a result of core affect and instrumental action
8. <mark>Subjective Conscious Experiences</mark> - urgency, indecision, etc
9. <mark>Emotional Meta-Experience</mark> - recognition of emotion labels
10. <mark>Emotional Regulation</mark> - cognitively based on recognition of labels in social context (e.g. norms, roles)

Core Affect

Traditional view
Emotions are "natural kinds"

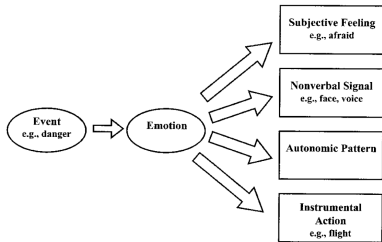Russell's View
Appraisal Theories

Figure 2. The traditional view in which emotion is an event that mediates between an antecedent and its various manifestations. Arrows represent causal direction.
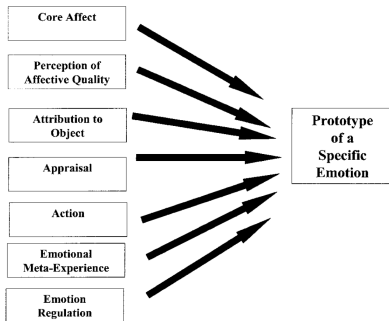

Figure 3. The proposed alternative to the traditional model. An observer notes a resemblance between a pattern of components and a cognitive prototype for an emotion. Arrows represent resemblance.

More than two dimensions

Participants matched emotion terms to emotion features

If someone said this: (24 emotions):	would you expect: (144 elements):
- Shame - Sadness - Hate - Jealousy - Pleasure - Love ...	- they decreased volume of voice (voice) - they wanted to flee (action) - they showed tears (face) - they felt at ease (feelings) - the consequences would be pleasant (appraisal) - they moved towards (gesture) ...

Johnny R.J. Fontaine, Klaus R. Scherer, Etienne B. Roesch, and Phoebe C. Ellsworth. The World of Emotions is not Two-Dimensional. Psychological Science December 2007 18: 1050-1057

Fontaine paper

- PCA from $144D \rightarrow 4D$ accounting for 75.4% of variance
- Dutch, English and French speakers
- same was found in large cross-cultural studies of Osgood
- dimensions could be appraised as :
    1. evaluation-pleasantness (35.3%)
    2. potency-control (22.8%)
    3. activation-arousal (11.4%)
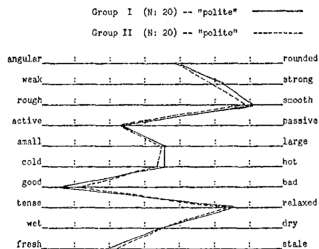   4. unpredictability (6%)

size of the circle - is the mean euclidean distance between languages
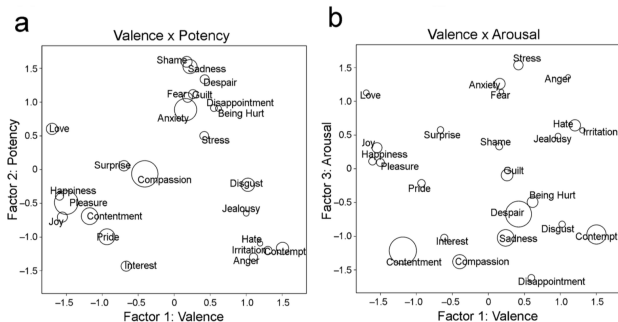
Osgood's Semantic Differential

- Semantic Differential
- Three dimensions account for about 70% of variance
- Cross cultural (universal)
- Evaluation, Potency, Activity (EPA)

Charles E Osgood. The nature and measurement of meaning. *Psychological bulletin*, 49(3):197, 1952.

WASABI

WASABI Affect Simulation for Agents with Believable Interactivity

- Combines **Dimensional Theory** (PAD model) with **Appraisal Theories**
- **Primary emotions** = "*Feelings*" (**core affect** or gut reactions)
- **Secondary emotions** = "*Emotions*" (**appraisals** or interpreted feelings)
- **Embodied Conversational Agent**

Christian Becker-Asano and Ipke Wachsmuth Affective computing with primary and secondary emotions in a virtual human. Autonomous Agents and Multi-Agent Systems Vol 20(1), pp. 32-49, 2010.
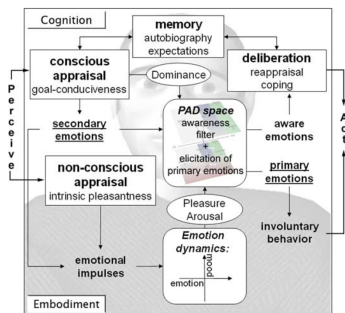
Primary vs. Secondary Emotions

Primary:

- Facial expressions
- innate
- simple
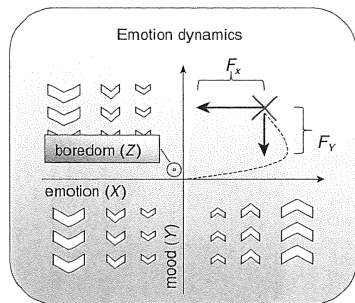- a.k.a. "Core Affect"
- child-like

Secondary:

- expressed verbally
- more complex data structures
- dependent on context and memory
- learned
- adult-like

WASABI Architechture

- emotional impulses (valence) drive emotion dynamics
- secondary (appraised emotions) also drive emotion dynamics
- PAD space combines emotion dynamics with dominance
- PAD space "filters" primary and secondary emotions
- primary emotions drive involuntary behaviour (facial expressions)
- secondary emotions drive reappraisal and coping (actions)

Emotion Dynamics

Emotion dynamics

- 2D space of valence (x) - mood (y) - boredom (z) <mark>NOT PAD SPACE</mark>
- x value is a gradient, y value changes based on x
- forces $F_x > F_y$ restore core affect to $(0, 0, 0)$
- PAD values derived from x, y, z
- and d dominance (from appraisal
- $PAD(x, y, z) = (\frac{x+y}{2}, |x| + z, d)$
- z is level of "boredom" - increases linearly when no impulses

Primary aware Emotions
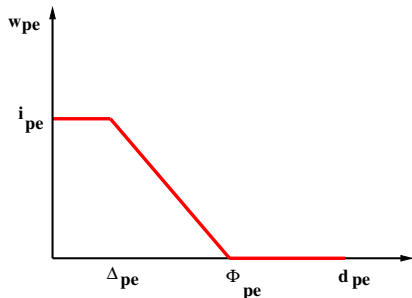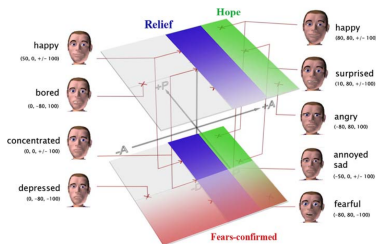
- <mark>awareness</mark> value: w_{pe}
- <mark>distance</mark> from current PAD to primary emotion "center": d_{pe}
- <mark>activation</mark> threshold: Φ_{pe}
- <mark>saturation</mark> threshold Δ_{pe} (for each emotion)
- <mark>intensity</mark>: i_{pe}
- if $d_{pe} > \Phi_{pe}$: $w_{pe} = 0$
- if $\Phi_{pe} > d_{pe} > \Delta_{pe}$:
  $w_{pe} = \left(1 - \frac{d_{pe} - \Delta_{pe}}{\Phi_{pe} - \Delta_{pe}}\right) \cdot i_{pe}$
- if $d_{pe} < \Delta_{pe}$: $w_{pe} = i_{pe}$

Hope:
- a potential event that is desirable
- awareness filter: high valence and high arousal
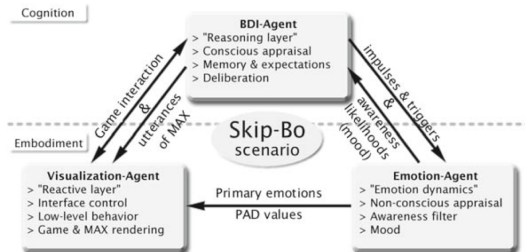
Fears-confirmed:
- displeased about the prospect of an undesirable event
- awareness filter: low valence and low power

Relief:
- pleased about disconfirmation of undesirable event
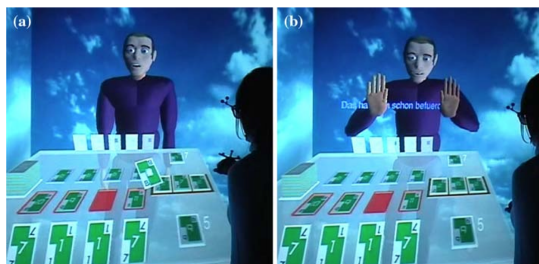- awareness filter: high valence and low arousal

MAX achitecture

- separation between cognition and emotion
- emotional appraisals directly drive action
- modified by beliefs, desires, intentions

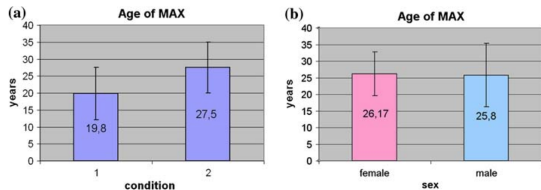- Skip-bo: competitive card game
- emotional appraisals <mark>directly drive action</mark>
- <mark>modified</mark> by beliefs, desires, intentions

MAX Evidence

If MAX were a real human, how old would you judge him to be?

1. Only primary emotions
2. Primary and secondary emotions

Next:

- Signals, Facial Expressions, Gestures
- Affect Control Theory
- Bayesian Affect Control Theory